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Title of Research Paper:

SMALLHOLDER FARMERS PERCEPTIONS AND CLIMATE CHANGE ADAPTATION IN BOLERO COMMUNITY IN MALAWI

Student Name: CHAKUFWA KAULANDA MUNTHALI

Student Number: Maynooth Number: 13190164

Local Number: MTCD/2C/9/13.

Student Email: Maynooth Email: CHAKUFWA.MUNTHALI.2014@NUIM.IE

Personal Email: chakumunthali@gmail.com

Institution at which student is registered: MZUZU UNIVERSITY

Name and email of supervisor(s):

1. Victor Kasulo (PhD): email: kasulov@gmail.com

2. Mr. Swithern Matamula: email: smatamula@hotmail.com

I, Chakufwa Kaulanda Munthali, certify that the research paper is my own work and I have not obtained a Degree in this University or elsewhere on the basis of this Research.

ABSTRACT

Smallholder farmers' perceptions of climate change are very important for their adoption of adaptation strategies. The study assessed smallholder farmers' perceptions of climate variability and climate change adaptation in Bolero Community, Malawi. The data was collected through knowledge, attitude and practices (KAP) survey and focused group discussions. The data was analyzed by using descriptive statistics and chi-square tests. The results showed that majority (74%) of the respondents perceived that the amount of rainfall received by the community over the past 10 years had decreased which was not supported by data from Malawi Meteorological Services. The study revealed that access to climate change information, access to loans, access to water, access to markets would motivate smallholder farmers to adopt climate change adaptation strategies. The policy implications of the study are: Climate change projects should not only focus on technical approaches to increase adoption rates but also to consider social aspects such as perceptions, attitudes and motivating factors to climate change adaptation. Communication based interventions needs to be promoted which will have to move beyond merely sharing information and spreading awareness on climate change issues but should focus on promoting specific behavioral practices that are feasible for the population of Bolero Community to implement.

Research Topic:

SMALLHOLDER FARMERS PERCEPTIONS AND CLIMATE CHANGE ADAPTATION IN BOLERO COMMUNITY IN MALAWI

1. Introduction

Adverse effects of climate change and variability continue to be a major threat to rural livelihoods (IPCC, 2007). According to Olsen (2006), African countries including Malawi are prone to greater impacts of this variability and change in climate. Climate change is attributed directly or indirectly to human activity and is usually observed over time (Mings, 2008). Climate change briefly refers to the long term significant change in the average weather that a given region experience (Intergovernmental Panel on Climate Change- IPCC, 2007). Climate variability refers to the variation in the mean state and other statistics of climate on all spatial scales beyond that of individual weather events which includes rainfall variability which results into droughts, floods, dry spells and strong winds (IPCC, 2007; UNFCCC, 1992).

In Bolero Community where this study was undertaken, the most susceptible sectors of human life which are sensitive to climate change and variability are agriculture, food security and natural resources. Bolero community is experiencing challenges in relation to the damage caused to natural resources like vegetation due to deforestation such as increased droughts, floods and siltation (Rumphi Social Economic Profile, 2008). The government of Malawi and other Non- Governmental Organizations like Total Land Care, Farmers Income Diversification Programme has been implementing different projects to ensure proper management of natural resources in this community. To this end, there has been no headway as regards improvements in areas of combating issues of climate change through adopting adaptation strategies to climate change and variability. It is believed that many African Governments including Malawi have approached climate change in a manner that suggest that the local people are very knowledgeable and have a positive

perception of climate change issues (Terdoos & Adekola, 2014). For instance Malawian Government has launched many programmes aimed at controlling climate change at local level where most of the approaches emphasizes the need for the populace to act as though they have a good grasp of the issues at stake. An example is the popular tree planting campaigns where locals are encouraged to plant trees.

Even if the trees are planted during official launch, they soon die off as the local people who are expected to tend them do not know why they should spend time on trees. In most such programmes little or no attention is paid to the perception and knowledge of the smallholder farmers concerned hence low adoption rate of adaptation strategies to climate change and variability.

Various studies have shown that without knowledge and awareness, adaptation measure to climate change and variability will remain a challenge, which will eventually be detrimental to the environment as a whole especially agriculture sector (Gworgwor, 2008; Mendelsohn, 1998; Rosenzweig & Parry, 1994). Kasulo et al. (2013); Bryant et al. (2008) and Maddison (2006) agree that the farmers' perceptions on climate variability are important in coping and adaptation as they determine decisions in agricultural planning and management by the farmers. Perception has been described as referring to a range of beliefs, judgments and attitudes (Slegers, 2008).

1.1 Problem Statement

Agriculture is the major economic sector in Malawi (GoM, 2006). Climate variability and change is having huge negative implications on the livelihoods of small holder farmers. According to Rumphu District Socio-Economic Profile (2008), Bolero is experiencing food insecurity and loss of natural resources due to the occurrence of extreme weather events such as erratic rains, droughts and dry spells. This is supported by Chinsinga (2008), who states that recent crop yields in Bolero community are way below the average potential as compared to 1990s mainly due to limited use of improved seed varieties, drought resistant crops, conservation

agriculture, and low utilization of fertilizer, low utilization of manure, and poor pest and disease management practices.

Most studies (Kasulo et al., 2013; Arbuckle et al., 2013; Kalinda et al., 2011) have shown that knowing farmers' perception, knowledge, beliefs and practices about climate change and variability and their motivating factors to climate change adaptation is very important in their decision making.

Despite all the evidence on the importance of knowing smallholder farmers' perceptions, knowledge, and attitudes and factors that motivate them to adopt climate change adaptation strategies, there have been no micro level studies at the farm level in Bolero community on documenting farmers' perception, knowledge, attitudes and practices and their motivating factors towards climate variability and change. This has led into the implementation of climate change adaptation programmes in Bolero community that mostly do not consider the needs of the local community. As a result most smallholder farmers are unwilling to change their longstanding practices which contribute to climate change and variability hence leading to low adoption rate of climate change adaptation strategies.

This study therefore, will assess the smallholder farmers' perception of climate variability and climate change adaptation in the study area.

1.3 Objective of the study

The main objective of the study is to assess smallholder farmers' perception and climate change adaptation in bolero community in Malawi.

The specific objectives are:

- To assess smallholder farmers perception of climate variability.
- To examine the Knowledge, Attitudes and Practices (KAP) of smallholder farmers in relation to climate change.
- To investigate factors that motivates smallholder farmers to adopt adaptation strategies to climate change.

1.4 Research Questions

What is the perception, knowledge, attitudes and practices of smallholder farmers about climate variability?

What factors would motivate smallholder farmers' decision to adopt adaptation strategies to climate variability?

1.5 Justification of the study

The key argument in this study is that perception affects adoption of adaptation strategies to climate variability and change, thus smallholder farmers cannot adopt if they do not perceive that there is climate variability and change. Therefore any adaptation programme should understand farmers' perception first. However, knowing farmers perception of climate variability and change only is not enough in coming up with climate change adaptation programmes that would address the effects of climate change and variability. There is also need to evaluate people's knowledge, attitudes and practices towards climate change and variability. This study therefore will be a full Knowledge, Attitudes and Practices (KAP) study hence it goes beyond perception. A KAP study is ideal and useful for this research because according to WHO (2008), it evaluates and measures the knowledge, attitude and practice of people. The findings of this study provides a better location specific insights and generate information relevant to policy and interventions that will contribute to high adoption rate of climate change adaptation strategies in Bolero Community and in Malawi.

This paper is organized into five sections. The first section is on introduction which presents the phenomenon under study, its linkages to current practice, policy and its significance. The second section is on Literature Review where the existing research and theory on the topic of the study are presented. The third section is on Methodology in which the methods and materials used to conduct this research are

presented. In addition under this section, ethical issues arising throughout the study are presented. The fourth section is on Results where the outputs of this study are presented in a logical fashion and per specific objective. The fifth section is on Discussion and Conclusions in which the significance of the research and also the contributions of the study to the theory of transformative community development are presented.

2. LITERATURE REVIEW

This section presents a review of existing literature on the theory and practice of Knowledge, Attitude and Practices (KAP) study and the importance of understanding the perception of smallholder farmers to climate variability which is a prerequisite to adoption of climate variability and change adaptation strategies. This will be done by looking at both theoretical background and the empirical evidence on smallholder farmers' perception, knowledge, attitudes and practices on climate variability. Furthermore, the literature on factors that motivates and influences smallholder farmers' decisions to adopt adaptation strategies to climate variability and change are also reviewed.

2.1 Theoretical Background of KAP Study

It has been argued that human activity is the main cause of climate variability and change (IPCC, 2007). Any modification of this kind of behavior necessitates insight into what people know, believe and do (Brody et al 2012). A KAP study is for this reason useful because it evaluates and measures knowledge, attitude and practice of people. KAP survey means Knowledge, Attitude and Practices. According to Kaliyaperumal (2004), Knowledge possessed by the community refers to their understanding of any given topic in this case climate change and variability. Attitude refers to their feelings towards the subject as well as any preconceived ideas that they may have towards the topic. Practice refers to the ways in which the community demonstrates their knowledge and attitude through their actions.

Vandamme (2009);Woods &Tsu(2008) stresses the fact that a KAP survey is a representative study of a specific population that collects information on what is known, believed and done in relation to a particular topic in this case climate change and variability.

According to IDAF (1994), KAP survey looks at what the respondents know about it (K), how the respondents feel about it (A) and what the respondents do about it (P).

In literature, three objectives of KAP survey can be found. According to Vandamme (2004), KAP studies can be used for diagnostic purposes for which they describe the populations' current knowledge, attitudes and practice towards a topic. Secondly they can be implemented to increase insights in a current situation and help to design appropriate interventions. Thirdly, they can be used as an evaluation tool to evaluate the effectiveness of certain interventions and programmes. In this study, a KAP survey is used as a diagnostic tool. When studying different methodologies used in the past to implement KAP surveys, it becomes clear that a standardized methodology is nonexistent. Therefore it can be stated that the KAP survey should be perceived more as a conceptual framework to study human behavior instead of specific methodology.

2.2 Empirical Studies on Smallholder Farmers Perception, Knowledge, Attitudes and Practices on climate change and variability

2.2.1 Smallholder farmers' perception about climate variability and change

A better understanding of how farmers perceive climate variability and change, ongoing adaptation measures and factors influencing the decisions to adapt good farming practices is needed to craft policies and programmes aimed at promoting successful adaptation of the agriculture sector (Bryan et al., 2009).

For farmers to adapt effectively to climate variability, they must have correct perceptions about the state of the climate and possible future trends.

The study by Gbetibouo, 2009, found out that the perception of farmers about climate change were in agreement with the meteorological data and the study further revealed that this correct perception had an influence on farmers' attitudes and adoption rate of adaptation strategies to climate change and variability.

Kasulo et al. (2013) and Kemausuor et al, (2010) have analyzed farmers' perception of climate change by using quantitative methods only. In all their studies, the results showed that there were still some gaps in farmers' perception of climate variability and change. Smallholder farmers' perceptions on climate variability differed from the recorded data from meteorological services. The researchers used the questionnaire only to collect data hence the interviewers were not given room to probe more on the questions being asked. The inclusion of qualitative method would have enabled the researchers to hear the voice of the respondents hence getting answers that reflect reality on the ground.

Thus, a number of other studies (Mertz et al., 2009 and Moyo et al, 2012 incorporated both quantitative and qualitative analysis in their studies on farmers perceptions of climate variability and change. The results from both questionnaire and focus group discussions revealed that there were gaps in farmers' perception to climate change and variability. This helped to validate the results of their studies as the researchers were able to triangulate the data collected through the quantitative methods by data collected through qualitative methods.

2.2.2 Smallholder Farmers Knowledge, attitude and Practices (KAP) about climate change

Understanding public knowledge on climate change is important in the global project of reducing the effects and impacts of climate variability as well as promoting adaptive behavioral changes among vulnerable populations. A few studies (Oopen, 2012; Arbuckle et al., 2013; JCCEA, 2005) have incorporated the KAP approach in analyzing small holder farmers' knowledge in climate change and variability.

The studies revealed that farmers who accepted that climate variability and change is occurring and attributable to human activity, significantly expressed concern about the impacts and support adaptive action. On the other hand, farmers who attributed climate change and variability to natural causes were uncertain about whether it is occurring, were less concerned and less supportive of adaptation and much less likely to support government mitigative action. The quantitative method that was used in these studies did manage to reveal what people know about climate change and variability and the practices and attitudes towards climate variability. The researchers would also have used qualitative methods like Focused Group Discussions to collect data in order to probe more on the questions being asked by the interviewers.

Bruinders et al, (2009) conducted a KAP study at Rhodes University to understand what levels of knowledge and what type of attitudes and practices students and staff ascribe to in order to gauge their impact on global climate change. In particular, the study aimed at providing some basic framework for advocating change with regards to KAP of and towards climate change at Rhodes University. The study used only the questionnaire to collect data. The results of the study showed that more knowledgeable individuals generally are more willing to get involved in climate change mitigation. The knowledge of individuals has an impact on the attitudes and practices as regards climate change. The Chi-Square test found no significant relationship between knowledge and education.

Chambers & Smith (2007) conducted a KAP survey to assess people's knowledge of, attitudes to, and practices in relation to the environmental management in the six member states of Organization of Eastern Caribbean States (OECS). The study used only the structured questionnaire for both the households and departments as a data collection tool. The study found out that there seemed minimal first hand knowledge of the environment among the population. As regards the attitudes, most respondents felt that the government is responsible for maintaining the environment. In this study, there was need to include qualitative methods of data collection in order to give chance to the interviewers to probe on the questions being asked.

Besides knowing smallholder farmers perception, knowledge, attitudes and practices to climate variability and change, it is also important to understand factors that would motivate farmers to adopt adaptation strategies to climate change and variability.

2.3 Factors that motivates smallholder farmers to adopt adaptation strategies to climate variability

For smallholder farmers to make a decision to adopt an adaptation strategy to climate variability, several factors come into play that influences them to do so. This is evidenced by research findings by different researchers in different countries.

A number of studies (Bryan et al., 2010; Sofoluwe et al., 2011; Gbetibouo, 2009, Di Falco et al., 2011; Tambo and Abdoulaye, 2012; Kalinda et al., 2011) were conducted to analyze factors that influence the decisions of farmers to adapt to perceived climate change and variability. The studies found out that smallholder farmers decisions to adopt particular climate change adaptation strategies are influenced or motivated by several factors which include: access to irrigation, access to social safety nets, access to extension services, and access to climate information including early warning systems, access to credit and loan services and access to livestock. The results showed that different communities have different motivating factors which would influence their decisions to adopt climate change adaptation strategies.

3. RESEARCH METHODOLOGY

This chapter outlines the methodology used in this study. Specifically, the chapter presents survey location, data collection methods and reasons for choice, data collection tools, population and sample size, ethical issues and data entry and analysis.

3.1 Survey Location

Bolero Extension Planning Area (EPA) is located in Rumphi District in Northern part of Malawi. It is under Mzuzu Agriculture Development Division and has 12 sections.

The EPA is 16 km towards west of the district headquarters border by Mhuju EPA to the east, Katowo EPA to the west, Nyika National Park to the north and Mwazisi sub EPA to the south. Its total area is 364 square kilometers. Bolero headquarters is on E 0581360 N 8786019 and stands at an average altitude of 1,099m above sea level. Bolero EPA has a population of 58,550 people distributed in 112 villages. Women constitute about 51% of the population. The area has an average of 5 persons per household. It has 12 administrative sections figure 1 below, 112 villages, 11,710 farm families and an average land holding size of 2.7 hectares per family (Rumphi FISP Database, 2012/2013). The main livelihood of people in Bolero community is subsistence agriculture which accounts for 65% of the income of the rural poor. The most common food crop grown in the area is maize. The common cash crop grown in the area is tobacco followed by Paprika. The common form of livestock is pigeons, chicken, goats and pigs (TEN Project household survey). Deforestation is at its highest levels in Bolero Community resulting into siltation and flooding of rivers and streams. The major causes of deforestation include brick baking, charcoal burning, construction of tobacco shades, curing of tobacco, opening of new gardens. Poor land management is resulting into loss of soil fertility (Rumphi SEP, 2008).

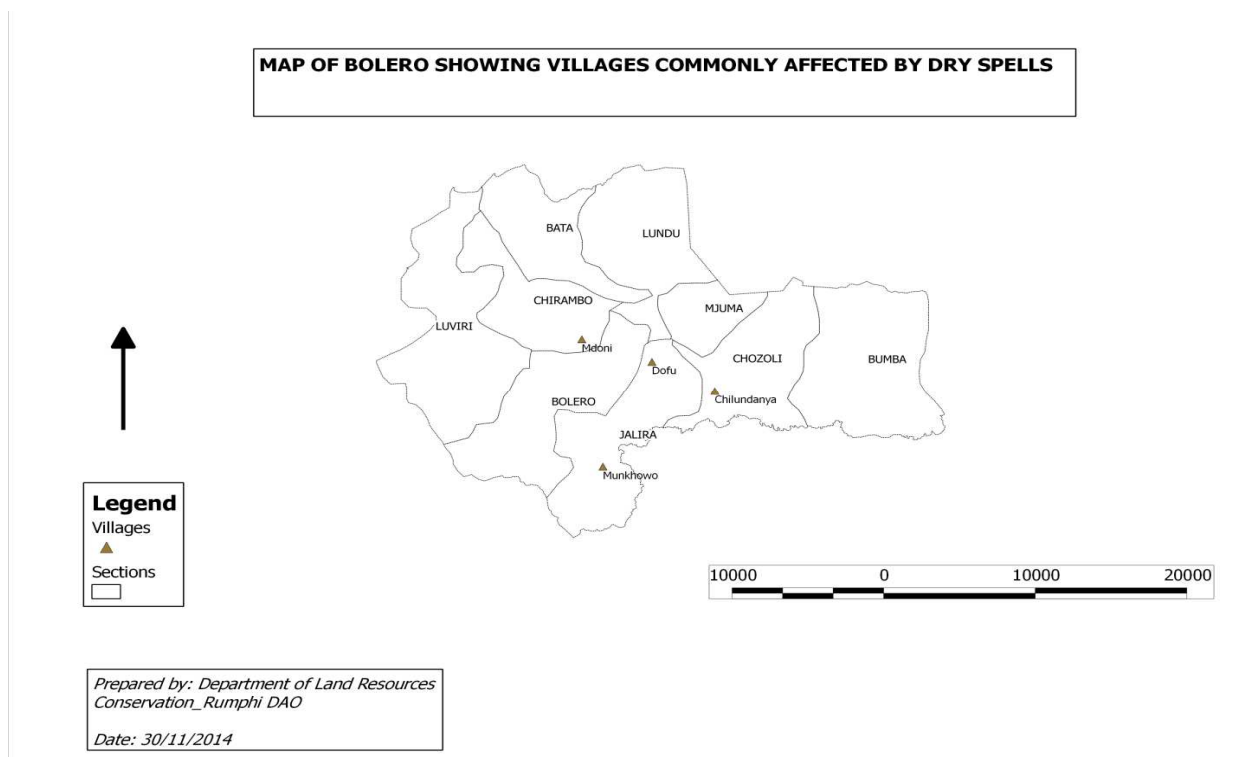


Figure1: Map of the study area in Bolero Community

3.3 Sampling and Data Collection Procedure Data collection Methods and Tools

In this study, data was collected by using a combination of approaches that included questionnaire survey and Focus Group Discussion.

Stratified random sampling procedure where a combination of purposive sampling and systematic random sampling procedures were used to select sections, villages and households in the study. The study was carried out in purposively selected sections and villages that are regularly hit by dry spells and droughts within Bolero Extension Planning Area (EPA) as Bolero EPA has 12 sections but of these, 6 sections are the ones that are frequently affected by dry spells, erratic rains and droughts and only 4 sections were sampled.

The study sampled 100 households in the four villages that were interviewed using a household questionnaire. All the interviewed individuals were above the age of 30 years and have lived in their respective villages for more than ten years. This was the prerequisite for an individual to participate in this study. One Focus Group Discussion was conducted targeting 13 local leaders in the sampled villages using a checklist (Appendix II).

Development of the questionnaire

The first step was identification of the domain of the study, more specifically; the domain was perception, knowledge, attitudes, practices and factors that motivates smallholder farmers to adopt adaptation strategies to climate change and variability. The questionnaire (Appendix I) was structured into six sections, the first section captured demographic characteristics of the respondents, the second dealt with respondents perception of climate change, the third captured respondents knowledge of climate change, the fourth captured smallholder farmers attitude to climate change, the fifth covered farmers practices a regards climate change, the sixth section dealt with factors that motivates farmers decision to adapt to climate change and variability.

Questions were designed to test smallholder farmers' perceptions, knowledge, attitudes, practices to climate change and variability and factors that would motivate farmers to adopt adaptation strategies to climate change. Questions on perception section were designed to test the understanding of smallholder farmers about climate change by asking them to indicate what changes in rainfall and temperature they observed for the past 10 years.

Questions on knowledge section were designed to test the knowledge of respondents on climate change. These were open ended questions to prevent guessing and therefore give false impression of the knowledge of the population with very few multiple choice questions.

Questions included in the attitude section were designed to gauge the prevailing attitudes, beliefs and misconceptions in the population about climate change and variability. Statements were provided and the respondents were asked to indicate the extent to which they agree with those statements. On a predetermined scale (strongly disagree, moderately disagree, neutral, moderately agree, strongly agree).

Questions included in the practice section were designed to assess the practices of the populations with regard to climate change and variability. They were open ended questions like those asked in the knowledge section with very few multiple choice questions

Questions on the motivating factors section, respondents were asked to indicate the level of importance of the factors given in relation to climate change adaptation.

Validation of the questions

Validation of the questions was conducted by pre testing on a small group of the representatives of the population after one day training of enumerators. There were feedback after pre testing and necessary revisions were done which resulted into final version of KAP questionnaire. The questionnaire was complimented by focus group discussion.

In this research both primary and secondary data were collected. Secondary data was collected from Meteorological Services Headquarters in Blantyre Malawi. The aim of collecting this data was to compare the smallholder farmers' perception of climate variability and actual data trends from the Meteorological Services.

3.5 Ethical Issues

During the study, the researcher had to interact deeply with the respondents, thus entering their personal domains of values, rights and weaknesses. The household questionnaire and interview guide included an introductory paragraph to explain the purpose of the study to the respondents. The respondents were informed of the research prior to commencement. The participants were provided informed consent.

There was total anonymity on the respondents who participated in the provision of data. It was also made clear to the participants that the research was only for academic purpose and their participation was absolutely voluntary.

3.6 Data Analysis

The variables for data analysis included perceptions, knowledge, attitudes, practices and factors that motivate smallholder farmers to adopt adaptation strategies to climate variability.

Quantitative data has been analyzed by using Statistical Package for Social Sciences (SPSS) version 16.0. Findings have been presented in form of bar charts and tables. Cross tabulation were used to generate Chi- Square values which were used to measure statistical significance of associations between variables. Qualitative data has been analyzed by using content analysis.

4. RESULTS

Under this chapter, the results of household survey through administering of questionnaires and focus group discussions are presented. First, there is a description regarding the demographic composition of the respondents and second, the results of the quantitative survey and focus group discussions are presented. The results are presented under each specific objective.

4.1 Demographic Information

The information presented under this section shows the details of the demographic data collected on individual respondents.

From the demographic information, 51% of the respondents of the household survey were females and 49% were males. In terms of marital status, 78 % of the respondents were married and 22% were single due to divorce, not being married, widowed and separation. The majority of the respondents (65%) attended primary school, 31% attended secondary school, tertiary education (1%) and 3% had no any formal education.

On occupation, the majority of the respondents (98%) earn their living through subsistence farming and only 2% had their own businesses. Respondents also reported living for an average of 29 years (standard deviation ± 16.286 years) in their current villages (Figure 2). The majority (49%) of the respondents were between the ages of 30 -40 years of age.

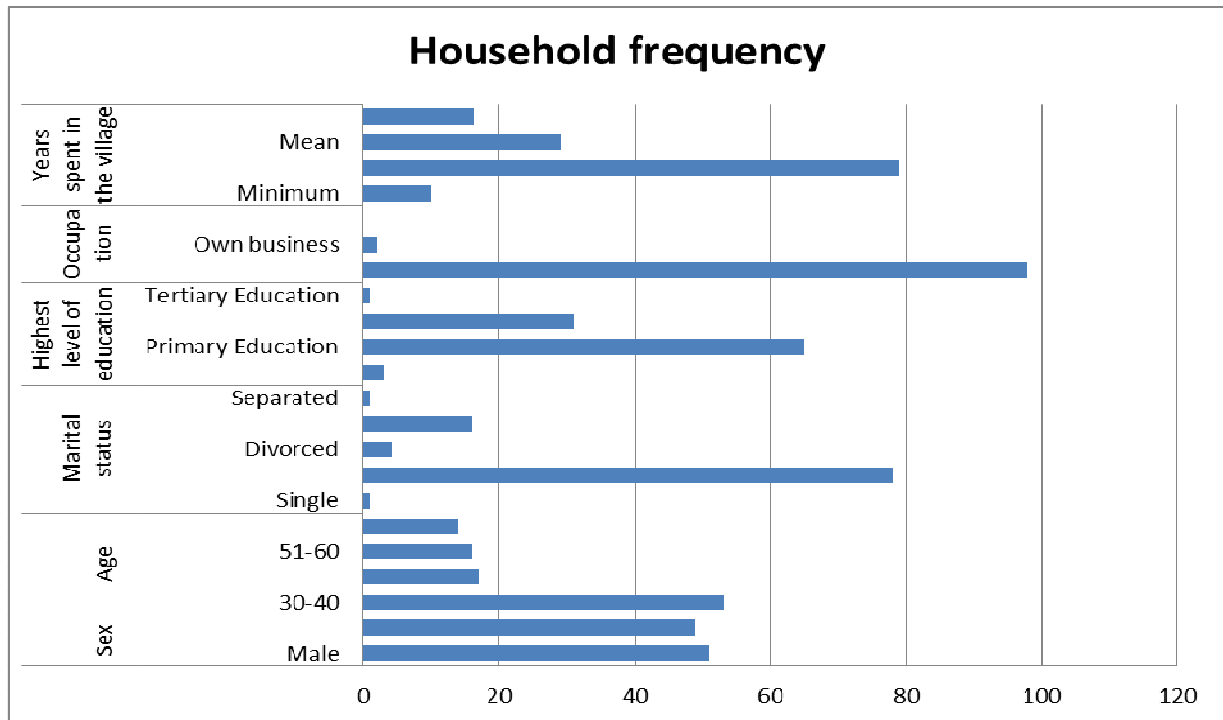


Figure 2. Frequency distribution of the demographic variables

4.2 Smallholder Farmers Perception on climate variability

The findings under this theme are presented to address the first specific objective which is to identify perception of smallholder farmers in relation to climate variability in Bolero Community.

Respondents were asked to indicate whether they have observed increased or decreased rainfall patterns and temperature trends over the past 10 years.

The study results shows that the majority (60%) of the respondents indicated that there has been increased temperatures in Bolero community for the past 10 years (table1).

In both minimum and maximum temperature readings from Malawi Meteorological Services in Blantyre for Bolero shows a positive trend in temperature which indicates that there has been increase in temperature for the past 10 years (Figures 3 and 4). In addition, table 1 also shows a cross tabulation and a chi square test results which shows that there was a significant association (Chi Square) = 39.54 , DF =12 , P-Value= .000 between respondents educational levels and perception of temperature trends.

Table 1: A cross tabulation on respondents perception of temperature changes in relation to education levels

Perception	Highest level of education				Pearson Chi-Square
	Primary	Secondary	Tertiary	None	
Increased temperature	41 (69.5%)	18 (25.5%)	1(5.0%)	0 (0%)	Chi- Square: 39.54 Df: 12 P value: .000
Decreased Temperature	11 (55%)	7 (35.0%)	0 (0%)	1 (10.0%)	
Extreme Temperature	11 (64.7%)	5(29.4%)	0 (0%)	1 (5.9%)	
No change	0 (0%)	0 (0%)	0(0%)	1 (100.0%)	
Don't know	2 (66.7%)	1(33.3%)	0(0%)	1 (1.0%)	

The perception of farmers was compared with the meteorological data from Malawi Meteorological Services in Blantyre.

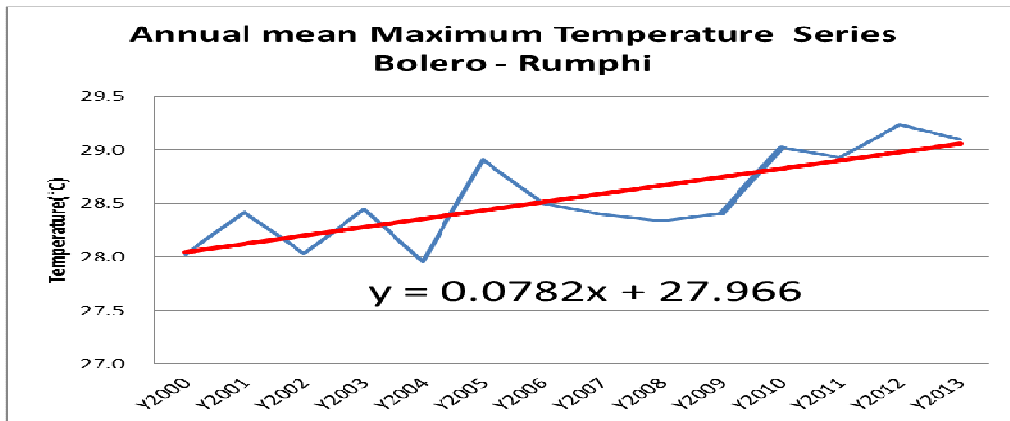


Figure 3: Bolero Annual Maximum Temperature from 2000- 2013

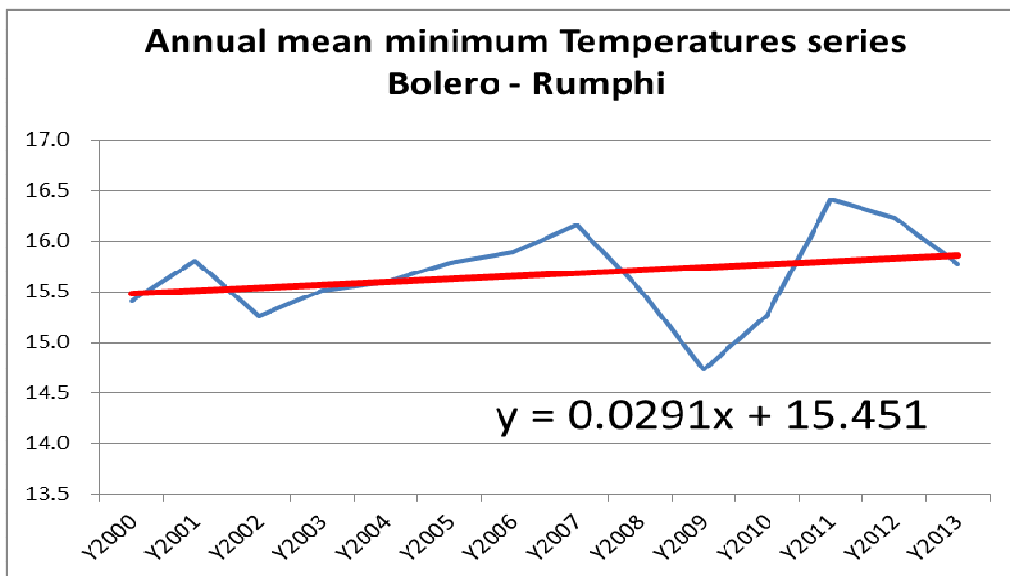


Figure 4: Bolero Annual Minimum Temperature from 2000- 2013

Source: Department of Climate Change and Meteorological Services in Malawi.

The study results shows that the majority (74%) of the respondents indicated that there has been decrease in rainfall over the past 10 years (table 2).

However the data from Malawi Meteorological Centre, shows that there has been positive trend of rainfall during the past 10 years. A Chi- Square test showed no significant association (Chi- Square = 24.545 DF= 18, P- Value= .135) between respondents perceptions of rainfall patterns and education levels.

Table 2. Respondents perception on changes in rainfall and education levels cross tabulation for the past 10 years

Perception on rainfall for the past 10 years	Highest level of education				Chi- Square test.
	Primary	Secondary	Tertiary	None	
Increased rainfall	13(56.5%)	7(30.4%)	1(4.3%)	2(8.7%)	Chi- Square test: 24.545 df: 18 p value: .135
Decreased rainfall	36(63.2%)	21(36.8%)	0(.0%)	0(.0%)	
Increased frequency of drought	9(100%)	0(.0%)	0(.0%)	0(.0%)	
Increased frequency of floods	1(50.0%)	1(50.0%)	0(.0%)	0(.0%)	
Changes in growing season	2(50.0%)	1(25.0%)	0(.0%)	1(25.0%)	
Erratic rains	4(100%)	0(.0%)	0(.0%)	0(.0%)	
No change	0(.0%)	1(100%)	0(.0%)	0(.0%)	

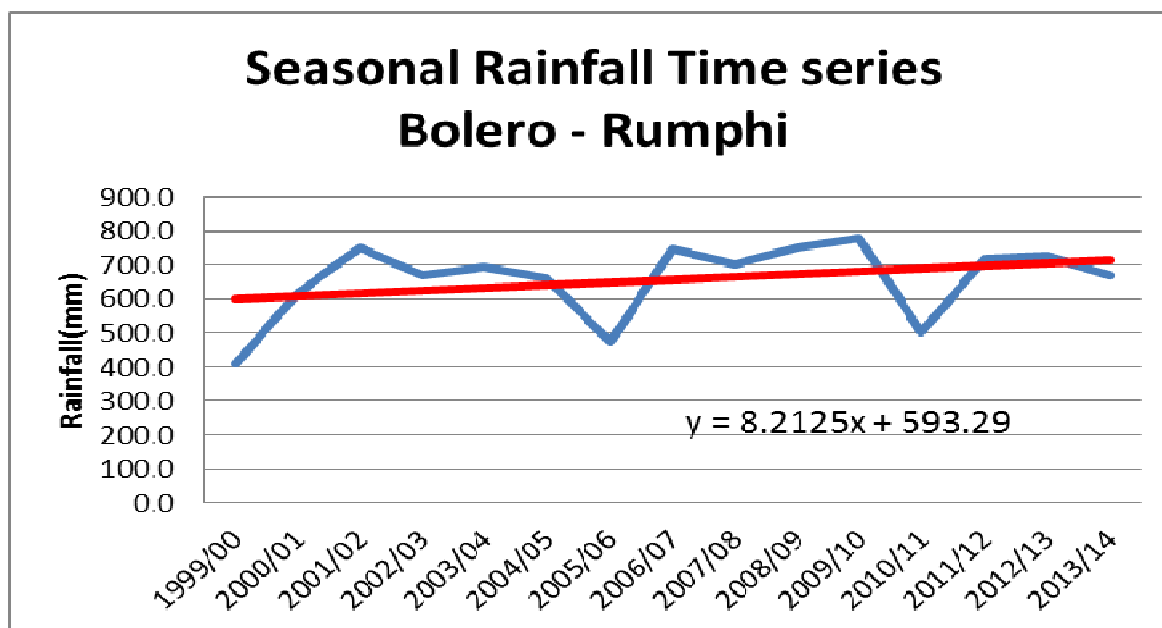


Figure 5: Seasonal rainfall for Bolero from 1999/2000- 2013/2014

Source: Department of Climate Change and Meteorological Services in Malawi.

Figure 5 shows that seasonal rainfall for Bolero from 1999/2000 - 2013/2014 was increasing.

4.3 Smallholder farmers Knowledge, Attitudes and Practices on Climate Change

The findings under this theme are presented to address the second specific objective which is to examine the Knowledge, Attitudes and Practices (KAP) of smallholder farmers in relation to climate change in Bolero Community

4.3.1 Smallholder farmers Knowledge on Climate Change

Respondents were asked to indicate if they have ever heard of climate variability and change, overall 96% of respondents in the household survey had some idea and have heard about climate variability and change this was similar to the findings of the Focus Group Discussions that was conducted but when they were asked to describe the meaning of climate change and variability, the respondents gave a variety of answers as indicated in table 3 below.

The most common understanding for the majority of the respondents of climate change and variability was the change in rainfall (48%) and change in temperature (5%) this adds up to 53% for change in the seasonal weather in general (Table3). A Pearson Chi- Square test was used to determine at 5% significance level if there was association between respondents knowledge on Climate change and variability and education levels.

A Chi- Square test in table 3 showed no significant relationship (Chi Square= 23.489; DF= 15; P- Value= .074) bewteen respondents knowledge of climate change and variability and education levels

Table3: cross tabulation of respondents' knowledge on the meaning of climate change in relation to education levels.

Meaning of climate change and variability	Highest level of education				Chi- Square
	Primary	Secondary	Tertiary	None	
Changes in rainfall and temperature	14 (66.7%)	6(28.6%)	0(.0%)	1(4.8%)	Chi square: 23.489 df: 15 P value: 074
Changes in the environment	5(83.3%)	1 (16.7%)	0(.0%)	0(.0%)	
Changes in weather	8(50%)	7(43.8%)	0(.0%)	0(.0%)	
Changes in rainfall	33(68.8%)	14(29.2%)	0(.0%)	1(2.1%)	
Changes in temperature	3(60.0%)	1(20.0%)	1(20%)	0(.0%)	
Don't know	2(50%)	2(50%)	0(.0%)	0(.0%)	

4.3.2 Smallholder farmers Attitudes to climate change

When asked on their level of agreement with the statement, there is nothing that your community can do about climate change; the study revealed that the majority of respondents (88%) disagreed with the statement and only 6% of respondents agreed with the statement. The study further examined if there is relationship between such attitude and gender. The results showed that 98 % of men disagreed and 78 % of women disagreed with the statement. On the other hand 22% of women were in agreement with statement and 2% of men were in agreement (Table 4). The results clearly indicates that there is relationship between sex of the respondents and their attitude on taking action towards climate change and variability. The Pearson chi-square test was conducted to examine if this association was significant. The Pearson Chi-Square test shows that there was significant association (Chi-Square = 12.746; DF: 12; P-Value= 0.013) between taking action towards climate change and gender.

Table 4. There is nothing this community can do on climate change sex cross tabulation

	Sex		Chi-Square Test
	Female	Male	
Strongly Disagree	37(45.1%)	45(54.9%)	Chi-Square Test: 12.746 df: 4 p value: 0.013
Disagree	3(50%)	3(50%)	
Neutral	6(100%)	0(.0%)	
Agree	5(100%)	0(.0%)	
Strongly Agree	0(.0%)	1(100%)	

On the point that climate change is caused by sin and God is punishing them, 75% of the respondents disagreed while 25% of the respondents agreed. In contrast, the majority of participants during FGDs reported that they still have the belief that droughts and dry spells occurs as a result of not respecting certain cultural beliefs and not conducting ancestral ritual offerings.

The study further examined if there was relationship between age and the belief that climate change is caused by sin. Table 5 Shows 71% of respondents within the age range of 31-40 years disagreed and only 29% of the respondents of 41 years and above disagreed. On the other hand 20% of the respondents between the ages of 30-40 years agreed with the statement while 80% of the respondents of over 41 years agreed with the statement. From the findings it is clear that there is relationship between age and such beliefs (Table 5). To examine if the relationship was significant, a chi- square test was conducted. The results in table 5 shows that there is significant relationship(Chi- Square= 27.206; DF= 16; P-Value= 0.039 between the belief that climate change is caused by sin and God is punishing us and age.

Table 5: cross tabulation and a chi square test on relationship between age and the belief that climate change is caused by sin.

Level of agreement	Age range of the respondents				Chi- square test
	30-40	41-50	51-60	60+	
Strongly disagree	36(75%)	10(20.8%)	2(4.2%)	0(.0%)	Chi-square: 27.206 df: 16 P value :039
Disagree	6(54.5%)	2(18.2%)	1(9.1%)	2(18.2%)	
Neutral	4(40%)	3(30%)	3(30%)	0(.0%)	
Agree	4(16%)	1(4%)	9(36%)	11(44%)	
Strongly agree	2(40%)	1(20%)	1(20%)	1(20%)	

4.3.3 Smallholder farmers Practices related to climate change

Smallholder farmers were asked what has been done to worsen the effects of climate change and variability, as individuals the majority of the smallholder farmers 82% reported cutting down of trees and 49% of smallholder farmers indicated that tobacco farming is worsening the situation in the community (Figure 6). During Focus Group Discussions, the most important action reported as the major contributor to climate change and variability were poor farming practices and deforestation.

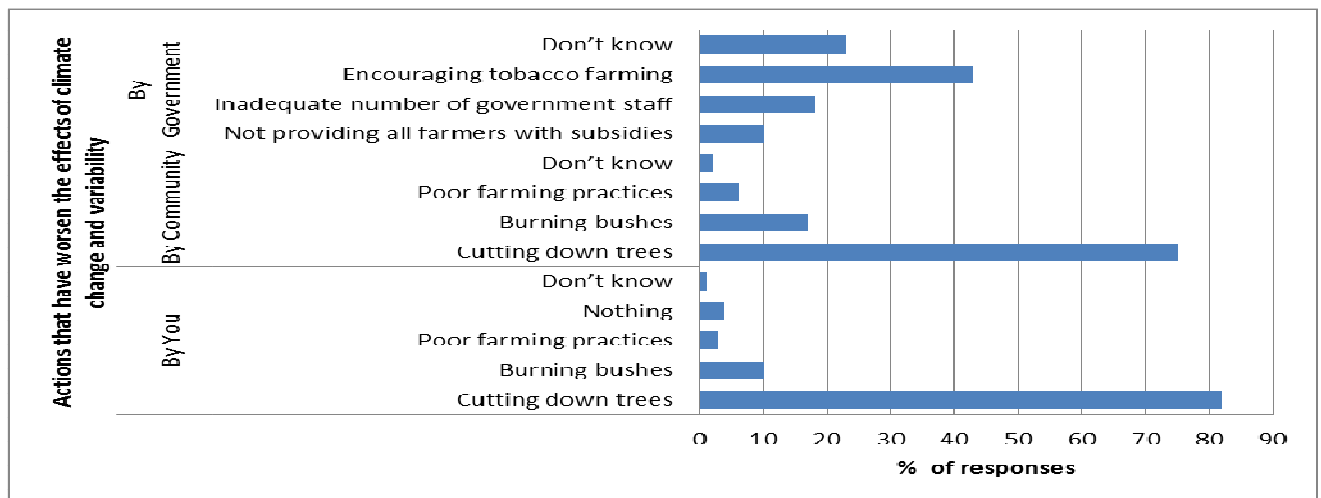


Figure 6: Respondents responses on what has been done to worsen the effects of climate variability and change

4.4 Factors that would motivate smallholder farmers to adopt adaptation strategies to climate change and variability

The findings under this theme address the third objective which aims at finding out what factors would motivate smallholder farmers to adopt adaptation strategies to climate variability and change. Smallholder farmers were asked to rank the factors that they believe would motivate them to adopt adaptation strategies to climate change variability (Figure 8).

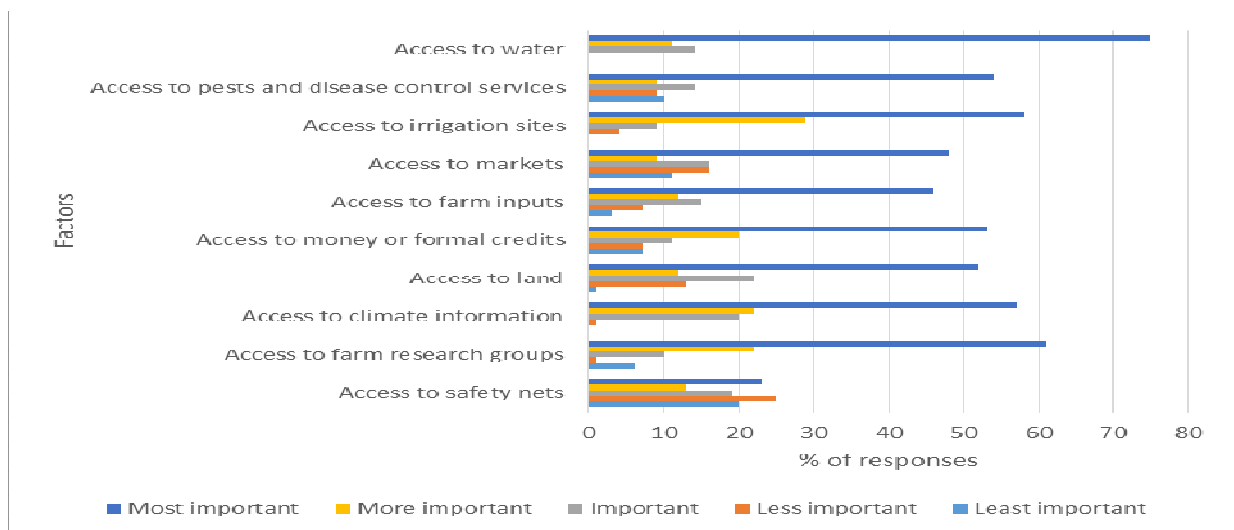


Fig 8: Respondents ranking of the listed factors in order of importance in motivating them to adopt adaptation strategies to climate change and variability

From the findings, access to water (75%), access to farm research groups (61%), access to irrigation sites (58%), access to climate information (57%), access to pests and disease control services (54%) were most frequently ranked by the respondents as the most important motivating factors and while access to safety net was frequently reported as the least important.

During focus group discussions, the majority of the participants reported that provision of small stocks and farm inputs, access to markets, access to loans and money are the most important.

5. DISCUSSIONS AND CONCLUSIONS

In this chapter, the findings of the survey and focus group session are discussed and conclusions are presented.

The study revealed that Smallholder farmers' perception of temperature over the past 10 years was in agreement with meteorological data, which showed that it has been increasing. This is in line with the findings by Gbetibouo (2009) in a study of farmers' perceptions and adaptations to climate change and variability in the Limpopo Basin in South Africa showing that farmers' perceptions about increasing temperature were in accordance with statistical records. A chi square test results revealed that there is a significant relationship between smallholder farmers educational levels and perception of temperature trends. However, the perception of many smallholder farmers on rainfall patterns indicated that there was a decrease in the amount of rainfall over the past 10 years which was not in agreement with the actual rainfall data for Bolero Community which shows a positive trend of rainfall over the past 10 years. The perceptions of smallholder farmers on rainfall pattern may have been influenced by the decrease of crop yield realized over the past 10 years and the occurrence of extreme weather events related to climate change such as droughts within the study area. In addition, Oxfam Report¹ reveal that, farmers across the world show a remarkable unanimity in observations of seasonal change, particularly regarding later onset and earlier cessation of rainy seasons, less, gentle and well distributed rainfall within the seasons.

In concurrence with Ferrier and Haque (2003); the study shows that farmers remember the extremes in climate and they also remember the recent events with reduced crop productivity. According to Rao et al (2011), this can influence decisions on farm investments and adopting of new technologies such as new seed varieties.

¹ www.oxfam.org/grow

From the results of the study, smallholder farmers' perceptions of climate variability and change may not be in the context of the theoretical definition of climate variability and change. There is a clear tendency in the data collected that the respondents perceive climate change and variability in relation to the local environment and does not have an understanding of climate change in a global context. However there are some risks related to a community to base its perceptions of climate change to local events as this would create a difficulty for climate change projects which take into consideration global view of climate change and yet local communities may have different perceptions on the causes of climate change. These perceptions may have a bearing on their attitudes towards climate change which could contribute to low adoption rate of climate change adaptation strategies. This is a clear indication that smallholder farmers in Bolero community do not understand the concept of climate change and variability fully hence these smallholder farmers need help. This is supported by Maddison (2006) who notes that if farmers understanding of climate change do not correspond to the evidence of change provided by data from nearby meteorological stations, then the farmers reveal themselves to be in need of help.

It is therefore important to ensure that information on climate change including meteorological data and seasonal climate forecasts should be made available to smallholder farmers and other natural resource users in Bolero Community. This would improve the existing knowledge gaps, increase their adaptive capacity and build climate change resilience of smallholder farmers in Bolero community.

The negative attitude manifested by the smallholder farmers that climate change is caused by sin and God is punishing us and also that droughts and dry spells are caused by not conducting ancestral ritual offerings, implies that smallholder farmers may tend to under invest in resources such as inputs and labor as well as good agricultural practices or decision making as they would always plan with failure on their minds. There is need to ensure that climate change education awareness is mobilized conducted in Bolero Community with the aim of re-orienting the society towards climate change issues.

Since 22% of women were either neutral or in agreement with the statement that there is nothing that can be done to address issues of climate change compared to 2% of men reveal that there is a challenge as regards climate change adaptation in Bolero Community. Most Women rural communities are very close to and highly depend on natural capital. Their local knowledge systems are very important in managing natural resources which is also vital for climate change adaptations. The negative attitude towards climate change and variability may result into low adoption rate of climate change adaptation strategies. It is important to engage and educate women in Bolero community on issues of climate change and variability.

The common practice that is worsening the effects of climate change and availability in Bolero community is cutting down of trees due to tobacco farming according to the study results. Smallholder farmers need to diversify their income generating activities through crop diversification in order to reduce over dependency on tobacco farming.

The study has revealed a number of factors that would motivate smallholder farmers to adopt adaptation strategies to climate change and variability which included access to markets, access to credits, access to water, access to irrigation sites, access to climate information, provision of farm inputs, small stocks, polythene tubes and tree seedlings. It is therefore important to build the capacity of smallholder farmers in Bolero Community in Village Savings and Loan Associations (VS&LAs) which are community managed financial institutions. The primary purpose of VS&LAs is to provide simple savings and loan facilities to smallholder farmers as there are no formal financial lending institutions. This will enable smallholder farmers to have access to affordable credits which will increase their financial resources and the ability to meet transactional costs associated with the various adaptations options they might want to take and have the means to access to markets. In addition, with more financial resources and access to markets, small holder farmers will be able to buy new crop varieties, new irrigation technologies, invest in livestock farming, which are among the motivating factors to their adoption of climate change adaptation strategies.

There is also need to conduct climate change awareness education and communication to the local population in Bolero Community.

Even though many smallholder farmers in Bolero community have heard about climate change and variability but there are some people who are not still aware of the risk factors associated with climate change and the challenge still exists among the local population in understanding of issues that can lead and are related to climate change. It is therefore important to promote communication based interventions which will have to move beyond merely sharing information and spreading awareness on climate change and variability issues but should focus on promoting specific behavioral practices that are feasible for most of the population of Bolero Community to implement. Furthermore, improving access to climate change information through awareness in Bolero Community needs to be created and promoted which would help smallholder farmers to modify their agricultural practices and dissuade their mind from spiritual angle. There is also need to have a policy that would aim at improving access to meteorological information to smallholder farmers in Bolero Community. It is also important to encourage smallholder farmers in Bolero Community on alternative occupations and sources of income. It is important to employ participatory adaptation strategy that involves smallholder farmers in decision making and planning which would ensure cooperation of local people in climate change adaptation. Areas that need further research are as follows:

1. Assessment of knowledge gaps on climate change issues in extension workers who work directly with Bolero Community
2. To find out the role played by community institutions and traditional leadership structures in the dissemination of climate change information.

LIMITATIONS

As it is with all research works, the study is not without limitations and shortcomings. The number of sampled villages was not large enough due to inadequate resources which included finance to pay the enumerators. Also during focus group discussions there were few women who participated in the discussion compared to men. However, in spite of the above limitations, the author is of the opinion that necessary information was obtained to validate the findings of the study.

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APPENDIX 1: HOUSEHOLD QUESTIONNAIRE FOR KAP SURVEY

CLIMATE VARIABILITY AND CHANGE PERCEPTION, KNOWLEDGE, ATTITUDE AND PRACTICE SURVEY FOR SMALLHOLDER FARMERS IN BOLERO COMMUNITY IN MALAWI		
#	QUESTIONS	CODING CATEGORIES
Q1	Interview number	
Q2	Interview initials	
Q3	SECTION NAME:	VDC Name _____ Village Name _____
Q4	Date of Interview(DD/MM/YY)	_____
Q5	Interview time (Circle AM or AP) HR _____ MIN _____ (AM or PM)	
<p>READ: Hello! My name is..... I am working on a study for Masters in Transformative Community Development Student from Mzuzu University. The purpose of the study is to collect information that will help to improve the perception, knowledge, attitudes and practices/ behaviours of smallholder farmers in Bolero Community and also improve programmes on climate change that are being implemented by organizations in this community. I would like to ask you some questions about what you know or have observed about Bolero’s climate, how you feel about certain climate related issues and what you do when it comes to disasters caused by climate variability. Your answers are confidential and cannot be linked back to you. Your participation is completely voluntary and you may decline to answer any specific question or completely refuse to participate. The interview should take about 20 minutes of your time and you will not be contacted in the future. I would greatly appreciate your help in responding to the questions.</p>		

Q6	Are you willing to answer the questions <i>Note: If not stop the Interview</i>	Yes	1
		No	2

SECTION A: DEMOGRAPHICS

Q7	What is your sex	Female	1	Male	2
Q8	a)How old were you on the last birth day b) in what year were you born	Age in years	_____	Year of birth	_____
				YYYY	
Q9	What is your current marital status	Single	1	Married	2
		Divorced	3	Widowed	4
		Separated	5	Not stated	6
		Other			
Q10	What occupation best describes the main type of work you currently do for a living or earning cash	Farmer (subsistence)	1	Business(yours)	2
		Business (someone else)	3	Housewife/ home duties	4
		Unemployed	5		

		Retired 6 Other (Specify) 7
Q11	<p>a) Is your job located in your home community that is the community in which you currently live</p> <p>Skip this if the answer to Q10 = currently unemployed</p> <p>b) How many years have you lived in this community (give approximate figure)</p>	<p>Yes_____ 1</p> <p>No _____2</p> <p>Years _____3</p>
Q12	What is your highest level of education completed	<p>Primary School _____1</p> <p>Secondary School _____2</p> <p>Bachelors Degree_____ 3</p> <p>Masters Degree or Higher_____4</p> <p>Other (Specify)_____ 5</p>

SECTION B: PERCEPTIONS TO CLIMATE VARIABILITY

Q13	Have you noticed any long term changes in the temperature over the past 10 years	Increased temperatures_____1 Decreased Temperatures_____2 Extreme Temperatures_____3 No change_____4 Do not know_____5
Q14	Have you noticed any long term changes in the rainfall over the past 10 years	Increased rainfall_____1 Decreased rainfall_____2 Increased frequency of drought_____3 Increased frequency of floods_____4 Changes in growing seasons_____5 Erratic rains_____6 No change_____7
SECTION C: KNOWLEDGE OF CLIAMTE CHANGE		
Q15	Have you ever heard of climate change	Yes_____1 No_____2

Q16	What do you think it is meant by climate change

Q17	Give some examples of effects of climate variability and change

Q18	Do you think your government is doing anything about climate change	Yes_____1
		No_____2

		A great deal	A fair amount	Not much	Hardly anything	Don't know
Q19	If yes to Q 18, how much do you know about your government response to	5	4	3	2	1

	climate change					
Q20	How much do you know your village risk associated with climate change	5	4	3	2	1

Q2 1 and Q2 2	Q21 and Q22 Relate to events listed in this column	Q21a) Do you know of these events are likely to occur in or near future in your community			Q21b) If yes, have you noticed any of the following changes in your community over the past 10 years				Q22 In your opinion how have the changes identified in Q21 affected your community
		Ye s	N o	Non Respo nse	Yes	No	Non R Don' t kno w	Non resp onse	
	Increased rainfall	1	2	3	1	2	3	99	
	More drought	1	2	3	1	2	3	99	
	More Flooding	1	2	3	1	2	3	99	
	Decreased rainfall	1	2	3	1	2	3	99	
	Changing in growing season	1	2	3	1	2	3	99	
	Warmer temperature	1	2	3	1	2	3	99	
	Cooler temperatures	1	2	3	1	2	3	99	
	Extreme temperatures	1	2	3	1	2	3	99	
	No change	1	2	3	1	2	3	99	

	Don't know	1	2	3	1	2	3	99	
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Q23	Do you think any of the following causes climate change		Yes	No	Don't know	No response		
	Burning fossil fuels such as oil, coal, natural gas		1	2	3	99		
	Transportation (driving of vehicles) through vehicle emissions		1 1	2	3	99		
	Deforestation		1	2	3	99		
	Poor agricultural practices(e.g. overgrazing, pesticides		1	2	3	99		
	Other (specify)_____		1	2	3	99		
	Q24	Do the following occur in your community		Yes	No	Don't know	If yes, do you think they are caused by climate change	
					Yes	No	Don't know	
Increased flooding		1	2	3	1	2	3	
Decreased agricultural productivity		1	2	3	1	2	3	
Frequency occurring of droughts/ dry spells		1	2	3	1	2	3	
Early cessation of rains		1	2	3	1	2	3	

	Erratic rains	1	2	3	1	2	3
	Late starting of rains	1	2	3	1	2	3

SECTION D: ATTITUDE TO CLIMATE CHANGE

Q2 5	How concerned are you about Climate variability and change	Very concerned___1 Moderately concerned___2	Not concerned at all___3 Not sure_____4 Don't know__5				
Q2 6	Do you think any of the following can be important in helping your community deal with climate change and variability	Not important at all	Moderately Important	Very Important	Don't know	No response	
	Reduced cutting down of trees	1	2	3		99	
	Reduction in fossil fuel(coal, oil, natural gas) use	1	2	3	4	99	
	Improved cultivation in agriculture sector	1	2	3	4	99	
	Improved awareness of climate change and variability	1	2	3	4	99	
	Improved pest management	1	2	3	4	99	

	strategies					
	Water harvesting	1	2	3	4	99
	Provision of finance assistance	1	2	3	4	99
	Other(specify)	1	2	3	4	99
Q2 7	Is climate change man made or is it caused by God?	Man Made__1Caused by God__2 Both____3Don't know/ note sure__4				
Q2 8	How interested are you in knowing how climate change affects the following list of climate related condition	Not interested at all	Modera tely interes ted	Very intere sted	Don' t know	Non response
	Drought	1	2	3	4	99
	Rainfall	1	2	3	4	99
	Seasonality of crops	1	2	3	4	99
	Flooding	1	2	3	4	99
	Windstorms	1	2	3	4	99

Q2	State your level of agreement	Strongly	Disag	Neut	Agre	Stro ngly	Don't know
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9	with the following statements	disagree	ree	ral	e	Agree		
	There is nothing this community can do about climate change	1	2	3	4	5	6	
	People in this community have no control over climate change because it is an act of God	1	2	3	4	5	6	
	Climate change is occurring in this community because of sins and God is punishing us	1	2	3	4	5	6	
	I am prepared to do more to help preserve the environment	1	2	3	4	5	6	
Q30	Rank the following climate change issues in order of importance from 1-7 in terms of how you believe they affect Bolero community. In the ranking use 1 to represent the least important and 7 to represent the most important(note- please ensure that each number is used only once for each item for this Q30	Least Important	less important	Not sure	important	Not important	More important-	Most important
	Increase in rainfall	1	2	3	4	5	6	7
	Drought	1	2	3	4	5	6	7
	Seasonality of crops	1	2	3	4	5	6	7
	Increased temperature	1	2	3	4	5	6	7

Q3 1	On scale of 1-5 with 1 representing not important and 5 being extremely important	Not important	-less important	- more important	- most important	Extremely important
	What number do you think responds the importance of climate change in your community	1	2	3	4	5

Q32	Who in your opinion is mainly responsible for addressing climate change (Select only one answer)	Government_____1
		Community_____2
		NGOs in the community_____3
		All the above_____4
		Other(specify)_____5
Q33	Do you think Bolero community is adequately prepared to handle extreme events associated with climate change	Yes_____1
		No_____2
		Don't know/ _____3
Q34	Are you interested in finding out more about the impact of climate change on Bolero community	Very interested_____1
		Somewhat interested_____2
		Not interested-----3
		Don't know_____4

SECTION E: PRACTICES RELATED TO CLIMATE CHANGE

Q35	What has been done to prevent or lessen the impact of climate change in your community
	By you?
	By your community
	By government

Q36	What has been done if any to worsen the effects of climate change on your community
	By you?

Q37	
	By your community
	By government
	What could be done to prevent or lessen the effects of climate change in your community

	By you?
	By your community
	By government

Q38	What has prevented action from being taken about climate change in your community
	By you?

	By community?
	By government

**SECTION F: FACTORS THAT MOTIVATES SMALLHOLDER FARMERS TO ADOPT
ADAPTATION STRATEGIES TO CLIMATE CHANGE**

Q39	Rank the following factors in order of importance from 1-5 in terms of how you believe they would motivate you to adopt adaptation strategies to climate change in Bolero community. In the ranking use 1 to represent the least important and 5 to represent the most important(note-please ensure that each number is used only once for each item for this only once for each item for this Q39	Least important	Less important	important	More important	Most important
Access to safety nets(food emergency, relief, food subsidies and other farm support)	1	2	3	4	5	
Access to extension services(farm research groups)	1	2	3	4	5	
Access to climate information(seasonal forecasts, early warning systems, weather forecasts)	1	2	3	4	5	
Access to land	1	2	3	4	5	

	Access to money/ formal credit	1	2	3	4	5
	Access to farm inputs	1	2	3	4	5
	Access to markets to buy farm inputs and seedlings	1	2	3	4	5
	Access to irrigation sites	1	2	3	4	5
	Access to pests and disease control services	1	2	3	4	5
	Access to water	1	2	3	4	5

Q40	Interview end time (Circle AM/PM) Thank you for participating	HR: MIN (AM/PM)
	INTERVIEWER COMMENTS OR NOTES	

- The topics that will be covered during the discussion
- Time frame for the discussions
- Suggested questions to elicit specific information needed for KAP Survey
- Closing session

Purpose for conducting the Focus Group Discussion Session

The purpose of this session is to obtain detailed information about the current state of people's perception, knowledge, attitudes and practices regarding climate variability and change in Bolero Community.

Respondent Profile

The respondents to this session will be smallholder farmers in Bolero Community who will represent the people who live in Bolero Community. These will be selected purposefully by considering farming experience, age, and number of years Changes (10) they have lived in Bolero Community.

The Focus of the Focus Group Discussion Session

The objective of conducting a Focus Group Discussion is to get a high confidence level of understanding of the following:

- The extent to which the smallholder farmers in Bolero Community have heard about climate variability and change.
- Current perceptions and understanding of what climate change and variability actually is and what impacts they believe it may bring (i.e. how climate change and variability is defined in the minds of respondents).
- The degree to which the respondents believe that climate change will impact them personally and how they perceive their personal level risk to climate variability impacts.
- Changes in behaviours that the respondents may be taking to reduce their level of risk and why they are taking such changes and why they may not be taking other possible changes.

- The extent to which smallholder farmers perceive climate variability risk affecting their wider community.
- The extent to which respondents are aware of what government is doing about climate variability and change,

Area of Focus

1. Perceptions, knowledge of climate change and variability and its impacts
Attitude and practice as regards to climate variability,

SUGGESTED QUESTIONS TO BE ASKED DURING FGD SESSION

1. When you hear the words, climate variability and change what immediately comes to your mind? What does climate change and variability mean to you? (Probe why is climate change/variability happening.
2. What is your view is causing climate (weather) change? Why this is occurring
3. What types of change do you think climate change and variability will bring or is bringing already? Note that this will lead into general discussions on impacts such as increased storms, drought, rainfall etc)
4. What type of climate impacts have you observed personally or experienced directly? What was the result of this experience?
5. What types of impact has climate change and variability had on your community? What impacts have these changes in weather had?
6. What do you think will happen if these impacts continue to occur and are not addressed?
7. What steps are you taking in your own life to reduce climate change impact? If you are not, what is holding you back?
8. In order for Bolero Community to get ready for climate change- every one need to be involved and play a role. What role should the government play in this community is happening to make Bolero Community more climate ready?

9. What types of activities are the community of Bolero community doing in response to climate variability
10. What roles should individuals and community at large play in getting ready for climate change impact? What type of responsibility do you have?
11. What things if any do you think can be done to make sure that we do not contribute to climate change?

Closing the session

Thank you so much for taking part in this discussion

Is there anything we missed in our discussion that you would like to talk about?