IMPACT OF CLIMATE CHANGE ON GENDER ROLES IN AGRO-PASTORALISTS COMMUNITY IN MVOMERO DISTRICT, TANZANIA

REGINA TALASWA MOLLEL

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN RURAL DEVELOPMENT OF SOKOINE UNIVERSITY OF AGRICULTURE.

MOROGORO, TANZANIA.

2015

EXTENDED ABSTRACT

Climate change is expected to influence of water flow, crop and livestock production, availability of pastures and other components of agricultural systems. On the contrary, the agro-pastoral gender roles are no longer sustainable due to the impact of climate change, resulting in changes of water flow. The main objective of this study was to determine the impact of climate change on gender roles in agro-pastoralists community in Mvomero District, Tanzania. The study adopted a cross-sectional research design.Quantitative data were collected by using questionnaire which was administered to a sample of 135 households. Focus group discussions were used to get qualitative data. Descriptive and inferential statistics were computed. Likert scale was used to analyze the perceptions of agro-pastoralists on climate change. Pearson's Chi-square test was used to analyze agro-pastoralists' awareness on climate change. An independent sample T-test was used to compare perceptions of the two groups (women and men).The results revealed that, gender differences on the level of awareness about climate change were found. However, the relationship was not statistically significant (P>0.05). The perceptions on climate change differed between men and women although the relationship was not statistically significant (P>0.05). Adaptation strategies used by agro-pastoralists in the study area including, timing andto reduce the number of livestocks. However, such coping strategies were not sustainable and some household became more vulnerable to climate change due to their ineffective coping strategies. Therefore, the study recommendstogovernment to espouse agro-pastoralists for improving their livelihood by accessing to extension services for the access of reliable information and knowledge on weather forecast using both local/indigenous, improving means and how to mitigate climate change impacts. Gender sensitive approaches should be introduced when training and assisting rural households' decision making towards adopting coping and mitigating strategies to positively impact on gender roles and wellbeing.

DECLARATION

I, **Regina TalaswaMollel,** do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.

_____ _____

Regina TalaswaMollel Date

(**M.A. Candidate**)

The above declaration is confirmed

_____ _____

Dr. J. N.Jeckoniah Date

(Supervisor)

_____ _____

Prof. H. Mahoo. Date

(Supervisor)

COPYRIGHT

ACKNOWLEDGEMENTS

I thank the Almighty God for his protection, blessings that brought me up to this moment. I wish to express my sincere gratitude to my supervisors, Professor H. Mahooand Dr. J.N.Jeckoniahfor their encouragement and continuous guidance. Theyhave devoted their precious time for critical comments, enthusiasm, endless advice, encouragement and guidance throughout the entire work. Successful accomplishment of this research would have been very difficult without their generous time devotion. In addition, I would like to acknowledge the financial support for this research provided by Professor H. Mahoo. Without his contribution, this research could not have been completed.

I would also like to extend my special thanksto thelecturersin the Development of Studies Institute, Sokoine University of Agricultureand all relevant individuals, organizations and institutions for their assistance in various stages of this research, for all the guidance they provided to me. Their thoughtful criticism of this research played an elemental role in its completion.

I also wish to convey my heartfelt,unreserved and special thanks to the respondents and the village administration in Hembeti, Mkindo and Misufini villages that assisted me in conducting the field work and responded to the Questionnaires. I appreciate their cooperation and provision of information essential for this study.

Finally, and most notably this research would not have been possible without the material support and encouragement frommy beloved husband, Reuben Oloitay, my daughters Namnyack,Nosotwa and my son Loserian. Their honest support and prayers helped me to concentrate on my study. To you all I say thank you.

DEDICATION

This work is dedicated to the Almighty God the merciful and provider of guidance throughout my life, who lavishly gave me the endurance, resilience, foresight and thoughtfulness to undertake this study and to complete it to satisfaction. Also, this work is dedicated to my beloved mother MwajumaMundiri, my brothers Jackson and James, whom together laid down the foundation of my education with a lot of sacrifices and efforts. I would like to dedicate to my beloved husband, Reuben LobikyekiOloitai, my daughters Namnyak, Nosotwa and my son Loserian. God bless them forever, AMEN.

.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS AND ACRONYMS

ADB	African Development Bank
CH_4	Methane
CO_2	Carbon dioxide
FAO	Food and Agriculture Organization
FGD	Focus Group Discussion
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IPCC	Intergovernmental Panel on Climate change
LDCs	Least Developed Countries
LRS	Likert Rating Scale
MDGs	Millennium Development Goals
N2O	Nitrous oxide
NAPA	National Adaptation Programme of Action
NBS	National Bureau of Statistics
NGOs	Non-Governmental Organizations
NSGRP	National Strategy for Growth and Reduction of Poverty
SNAL	Sokoine National Agriculture Library
SPSS	Statistical Package for Social Sciences
SUA	Sokoine University of Agriculture
TDV	Tanzania Development Vision 2025
UN	United Nations
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change

URT	United Republic of Tanzania
USAID	United States Agency for International Development

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Climate variability is the variations in the mean state and other statistics (such as standard deviations, the occurrences of extremes, etc.) of the climate on temporal and spatial scales beyond that of individual weather events(Hegerl*et al.*, 2007). Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability) (Hegerl*et al.*, 2007). According toBhrusal(2009) Climate variability is a long term summary of weather conditions taking into account short term fluctuations happening from year to year such as severe storms. It is also a function of the character, magnitude, and rate of climate change and variation to which a system is exposed; its sensitivity and its adaptive capacity. The underlying concept is that global climate change causes local impacts and that it is not possible to treat variability separately from climate change**.**

Research indicates that the effects of climate change including variation in temperature, rainfall, drought, floods, heat waves, hurricanes and typhoons have already occurred across the world; affecting countries, income groups and occupations differently (Chaudhary and Aryal, 2009).There is high level of certainty in the assertion that climate change is a result of global warming that have significantly been caused by increased emission of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and other greenhouse gases (Collier *et al.*, 2008). Thus, it is a long term measurable change in the elements of climate tending towards extreme. The classical period often referred to in climate change studies is 30 years.

Climate change has already begun to transform life on earth, around the globe, seasons are shifting, temperatures and sea levels are rising (FAO, 2011). According to the Food and Agriculture Organization (2011) global climate change has already had observable effects on the environment.The rise in global temperature by 4^{o}C forecast to occur towards year 2100 is likely to occur if mitigation efforts do not work out (FAO, 2011).Mubaya*et al.* (2010) noted that the impact of climate change is two-fold, bio-physical and socio-economic. Whereby bio-physical impact include rising sea, waters, more frequent and intense storms, extinction of species, worsening drought and crop failure. As well as changes in cloud cover and precipitation, melting of polar ice caps and glaciers, and reduced snow cover (Mendelsohn and Dinah, 2005).The environmental degradation caused by bio-physical impacts creates socio economic impacts, mainly on the agricultural sector where areas suitable for agriculture, the length of growing seasons and yield potential, particularly along the margins of semi-arid and arid areas are expected to decrease (Mubaya*et al*., 2010).

Approximately 20-30 percent of plant and animal species are expected to be at risk of destruction (FAO, 2007).These extreme events could be worsened by existing social and economic challenges in the region, particularly for those areas and communities dependent on resources that are sensitive to climate changes (ONRS, 2010).Consequently, small scale subsistence agro-pastoralists in terms of productivity, food security and family income are also affected. Climate change is expected to influence crop and livestock production, hydrologic balances, food systems, input supplies and other components of agricultural systems(Masike, 2007).The combination of generally increasing temperatures and shifting rainfall amounts and patterns will clearly have impacts on crop and livestock agriculture which forces agro-pastoralists to shift their roles (Masike, 2007). Water scarcity has become globally significant over the last (50) years or so, and is an

accelerating condition for 1-2 billion people worldwide (MEA, 2005). Feed is and will remain a critical constraint on livestock production in climate change is likely to have major impacts on poor livestock keepers (Thomas and Twyman, 2005).

Climate change and variability have affected gender roles among the Agro-pastoralists communities.It has the impacts on both women and men and that there is gender variation in gender coping and adaptation strategies (Barrow and Mogaka, 2007).Climate change changes the allocation of tasks and time in different ways for men and women. For example, water stress, decreasing the time for food production and preparation as well as participation in income generating activities (AfDB, 2009).In a case study in Guyana, droughts and floods caused both women and men to spend more time planting and diversifying their crops, but women's workload increased as they had to perform household activities at the same time(Bynoe, 2007).For example, in Vietnam women collect water from water sources that are farther and farther away as each drought take its toll (Shaw, 2008).

All countries and ecosystems in the globe will face the consequences of the changing climate. However, the seriousness of the effects will definitely vary from country to country or across ecosystems. Many areas in Africa are recognized as having climates that are among the most variable in the world on seasonal and decadal time scales (UNFCCC, 2007). Cooper *et al*. (2008) noted that whilst the exact nature and extent of the impacts of climate change on temperature and rainfall distribution patterns remain uncertain, it is the poor and vulnerable who will be the most susceptible to changes in climate. Agricultural production on the continent relies mainly on rainfall and is severely compromised in many countries, particularly for subsistence farmers (UNFCCC, 2007).

Furthermore, Africa is one of the most vulnerable continents to climate change and climate variability; a situation aggravated by the interaction of 'multiple stresses' occurring at various levels and low adaptive capacity (Boko*et al*., 2007).

Climate change has affected sectors of economy such as water resources, forest and livestock (Meena and Sharif, 2008). For example, Burkina Faso became more interested in short- and medium-term sorghum varieties to cope with the impact of climate change. However, the shift in cropping practices entailed costs and risks people because these varieties were more vulnerable to weeds, pests, and water stress and less productive than longer duration varieties (Roncoli*et al*., 2001).

Tanzania is experiencing greater weather extremes including increases in temperature and changes in rainfall patterns, such effects have increased drought, floods and land resources degradation (Yanda*et al.,* 2006). The intensity of droughts, floods and changes to growing seasons have significant effects on gender roles (Yanda*et al.,* 2006).According to the National Adaptation Programme of Action (URT, 2007) the adverse impacts of climate change are already having their toll on the livelihoods of people. All these changes will aggravate the situation leading to increased vulnerability of the communities to the impacts of climate change and affecting sectors of the economy, especially agriculture, water, energy, health and forestry (IPCC, 2010).

Analysis of observational data in Tanzania carried out by New, (2006) showed clear evidence of decreasing numbers of cold days and nights and a decrease in cold waves. Daily temperature observations show only small increasing trends in the frequency of hot days, but much larger increasing trends in the frequency of hot nights, especially in the months of December to February (McSweeney*et al.*, 2008). Similarly, rainfall trends in

Tanzania show significant decrease in annual rainfall, notably in the 'long' rains (March to May); annual rainfall has decreased at an average rate of 2.8mm per month per decade (3.3%) (McSweeney*et al.,* 2008 cited by Taylor *et al*., 2011).Thus, by 2100 Tanzania expects to have a decrease in rainfall of between 0 to 20% (Mwandosya*et al.,* 1998). Such major changes in rainfall patterns will inevitably have severe consequences to society's practices. Some of those observed (repeated droughts and floods) are already happening (Hulme*et al*., 2001 cited by Shemsanga*et al*., 2010).For example, the drought that occurred in 2005/06 and the *El Niño* in 1997/98, highlight the country's vulnerability to current climatic hazards (Ehrhart and Twena, 2006).Mean annual temperatures and average daily temperatures are expected to rise by 2 to 4^0C in Tanzania by 2075 as a direct consequence of climate change (URT, 2003; URT, 2007).

Rural areas of Mvomero District are some of the parts in Tanzania that have already experienced the impact of climate change. These changes will aggravate the situation leading to increased vulnerability of the communities to the impacts of climate change and affecting sectors of the economy, especially agriculture, water, energy, health and forestry (URT, 2007). Land degradation and water shortages have become looming problems in Tanzania (URT, 2007). Availability of water for cropping as well as other uses including domestic use and for livestock is currently threatened by excessive drought (Mubaya*et al*., 2010). The present decade and the coming decades are likely to see increasing demand and competition for the remaining resources like water and pastures in agro-pastoralists community (Masike, 2007).Small changes in temperature resulted in changes in livestock and crop productivity; an implication of this is that, significant changes in management of the grazing, kind of crop planting and new life system may be required to attain the production levels desired (Morgan *et al*., 2007). Deterioration of pastures during droughts

and periods of overgrazing have resulted in poor health and death of livestock impacting food and livelihood of herders (Challinor*et al*., 2007).

According to Swai*et al.* (2012), women and men respond to climate signals by diversifying their crops, but this requires additional human capital investments in the form of time and labor. Changes to the mix of crops increased workloads to women because these crops led to more weeding work (Nelson and Stathers, 2009). This may be due to the fact that crop diversification requires more labor and time to operate as different types of crops may have labor requirement. Both men and women are more affected by climate change, but women are more affected because of asymmetrical gender relations (Nombo*et al.,* 2013).Swai*et al*. (2012) noted that, these tasks require more time and cause greater difficulties for women who have to deal with other household chores at the same time.The impacts are differentiated by geographical location, gender and wealth status.

1.2 Problem Statement

The government of Tanzania has undertaken several efforts including a quick scan on the impacts of Climate Change in 2009, preparation of the National Adaptation Programme of Action in 2007 which seeks to identify immediate and urgent Climate Change Adaptation Actions (URT, 2012).Tanzania's agreement of the United Nations Framework Convention on Climate Change and Kyoto Protocol in 1996 and 2002 respectively, are steps towards ensuring that climate change issues are addressed at the national level. Despite the interventions that focus on reducing the impact of climate change, agro-pastoral based livelihoods are still not sustainable due to the impact of climate change, resulting in changes in water flow and grazing land availability which causes some socio-economic and ecological impacts (Antezza, 2008).Studies on gender and climate change have been conducted in Tanzania, for example the studies bySwai*et al.* (2012), Meena*et al.*

(2008)and Nelson and Stathers (2009), but with alienated focus on either agriculture, livestock and or both agriculture and livestock. Studies linked to agro-pastoralists communities and their gender roles to climate changes are still scant. Therefore, this study sought to understand the impacts of climate change on gender roles in agro-pastoralists communities in Mvomero District.

1.3 Justification of the Study

Agro-pastoral systems, livestock and crop production are key assets for poor people, providing multiple economic, social, and risk management functions (Ndesanjo, 2009).Despite the widespread scientific debate concerning climate change and variability, little is known about climate change impacts to agro-pastoralist households on their gender roles. More information is required to find out on how climate change impacted the gender roles in agro-pastoralists. A better understanding of the local dimensions of climate change is essential to develop appropriate adaptation measures that will mitigate adverse consequences of climatic change impact (IPCC, 2007).

The study was essential as it intended to generate awareness on the impact of climate change in agro-pastoralists communities.Information gathered can be used as input formulating coping strategies for agro-pastoralists' communities.Furthermore, outcome of the study is useful to stakeholders who are responsible for development sectors as well asthe disaster management section of the government. In addition to that the knowledge gained from the study is useful to citizens who are employed in the agricultural sectors for advisory purposes.

The information generated by the study contributes to the efforts attainment of theMillennium Development Goal (MDGs), goal number 7 that seeks to ensure

environmental sustainability. Tanzania Development Vision 2025 which among other issues aims to ensure environmental sustainability as one of its goals. In addition, the National Strategy for Growth and Reduction of Poverty (NSGRP), Cluster I, Goal 4 under cluster two which also focuses on climate change adaptation and mitigation.

1.3Objectives

1.3.1 The Overall objective

The overall objective of this study was to assess the impact of climate change on gender roles in agro-pastoralists communities in Mvomero District.

1.3.2 Specific objectives

i. To assess agro-pastoralists' awareness on climate change.
ii. To assess agro-pastoralists' perception of the impacts of climate change on gender roles.
iii. To determine the coping and adaptation strategies taken by agro-pastoralists to minimize the impact of climate change on gender roles.

1.4Research Hypothesis

H_0**:** The attitude of agro-pastoralists does not differ by the impact of climate change on their gender roles.

1.5 Conceptual Framework of the Study

The study adopted a framework byNdesanjo (2009) in his work on Understanding Pathways to Increasing Resilience in a Changing Climate among Pastoral Societies of Northern Tanzania**.** The framework is however modified to fit into and guide this study (Fig. 1). It is organized into three parts of key variables which are narrative outline

presentation of variables to be studied and hypothetical relationships between and among the variables. Those variables are backgrounds, independent and dependent variables. Three of the resulting changes of the climate are changes in precipitation, temperature and extreme events such as droughts and floods tends to bring shocks and stress into agro-pastoralists communities and hence shifting their gender roles.

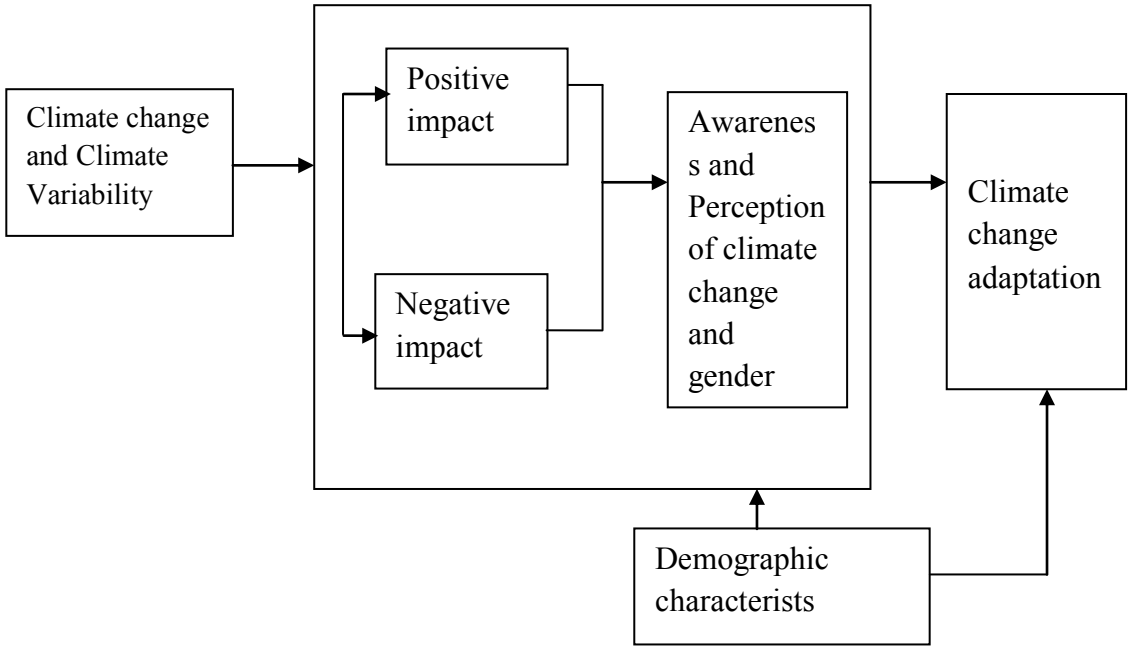

Figure 1: Conceptual framework for understanding the impact of climate change on gender roles among agro-pastoralists communities.

Source: Modified from Ndesanjo, (2009)

1.6 Organization of the Dissertation

This dissertation is organized in four chapters. Chapter one cover extended abstract and introduction of the overall theme of the study. Chapter two consists of paper one, and Chapter three contains paper two. Chapter four presents the conclusion, recommendations and overall implication of the study findings.

REFERENCES

African Development Bank, (2009). 'Information Note on the Checklist for Mainstreaming Gender and Climate Change in Projects. African Development Bank and African Development Fund.[http://www.afdb.org/en/ knowledge/publications/annual-report/annual-report-2009/]site visited on 17/12/2015.

Antezza, J. (2008). Climate change induced displacement in the IGAD: Implications for policy and livelihoods among pastoral communities. *First workshop on climate induced migration and displacement held in MENA Marseille – June 15-16 2010.*

Barrow, E. and Mogaka, H. (2007). Climate change 2007: Impacts, adaptation and vulnerability. Traditional strategies used by pastoralists to cope with La Nina induced drought in Kajiado, Kenya. *African Journal of Range and Forage Science*21 (3): 1–2.

Bhrusal, Y. (2009). *Local Peoples' Perceptions on Climate Change*. Its impacts and adaptation measures in mid-mountain Region of Nepal: A Case Study from Kaski District. Tribhuvan University Institute of Forestry Pokhara, Nepal. 31pp.

Boko, M., Niang, I., Nyong, A., Vogel, C., Githeko, A., Osman-Elasha, B., Tabo R., Medany, M. and Yanda, P.(2007). Africa. Climate Change 2007: *Impacts, Adaptation and Vulnerability.* Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.In Parry, M. L.,Canziani, O.F.,Palutiko, J. P. van der Linden, P. J. and Hanson; C.E.(Eds.). Cambridge: Cambridge University Press.[https://www.ipcc.ch/ pdf/assessment-report/ar4/wg2/ar4-wg2-chapter9.pdf] sitevisited on 17/12/2015.

Bynoe, P. (2007). *Urban Dynamics and Environmental Sustainability* (MDG # 7): A Case Study of Seven Squatting Areas in Georgetown, Guyana. In Aragon (Ed) Population and the Environment in Pan-Amazonia.pp225-236.

Challinor, A., Wheeler, T., Garforth, C., Craufurd, P. and Kassam, A. (2007).*Assessing the Vulnerable* 3: 381-399.

Chaudhary, P. and Aryal, K.P. (2009).Global warming in Nepal.Challenges and Policy Imperatives. *Journals of Forest and Livelihood*8 (1): 5 - 14.

Collier, P., Conway, G. and Venables, T. (2008). "Climate Change in Africa", *Oxford Review of Economic Policy;* London, Oxford University Press24 (2): 337-353.

Cooper, P. J., Dimes, J., Rao, K. P., Shapiro, B., Shiferaw, B. and Twomlow, S. (2008). Coping better with current climatic variability in the rain-fed farming systems of sub- Saharan Africa: An essential first step in adapting to future climate change? *Agriculture, Ecosystems and Environment*126: 24–35.

Ehrhart, C. and Twena, M. (2006).*Climate Change and Poverty in Tanzania Realities and Response Options for CARE*. Background report CARE International Poverty-Climate Change Initiative. pp30.

Food and Agriculture Organization (FAO), (2007). Climate change adaptation and mitigation in the Food and Agriculture sector technical background document from the expert consultation held on 5 to 7 March 2008 FAO, Rome. pp16.

Food and Agriculture Organization (FAO), (2011).*Climate Change and Food System Resilience in Sub-Saharan Africa*.Food and Agriculture Organization of the United Nations, Rome.436 pp.

Hegerl, G. C., Zwiers, F. W., Braconnot,P. N.P., Gillett, Y., Luo, J. A. Marengo, O., Nicholls, N., Penner J. E. and Stott, P. A. (2007). *Understanding and Attributing Climate Change*.pp665–744.

Hulme, M., Doherty, R., Ngara, T., New, M. and Lister, D. (2001). African Climate Change: 1900-2100. *Climate Research* 17:145-168.

Intergovernmental Panel on Climate Change (IPCC), (2010).*Economics of Adaptation* Cambridge University Press, Cambridge. 49pp.

Intergovernmental Panel on Climate Change, (2007). Climate Change 2007: *The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., Qin, D., Manning, M., Chen, Z., Marquis, M., Tignor, K.B.M. and Miller, H.L. (Eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.996 pp.

Masike, S. (2007). The impacts of climate change on cattle water demand and supply in Khurutshe, Botswana. PhD thesis, University of Waikato, New Zealand.pp 316.

McSweeney, C., New, M. and Lizcano, G. (2008).*UNDP Climate Change Country Profiles:Tanzania*,[http://countryprofiles.geog.ox.ac.uk/index.html?country=Tanzania&d1=Reports] site visited on 19/12/2015.

Meena, H. and Sharif, S. (2008). *Gender, Poverty and Food Security In Relation To Climate Change Impact and Adaptation*, a case of Kilimanjaro Region. pp30.

Mendelsohn, R. And Dinah, A. (2005) *Exploring Adaptation to Climate Change in Agriculture: The Potential of Cross-Sections Analysis.* ARD, World Bank.pp. 639-655.

Millennium Ecosystem Assessment (MEA), (2005).*Ecosystems and human well-being: Biodiversity synthesis*. World Resources Institute, Washington DC. [http://www.unep.org/maweb/documents/document.354.aspx.pdf] site visited on 18/12/2015.

Morgan, J. A., Milchunas, D. G., LeCain, D. R., West, M. and Mosier, A. R. (2007). Carbon dioxide enrichment alters plant community structure and accelerates shrub growth in the short grass steppe. PNAS 104, 14724-14729.

Mubaya, C.P., Nyuki, J., Liwenga, E., Mutsavangwa, E. P. and Mugabe, F.T. (2010). Perceived Impacts of Climate change related Parameters. *Journal of Sustainable Development in Africa*12 (5): 170-186.

Mwandosya. M. J., Nyenzi, B. S. and Luhanga, M. L. (1998). *The Assessment of Vulnerability and Adaptation to Climate Change Impacts in Tanzania*. Dar es Salaam. Centre for Energy, Environment, Science and Technology (CEEST). [http://www.google.com/search?q=Mwandosya+et+al+1998] site visited on 17/12/2015.

Ndesanjo, R. (2009).*Understanding Pathways to Increasing Resilience in changing Climate among Pastoral Societies* of Northern Tanzania.(UDSM). pp29.

Nelson, V. and Stathers, T. (2009). Resilience, power, culture, and climate: a case study from semi-arid Tanzania, and new research directions. *Gender and Development*17(1): 81 - 94.

New, M. (2006). Evidence of trends in daily climate extremes over southern and west Africa, [etccdi.pacificclimate.org/papers/New_etal_2006.pdf] site visited on 14th March, 2015.

Nombo, C.I., Urassa, J.K., Mbwambo, J.S., Mattee, A.Z., Mamiro, D.P., Kabote, S.J., Matata, L. and Synnevåg, G. (2013). A gendered analysis of climate change impacts and adaptations in semi-arid area farming systems of Tanzania.*Journal of Continuing Education and Extension* 4 (1): 212-227.

Roncoli, C., Ingram, K. and Kirshen, P. (2001). The costs and risks of coping with drought: Livelihood impacts and farmers' responses in Burkina Faso. *Climate Research* 19:119–32.

Shaw, R. (2008). Drought-management considerations for climate-change adaptation: Focus on the Mekong region. International Environment and Disaster Management (IEDM) and Oxfam, Vietnam. [http://www. oxfam.org.uk/resources/policy/climate_change/downloads/vietnam_climate_change_report.pdf]site visited on 16th April, 2015.

Shemsanga, C., Omambia, A. N. and YanshengGu. (2010). the Cost of Climate Change in Tanzania: Impacts and Adaptations. Jo*urnal of American Science*(3): 182-196.

Swai, O. W., Mbwambo, J. S. and Magayane, F. T. (2012). Perceived Effects of Climate Change on Agricultural Production: A Gendered Analysis Done in Bahi and Kondoa Districts, Dodoma Region, Tanzania. *Research on Humanities and Social Sciences*2(9): 59 - 68.

Thomas, D. S. G. and Twyman, C. (2005). Equity and justice in climate change adaptation amongst natural-resource-dependent societies. *Global Environmental Change* 15: 115-124.

United Nations Framework Convention on Climate Change (UNFCCC), (2007). Climate change: Impacts, vulnerabilities and adaptation in developing countries UNFCCC. pp64.

United Republic of Tanzania (URT), (2003).*Dodoma Region Socio-economic Profile*.Government Printer Dar es Salaam Tanzania. pp219.

United Republic of Tanzania (URT), (2007).National Adaptation Programme of Action (NAPA); Vice President's Office, Division of Environment. pp52.

United Republic of Tanzania (URT), (2012).*Five Year Environmental Action Plan, 2012 – 2017*. Ministry of Agriculture, Food Security and Cooperatives.*Tanzania Agriculture Climate Resilience Plan,*2014–2019. pp83.

Yanda, P., Kangalawe, R. and Sigalla,R. (2006).Climate and Socioeconomic Influence on Malaria and Cholera Risks in the Lake Victoria Region of Tanzania. *Environmental Economics*4(3): 44 -70.

CHAPTER TWO

PAPER ONE

Adaptation and Coping Strategies to Climate Change among Agro-Pastoralists Community in Mvomero District, Tanzania

Regina Mollel[1], John Jeckoniah [1], Henry Mahoo[2]

[1] MA–Rural Development Student, Sokoine University of Agriculture

P. O. Box 3024,Morogoro, Tanzania: reginamollel@gmail.com

[1]Lecturer, Development Studies Institute, Sokoine University of Agriculture,

P.O. Box 3024,Morogoro, Tanzania: jjeckoniah@yahoo.co.uk

[2]Associate Professor, Department of Agricultural Engineering and Land Planning

P.O. Box 3003,Morogoro, Tanzania: mahoohenry@yahoo.com

Targeted Journal: Rural Planning Journal (RPJ)

Abstract

The climate is perceived to be changing, thus calling for understanding of livelihoods strategies to guide in developing climate-resilient livelihoods.This paper investigated adaptation strategies undertaken by agro-pastoralists to cope with climate change impact in MvomeroDistrict. A cross sectional research design was adopted where data were collected only once and 135 sampled households were involved in the study. Household questionnaires, key-informants interviews and focus group discussions (FGDs) were the main methods for data collection. Descriptive statistical analysis and content analysis were the main methods used in data analysis. The study revealed various adaptation strategies used by agro-pastoralists in the study area including, timing and the use of improved crop varieties. The coping strategies for livestock keepers were to reduce the number of livestocks, moving the animals to other places temporarily and some of them permanently. However, such coping strategies were not sustainable and some household became more vulnerable to climate change due to their ineffective coping strategies. Therefore, the study recommends to government and nongovernmental organizations to improve agro-pastoralists access to extension services for the access of reliable information and knowledge on predicting weather forecast using both local/indigenous and improved means.

Key words: Climate change, agro-pastoralists, adaptation, and climate-resilient

INTRODUCTION

The impacts of a changing climate on the lives and livelihoods of the global poor become clearer with each passing year (IPCC, 2007). Climate change is largely attributed to both natural and anthropogenic factors. Natural factors such as solar variations and volcanic activities occur beyond human involvement while anthropogenic factors are human based activities causing changes in earth's atmosphere. According to the Intergovernmental Panel on Climate Change (2010), any increase in global average temperature above the range of 1.5- 2.5°C is likely to result in significant alterations in the structure, function, and geographical ranges of ecosystems. Adverse climate change impacts are considered to be particularly strong in countries located in tropical Africa that depend on climate sensitive economic sector like subsistence crop cultivation and livestock production (IACR, 2004; Dixon *et al*., 2001and Hope, 2009). Similarly, Tanzania is experiencing greater weather extremes including increases in temperature and changes in rainfall patterns. Such effects have increased drought, floods, land resources degradation as well as health problems. The intensity of droughts, floods and changes to growing seasons have significant effects on agricultural productivity, water supply, food security and human welfare (Maclean, 2009; Mubaya*et al*., 2010).

Agro-pastoralists and pastoralists everywhere encounter numerous hardships with respect to climate change due to their reliant on rainfall as the source of pasture growth and seasonal rainfall for crops production, this put greater challenge to their livelihoods (Antezza, 2008). Consequently, climate change, including climate variability, is a major driver of changes in livestock production through impacts on ecological conditions, in particular on pasture growth and quality and on the availability of water resources, as well as on the distribution of livestock diseases (Cooper *et al*., 2008). Generally, the agro-pastoralists have experienced devastating droughts and their strategies based on centuries

of exposure to the droughts are not working due to partly an inability to implement them (RoK, 2002). Mvomero is one of the districts in Tanzania, which is the pastoralist and agro-pastoralists zones and has typically experienced drought. Due to recurrent drought Mvomero is facing water shortage for both human and livestock consumption, this is to say that, climate change impacts have a direct consequences on the economy, ecosystems, water resources, weather events, health issues and desertification among this communities. While many communities in the world have historically adapted to the impacts of changing climate; little empirical evidence is available on how the agro-pastoral communities in Mvomero District is copping to the impact of climate change and variability. It is also argued that adaptation mechanisms are hampered by the severity and the speed of climate change effects and resource constraints (Masike, 2007). According to IPCC (2001)climate change adaptation measures vary from society to society owing to its geographical, sociological, and economical characteristics.On the basis of this fact this paper assesses the adaptation and coping strategies towards climate change among agro-pastoralists community of Mvomero.

2.0 METHODOLOGY

The study was conducted in Mvomero District; it was selected because it is among the districts perceived to be experiencing adverse impact of extreme events associated with climate change such as droughts and floods. Thereare also many agro-pastoralists communities which made the district ideal for the study. A cross-sectional research design was adopted whereby data were collected once. Three villages Mkindo, Hembeti, and Msufini were selected purposively due to relatively higher agro-pastoralists populations. A total of 135 respondents were randomly selected to participate in the study. The sampling unit was those who practices both livestock keeping and crop cultivation. The combination of simple random and systematic sampling techniques was employed in selecting the

respondents who participated in the study.A structured questionnaire with closed and open-ended questions was used to collect information on adaptation and coping strategies. Moreover, checklists were used for key informants and focus group discussions (FGDs). The Key informant and participants to FGDs included: village leaders, wards officers, well-known agro-pastoralists' leaders, crops and livestock extension workers, members of village government committees and elderly farmer's men and women. Descriptive statistical analysis was used to compute socio-economic characteristics of the respondents and their adaptation and coping strategies on the impact of climate change. Ethnographic content analysis was used to analyze qualitative data.

RESULTS AND DISCUSSION

Demographic and social characteristics of the respondents

The demographic and social characteristics of the respondents namely age, sex, marital status, education level and economic characteristics like agricultural activities undertaken by the community gives information to explain the social and economic set up of the people in the study area. For example one's formal education is an essential determinant for agro-pastoralists to adopt and use recommended strategies in dealing with the impact of climate change and vulnerability. Findings presented in Table 1 reveal that, generally, the study population has low levels of education.For example, about one third (36.3%) the respondents have no formal education while (45.2%) had completed primary education (Table 1). Findings presented in Table 1 reveal that the 40-49 age groups were domination. This is an appropriate age group in studies related to climate change and majority of the respondents were married (85.8%). The majority of the respondents had the average family size of between 4-6 people which correctly depicts the typical rural household sizes in Tanzania. Some studies e.g. Selemani*et al*. (2012) have argued that the

household characteristics is related to its ability to cope with the adverse condition caused by climate change in the area.

Table 1: Socio-economic characteristics of the respondents(n=135)

Variable	Category	Frequency	Percent
Age	20-29	9	6.7
	30-39	31	23.0
	40-49	45	33.3
	50-59	29	21.5
	60<	21	15.6
Sex	Male	82	60.7
	Female	53	39.3
Education	No formal education	49	36.3
	Primary education	61	45.2
	Secondary	15	11.1
	Post-secondary	10	7.4
Family size	1-3	32	23.7
	4-6	81	60.0
	7-9	21	15.6
	10&<	1	0.7
Marital status	Married	116	85.9
	Widowed	12	8.9
	Separated	3	2.2
	Divorced	3	2.2
	Single	1	0.7

The Coping Strategies adopted in relation to Climate Change

Livestock keeping

The study findings show that the agro-pastoralists use different coping options to reduce the shocks of climate change. Some of the respondents preferred to reduce the number of livestock keeping (Fig.2). To cope with the impact of climate change in livestock keeping,

this study found that agro-pastoralists reduced their animals to maintain a number that they can manage. On the other hand, 32.4% of them moved their animals to other places temporarily. This implies reducing strategy as adopted by livestock keepers enabled the survival of few animals that they were able to feed especially during drought season for drought. These findings compare with that reported by Paavola (2003) who found that both farmers and pastoralists have adapted to some ways of coping to the impact of climatic changes such as drought.Furthermore, Paavola (2003) reported that, during the drought season, pastoralists and agro-pastoralists would prefer first to distribute livestock and/or shifting herd to safer places to reduce risk.

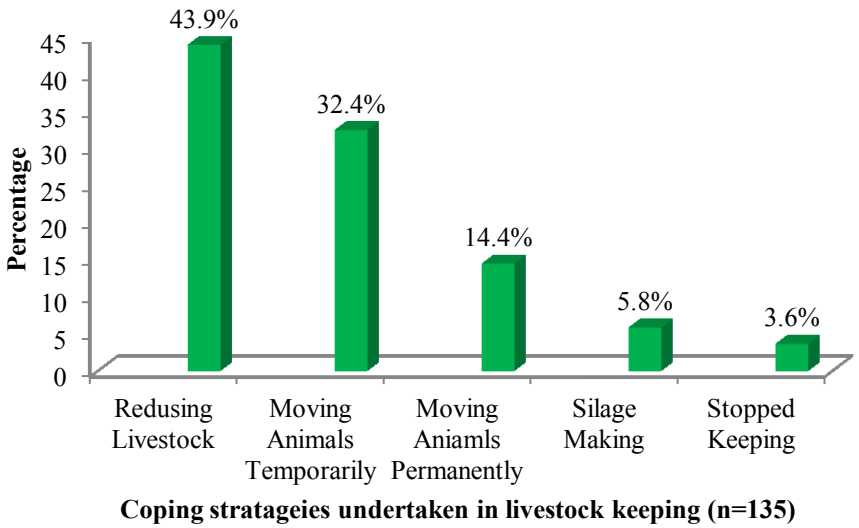

Figure 2: Coping strategies undertaken in livestock keeping

Crops production

This study found that the farm practice especially planting dates were highly changing from season to season due to unreliability of rainfall, therefore, in the part of crop production a significant number of the agro-pastoralist adapted changing planting seasons where by timing was the major coping strategy used as reported by 48.6% of the

respondents (Fig.3). Other copying strategies that were reported include planting high yield varieties. However, the nature of these effects and the agro-pastoralists responses to them are complex and uncertain.

This implies that timing strategy adopted by crop producers were ambiguous, resulting into loss of inputs due to wrong timing in some instances.Similar findings have been reported (Nhemachena, 2008) in his study to compare the practices in 11 African countries which revealed that farmers 'adaptation included timing of the planting season as well as planting high yield varieties among others.

Furthermore, one of the respondents in the group discussion explained that, to some extend timing of farming practices were not much reliable. Sometimes ago-pastoralists do wrong timing, they admitted cases where they did early planting (before or just after the first rain, the rain delayed resulting to loss of inputs). The following quote amplify the different scenario that happen…*we use our own forecast signals and sometimes it does not work in favour of our predictions….FGD participant in Mkindo village.*

Also planting of hybrid seed (short maturity time, drought tolerant high yield) was practiced and claimed to be useful but less than fifty percent of the respondents adapted this practice. This is due to the fact that these varieties are not affordable by many households. Nevertheless, agro-pastoralists are doing their best in coping with climate variability without being advisedby extension officers. Therefore, provision of extension services is important in assisting agro-pastoralists in their decision.

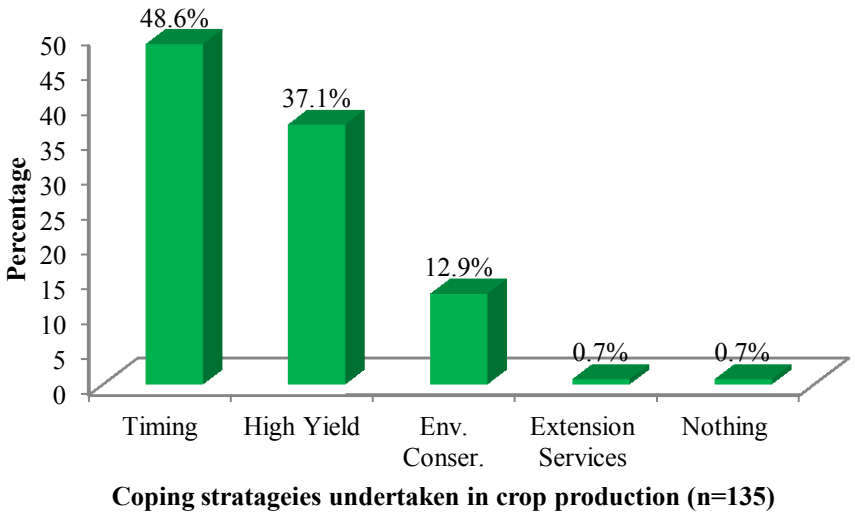

Figure 3: Coping strategies undertaken in crop production

CONCLUSIONS AND RECOMMENDATIONS

The study findings showed that, the agro-pastoralists uses different coping options to reduce the shocks of climate change. Timing strategy adopted by crop producers was ambiguous, resulting into loss of inputs due to wrong timing. Reducing strategy as adopted by livestock keepers enabled the survival of few animals but the sustainability of this strategy is not known. Therefore, the study recommends to government to espouse agro-pastoralists for improving their livelihood by accessing to extension services for the access of reliable information and knowledge on weather forecast using both local/indigenous, improving means and how to mitigate climate change impacts.

REFERENCES

Antezza, J. (2008). Climate change induced displacement in the IGAD: Implications for policy and livelihoods among pastoral communities. *First workshop on climate induced migration and displacement held in MENA Marseille – June 15-16 2010.*

Cooper, P. J., Dimes, J., Rao, K. P., Shapiro, B., Shiferaw, B. and Twomlow, S. (2008). Coping better with current climatic variability in the rain-fed farming systems of sub- Saharan Africa: An essential first step in adapting to future climate change? *Agriculture, Ecosystems and Environment*126: 24–35.

Dixon, J., Gulliver, A. and Gibbon, D. (2001). Farming systems and poverty: Improving farmers' livelihoods in a changing world. FAO (Food and Agriculture Organization), Rome, and World Bank, Washington, DC. pp99.

Hope, K, R. (2009) Climate Change and Poverty in Africa.*International Journal of Sustainable Development and World Ecology*16 (6): 451-461.

Inter Academy Council Report (IACR), (2004). Realizing the promise and potential of African agriculture. Royal Netherlands Academy of Arts and Sciences, NL-1000 GC Amsterdam: The Netherlands [http://www.interacademycouncil.net/24770/2529/aspx]site visited on 17/12/2015.

Intergovernmental Panel on Climate Change (IPCC), (2001).*Impact Adaptation and Vulnerability*.Cambridge University, Press, Cambridge, United Kingdom. 1033pp.

Intergovernmental Panel on Climate Change (IPCC), (2007).Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge. 60pp.

Intergovernmental Panel on Climate Change (IPCC), (2010).*Economics ofAdaptation* Cambridge University Press, Cambridge. 49pp.

Maclean, R. (2009).Environmental Management, Policy and Planning*, Environmental Quality*18 (4): 101-106.

Masike, S. (2007). The impacts of climate change on cattle water demand and supply in Khurutshe, Botswana. PhD thesis, University of Waikato, New Zealand.pp 316.

Mubaya, C.P., Nyuki, J., Liwenga, E., Mutsavangwa, E.P. and Mugabe, F.T. (2010). Perceived Impacts of Climate change related Parameters. *Journal of Sustainable Development in Africa* 12 (5): 170-186.

Nhemachena, C. (2008). Determinants of African farmers' strategies for adapting to climate change: *Multinomial choice Analysis Afjare*2(1): 230 – 265.

Paavola, J. (2003). Determinants of macro invertebrate diversity in headwater streams: regional and local influences. *Journal of Animal Ecology*72 (3): 425-434.

Republic of Kenya (RoK), (2002). First National Communication of Kenya to the Conference of the parties to the United Nations Framework Convention on Climate Change (UNFCCC). Nairobi, Kenya: Ministry of Environment and Natural Resources, National Environment Secretariat, [http://unfccc.int/ resource/docs/natc/kennc1.pdf] site visited on 14th April, 2015.

Selemani, I., Eik, L., Holand, Ø.,Ådnøy, T., Mtengeti,E. and Mushi, D. (2012). The role of indigenous knowledge and perceptions of pastoral communities on traditional grazing management in north-western Tanzania, Norwegian University of Life Sciences, Norway; *African Journal of Agricultural Research* 7(40): 5537-5547.

United Republic of Tanzania, (2012).*Five Year Environmental Action Plan, 2012 – 2017*. Ministry of Agriculture, Food Security and Cooperatives.*Tanzania Agriculture Climate Resilience Plan*2014–2019. pp83.

United Republic of Tanzania, (2007).National Adaptation Programme of Action (NAPA); Vice President's Office, Division of Environment, January 2007.pp 52.

United Republic of Tanzania, (2010). The *National Irrigation Policy United Republic of Tanzania* Ministry of Agriculture Food Security and Cooperatives, Dar es Salaam, Tanzania. 96pp.

CHAPTER THREE

PAPER TWO

Agro-pastoralists' Perception on Climate Change in Mvomero District: A gendered Perspective

Regina Mollel[1], John Jeckoniah [2], Henry Mahoo[3]

[1] MA- Rural Development Student, Sokoine University of Agriculture,

P. O. Box 3024,Morogoro, Tanzania: reginamollel@gmail.com

[2]Lecturer, Development Studies Institute, SokoineUniversity of Agriculture,

P.O. Box 3024,Morogoro, Tanzania: jjeckoniah@yahoo.co.uk

[3]Asociate Professor, Department of Agricultural Engineering and Land Planning,

P.O. Box 3003, Morogoro, Tanzania: mahoohenry@yahoo.com

Targeted Journal: Rural Planning Journal

Abstract

Studies on agro-pastoralist's perception of climate change are ever increasing. However, the findings are location specific and difficult to generalize. This paper analyzed agro-pastoralists' perception of climate change from the gender perspective in Mvomero district in Tanzania. The study adopted cross sectional research design and involved 135 agro-pastoralists. Quantitative data were collected using semi structured questionnaire. Descriptive and inferential analysis was computed. Pearson's Chi-square, summated index scale and an independent sample T-test were computed to establish relationship between key study variables. The study found higher level of awareness about climate change. Climate change and climate variability were attributed to frequency of unfavorable climatic events such low rainfall, high temperature and unpredictable on set of rainfall seasons. Gender differences on the level of awareness about climate change was found however the relationship was not statistically significant ($P>0.05$). The perceptions of climate change differed between men and women although the relationship was not statistically significant ($P>0.05$). Therefore,the study recommends to the government and nongovernmental organizations should espouse agro– pastoralists to improve their livelihood by improving their knowledge on the climate change and how to mitigate its impacts. Gender sensitive approaches should be introduced when training and assisting rural households' decision making towards adopting coping and mitigating strategies to positively impact on gender roles and wellbeing.

Key words: Climate change, Knowledge, Perception and Vulnerable.

INTRODUCTION

Climate change is perhaps the greatest challenge facing our planet today (Adebayo and Oruonye, 2013). The impacts of climate change phenomena are progressively emerging as an unprecedented global challenge to development in general and poverty reduction especially among millions of rural people living in marginal regions with minimal livelihood options (Brown and Crawford, 2008). Scientific evidence observed that Africa is one of the most vulnerable regions to the effect of global climate change due to her low human adaptive capacity to anticipated increases in extreme events resulting from widespread poverty, heavy reliance on rain fed agriculture, lack of economic and technological resources, insufficient safety nets and educational progress (Bako, 2013, Cooper *et al.,* 2008; and IPCC, 2007). Some of these challenges manifest themselves in the form of drought, flooding and inundation of coastal lands, low agricultural productivity, alteration of surface and ground water and devastation of ecosystems among others (IPCC, 2007). On the whole, the impact of climate change on agricultural production depends on the balance of these impacts (Fischer *et al.*, 2005; McCarthy *et al.*, 2001 and Dinar *et al.*, 2008).

Agro-pastoralism has been a source of livelihood for rural people; however, the agro-pastoral based livelihoods are no longer sustainable due to the impact of climate change, resulting in changes in water flow which cause some socio-economic and ecological impacts in Tanzania (Antezza, 2008). They include decreased biodiversity, lowered agricultural productivity (e.g. irrigation projects), domestic water shortage etc. All these add hardships to already struggling communities (Orinda and Murray, 2005). Currently, rationing of both water and pastures are of repeated occurrence in many places across the country. Further deterioration in water availability will have major effects in Tanzania where already some communities (25% of the Tanzanians) are walking an average of over

30 minutes looking for water (URT, 2003). Traditionally, women and children are responsible for domestic water and fuel-wood collection in Tanzania. As firewood, water and pastures become rare in neighborhoods, they travel long distances to collect with negative connotation to their main economic activities.

Bako (2013) argued that, the awareness of climate change has spread at an unprecedented pace and it is now accepted as a major threat to human survival and sustainable development. However, men and women have knowledge and experiences accumulated from years of working the environment that can be tapped for climate adaptation. Thus, climate change has specific gender characteristics emanating from men's and women's social roles, discrimination and poverty (Brody *et al*., 2008). This leads to differences in capacities, knowledge, interests as well as needs (UNDP, 2009). Blaikie*et al.* (1997) also contend that, knowledge is not homogeneous within a local population but varies according to respondents, due to gender roles and among others. This is likely to introduce gender based variations in climate change perceptions and knowledge among men and women agro-pastoralists.

Several studies on perception to climate change have been conducted in Sub-Saharan Africa (SSA) including Tanzania. These studies have been changing focus and covered different aspects such as livestock (Galvin *et al.,* 2001), agriculture (Deressa*et al.,*2008), Ishaya and Abaje (2008), Lema and Majule (2009), Mengistu (2011) Swai*et al*. (2012), Oruonye (2011), Hague *et al.* (2012), and Bako (2013); while others have focused on both livestock and agriculture Meena*et al*. (2008) and Mbilinyi*et al.* (2013). In most of such studies, findings are not disaggregated by gender to underscore specific gender based variations on climate change perceptions among men and women agro-pastoralists in developing countries like Tanzania. Despite the widespread scientific debate concerning

people's perception to climate change and variability, many agro-pastoral systems are still facing several hardships like access to water and availability of grazing land. There is a need to as many as empirical evidence on agro-pastoralists communities' perceptions on climate change and its impacts on changing gender roles. A study by Brody *et al*. (2008) has further identified knowledge gaps in linking gender and climate change noting that integration of a gender sensitive perspective in climate change research and responses should be given due attention as an important development issue. To that end, this paper contribute empirical evidence on agro-pastoralist communities' perceptions of climate change impacts on their gender roles with a special focus on grass root communities.

METHODOLOGY

The study was conducted in Mvomero District. The area was selected due to adverse impact of extreme events associated with climate change such as droughts and floods which are affecting the area. Furthermore the place is also selected due to the presence of agro-pastoralists community. The study adopted a cross-sectional research design, whereby data were collected once in a time. Three villages Mkindo, Hembeti, and Msufini were selected purposively from Hembeti ward and a total 135 respondents were randomly selected to participate in the study. Crop cultivation and livestock keeping in all the three villages are an important economic activity. The sampling unit involved those who practices both livestock keeping and crop cultivation. Quantitative data was collected by using questionnaires to get information on how agro-pastoralists community perceives climate change impacts and gender roles in the study area. A checklist was used to collect data from key informants and focus group discussion (FGD) in which qualitative data was solicited. Key informants interviewee included: village leaders, wards officers, well-known agro-pastoralists' leaders, crops and livestock extension workers and members of village government committees.

To capture respondents' perception on climate change and gender roles, Likert scale was used to analyze information on the perceptions of agro-pastoralists on climate change and gender roles. During the analysis, the five levels on the likert scale were computed and merged into three levels: agree disagree and uncertain. Finally the general perception of all respondents was presented after computing the average percentages of these major three groups of responses: agreed, uncertain/neutral and disagree. Summated scale technique was also applied to compare the overall attitude of perception where score on positive statement were compared to score on negative statements. A descriptive statistical analysis and inferential analysis was used to compute frequency distributions cross tabulation with chi-square. The Chi-square test was computed to establish the association between perceptions. Independent sample T-test was used to compare the perception of climate change between men and women.

RESULTS AND DISCUSSION

Awareness of the Changing Climate

The findings presented in Table 1 revealed that, relatively more men were aware of climate change than their female counterparts. However, Chi-square statistics revealed there was no significant relationship in awareness to climate change between men and women. Generally, majority of respondents were aware of the changing climate. Low level of awareness towards climate change may impact on adaption of recommended climate change mitigating strategies. Awareness of the people contributes into their willingness to adapt effectively to climate change impact. These results are comparable with the study done by Mary and Majule (2009) who found that, farmers in Tanzania had high awareness on climate change impact leading to risk of crop failure and rising of production cost due to re-planting and re-ploughing of crops. Other scholars have also reported similar

findings related to farmer's perception to climate change Ishaya and Abaje (2008), Adebayo and Oruonye (2011) and (Egbe*et al.*, 2014).

Table 2: Awareness of the Changing Climate

Variable	Categories	Aware	Unaware	χ2	p-value
		%	%		
Sex	Male	61.9	38.1	0.126	0.430
	Female	58.8	41.2		

Perceived Climate change: rainfall and temperatures

Change in rainfall pattern and trend as well as temperature are important indicators of the changing climate. In this study it was revealed that the perception for change in rainfall and temperature differ between the sex. Men were more likely to perceive that the temperature was increasing while relatively fewer women perceived increases in temperature. Similar trend between men and women were observed with regard to change in rainfall distribution (Table 2). The findings compare with Bryan *et al.* (2013) where a study of arid and semi arid divisions in Kenya found that majority of farmers perceived an increased in average temperature and rainfall variability respectively (Bryan *et al.,*2013).

Table 3: Awareness of the climate change: rainfall and temperature

Variables	Levels	Increasing	Decreasing	Stayed the same	Do not know	χ2	P-value
Awareness on the trend		%	%	%	%		
of rainfall for the last	Men	6.1	63.4	3.6	25.6		
5yrs	Women	3.8	49.1	9.5	37.7	5.536	0.354
Awareness on the	Men	67.1	2.4	1.2	29.3		
changes of temperature for the last 5yrs	Women	57.7	1.9	0.0	40.4	2.284	0.516

Perception of Climate Change on Gender Roles

It is argued that agro-pastoralist's perception of climate change and its impact on gender roles influence the probability of adopting mitigation and coping measures (IFPRI, 2007). This study found that, generally there was a relatively higher score on negative statements than positive ones, implying negative perception. For example, respondents disagreed with the statement that climate change stabilized gender roles in the study area and that climate change forces women and men to spend short time for labour in agricultural Production. A vast majority of respondents (99.3%) also disagree with the contention that as a result of droughts women spend short hours searching for pastures and water. Similar trend have also been reported in literature, for example, in Vietnam by Shaw (2008) found that, women collect water from water sources that are farther and farther away as each drought take its toll. Furthermore, Asheber (2010) found similar result in Ethiopia and Dankelman*et al*. (2008) in Senegal, where women had to travel long distances in search for water. Cultural traditions make women responsible for collecting water, even when this involves long hours performing heavy physical labor or travelling long distances.

Of the five statements with positive connotations, the greatest propositions of the respondents (97.8%) agreed with the statement that climate change forced men to collect firewood and pastures and 63% of the respondents agreed that climate change has influenced women to engage in petty business as they are core bread winner. This implies the perceived change in gender roles as a result of changing climate. These results compare with the study done by Angula (2010) who found that, the impact of climate change influenced majority of women to involve in pet trade to supplement family income. The overall perception mean score for all statements was 32.2 out of 96 which show that majority of the respondents involved in the study had a negative perception on climate change. These findings also compare with other scholars in the field: GlobeScan,

(2006) and Pew Research (2006) both of which found that climate change is more likely to be perceived as a threat in developing countries.

Table 4: Climate change and gender roles Percent (n=135)

Statement	Agree	Disagree	Uncertain
Climate change brought about shared activities.	86.7	5.2	8.1
Climate change has influence women in business	63	28.9	8.1
Climate change necessitates men to participate domestic activities.	87.4	11.1	1.5
Climate change forced men to collect firewood and pastures.	97.8	2.2	0
Climate change forced men to milk and selling milk.	77.8	9.6	12.6
Crop varieties lead fewer responsibilities to women.	3	97	0
Drought made women to spend short hours in pastures and water collection.	0	99.3	0.7
Climate change made women to be lazy on tedious work.	3	90.4	6.7
Climate change forced men and women to spend short time in agriculture production.	0.7	99.3	0
Climate change stabilized gender roles in agro-pastoralists.	0	100	0
Total	**42**	**54**	**4**

Conclusion and Recommendations

The study found that the level of awareness about the climate change was relatively higher. There was a gender difference on perceived climate change among men and women. This may affect the adoption of recommended practices to mitigate the impact of

climate change. Therefore, it is recommended to the government and nongovernmental organizations to increase the knowledge on climate change and on how to mitigate its impacts. Gender sensitive approaches should be used when training and assisting rural households' decision to adopt coping and mitigating strategies to positively impact on gender roles.

REFERENCES

Adebayo, A.A. and Oruonye, E.D. (2013).An assessment of climate change in Taraba State, Nigeria.*Nigerian Journal of Tropical Geography*4(2): 602– 612.

Angula, M. (2010). Gender and climate change: Namibia case study. Heinrich Böll Foundation Southern Africa. Cape Town, South Africa. Available at: [http://www.boell.org.za/downloads/Namibia.pdf] site visited on 16th April 2015.

Antezza, J. (2008). Climate change induced displacement in the IGAD: Implications for policy and livelihoods among pastoral communities. *First workshop on climate induced migration and displacement held in MENA Marseille – June 15-16 2010.*

Asheber, S.A. (2010). Mitigating drought: Policy impact evaluation: A case of Tigray region, Ethiopia. University of Twente Faculty of Geo-Information and Earth ObservationITC.[http://www.itc.nl/library/papers_2010/msc/gsim/asheber.pdf]site visited on March 13th, 2015.

Bako, M.M. (2013). Climate change vulnerability assessment in parts of Northern Nigeria. *Nigerian Journal of Tropical Geography*4(2): 449 – 470.

Blaikie, P., Brown, K., Stocking, M., Tang, L., Dixon, P. and Sillitoe, P. (1997). Knowledge in Action: Local Knowledge as a Development Resource and Barriers to its Incorporation in Natural Resource Research and Development. Great Britain: Elsevier Science Ltd. *Agricultural Systems*55(2): 217-237.

Brody, A., Demetriades, J. and Esplen, E. (2008).Gender and climate change: mapping the linkages (a scoping study on knowledge and gaps prepared for DFID). UK: BRIDGE, Institute of Development Studies (IDS). [http://uneca.org/ acpc/publication/docs/DFID_Gender_Climate_Change.pdf] site visited on 26 Feruary, 2015.

Brown, O. and Crawford, A. (2008).*Assessing the security implications of climate change for West Africa-Country case studies of Ghana and Burkina Faso.*Winnipeg: International Institute for Sustainable Development. pp 66.

Bryan, E., Ringler, C., Okoba, B., Roncoli, C. and Silvestri, S. and Herrero, M. (2013).Adapting agriculture to climate change in Kenya: Household strategies and determinants.*Journal of Environmental Management*114: 26–35.

Cooper, P. J., Dimes, J., Rao, K. P., Shapiro, B., Shiferaw, B. and Twomlow, S.(2008). Coping better with current climatic variability in the rain-fed farming systems of sub- Saharan Africa: An essential first step in adapting to future climate change? *Agriculture, Ecosystems and Environment* 126: 24–35.

Dankelman, I., Khurshid, A., Wahida, A., Gueye, B., Daigne, Y., Neureen, F. and Rose, M. (2008).Gender; climate and human security.Lessons from Bangladesh, Ghana and Senegal. New York. [http://ww.dnolineorg/resorccs/EDO.Gender-Climate Change _Human.Security.pdf] site visited on 14th March; 2015.

Deressa, T., Hassan, R.M., Alemu, T., Yesuf, M. and Ringler, C. (2008).Analyzing the Determinants of Farmers' Choice of Adaptation Methods and Perceptions of Climate Change in the Nile Basin of Ethiopia.*Environment and Production Technology Division, Ethiopia*19(2): 248-255.

Dinar, A., Hassan, R., Mendelsohn, R. and Benhin, J. (2008).*Climate Change and Agriculture in Africa*: Impact assessment and adaptation strategies. London: Earth Scan.pp223.

Egbe, C.A., Yaro, M.A., Okon, A.E. and Bison, F.E. (2014). Rural people's perceptions to climate variability/change in cross River State Nigeria. *Journal of Sustainable Development*7(2): 25 – 36.

Fischer, G., M. Shah, F., Tubiello, N. and van Velhuizen, H. (2005). 'Socio-economic and climate change impacts on agriculture'.*Philosophical Transactions of the Royal Society B* 360: 2067 – 2083.

Galvin, K.A., Boone, R.B., Smith, N.M. and Lynn, S.J. (2001). Impacts of climate variability on East African pastoralists: linking social science and remote sensing. *Climate Research*19: 161-172.

GlobeScan, (2006).*30-country poll finds worldwide consensus that climate change is a serious problem. Toronto, Canada: GlobenScan, Inc.* [environment. yale.edu/climate-communication/files/IntPblic Opinion] site visited on 25th June 2015.

Haque, A., Yamamoto, S., Malik, A. and Sauerborn, R. (2012). *Households' perception of climate change and human health risks: A community perspective. Environmental Health*11(1): 12.

IFPRI (2007).IPCC. 2007. Climate Change: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Core Writing Team, Pachauri, R.K and Reisinger, A. (Eds.).IPCC, Geneva, Switzerland.104 pp.

Intergovernmental Panel on Climate Change, (2007).*Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge. 60pp.

Ishaya, S. and Abaje, I.B. (2008).Indigenous people's perception on climate change and adaptation strategies in Jema'a local government area of Kaduna State, Nigeria.*Journal of Geography and Regional Planning*1(8):138-143.

Lema, M. and Majule, A. (2009). Impacts of climate change, variability and adaptation strategies on agriculture in semi arid areas of Tanzania: The case of Manyoni District in Singida Region, Tanzania. *African Journal of Environmental Science and Technology*3(8): 206-218.

Mary, L. A. and Majule, A. E. (2009). Impacts of climate change, variability and adaptation strategies on agriculture in semi-arid areas of Tanzania: The Case of Manyoni District in Singida Region, Tanzania. *African Journal of Environmental Science and Technology*3(8): 206 – 218.

Mbilinyi, A., Ole Saibul, G. and Kazi, V. (2013). Impact of Climate Change to Small Scale Farmers: Voices of Farmers in Village Communities in Tanzania. Economic and Social Research Foundation, Dar es Salaam. 36pp.

McCarthy, J. J., Canziani, O. F., Leary, N. A., Dokken, D.J. and White, C. (2001).*Climate change 2001: Impacts, Adaptation, and Vulnerability.* Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge: Cambridge University Press. UK and NewYork,USA.[http://www.preventionweb.net/files/8387_wg2TARfrontmatter1]site visited on 18/12/2015.

Meena, H.E., Lugenja, M.S., Ntikha, O.A. and Hermes, M. (2008). Analyses of Technological and Policy Options for Adaptation to Consequences of Climate Change in Tanzania: The Case of Crops and Livestock. CEEST Foundation for Energy, Environment and Development. 31pp.

Mengistu, D. K. (2011). Farmers' perception and knowledge of climate change and their coping strategies to the related hazards: Case study from *Adiha*, central Tigray, Ethiopia. *International NGO Journal*2(2): 138-145.

Orindi, V. A. and Murray, L. A. (2005).*Adapting to climate change in East Africa: A strategic approach.* London: International Institute for Environment and Development. 25pp.

Oruonye, E.D. (2011). An assessment of the level of awareness of the effects of climate change among students of tertiary institutions in Jalingo metropolis, Taraba State Nigeria.*Journal of Geography and Regional Planning*4(9): 514-519.

Pew Research Centre, (2006).*No Global Warming Alarm in the U.S., China*. Washington, D.C.: The Pew Research Centre for the People and the Press. *Problem*. Toronto, Canada: GlobeScan, Inc. pp44.

Shaw, R. (2008). Drought-management considerations for climate-change adaptation: Focus on the Mekong region. International Environment and Disaster Management (IEDM) and Oxfam, Vietnam. Available at: [http://www. oxfam.org.uk/resources/policy/climate_change/downloads/vietnam_climate_change_report.pdf.]site visited 16th April, 2015.

Swai, O. W., Mbwambo, J. S. and Magayane, F. T. (2012). Perceived Effects of Climate Change on Agricultural Production: A Gendered Analysis Done in Bahi and Kondoa Districts, Dodoma Region, Tanzania. *Research on Humanities and Social Sciences*2(9): 59- 68.

United Nations Development Programme, (2009). Resource guide on gender and climate change, United Nations Development Programme, Printing: A. K. Office Supplies, Ltd. pp133.

United Republic of Tanzania, (2003).*Dodoma Region Socio-economic Profile*.Government Printer Dar es Salaam Tanzania. pp219.

CHAPTER FOUR

4.0 CONCLUSIONS AND RECOMENDATIONS

4.1 Conclusions of the Major Findings

The following are the summary of the major findings of this study which is the basis for the recommendation prepared.

4.1.1 Agro-pastoralists' awareness on climate change and variability

Agro-pastoralists' awareness toward climate change and variability was the first specific objective of this study. The results of this objective are presented in the second paper of this dissertation. The results rejected the null hypothesis that agro- pastoralists are not aware on the climate change and variability as half of them said that, they are aware of rainfall and temperature variability. On the other hand, majority of the respondents were aware on the effect of climate change by looking on the decline in water resources and fuel wood scarcity. Moreover, a chi-square test (χ^2)statistic revealed that there is no statistical significant influence ($p>0.05$) of sex on awareness of climate change. High level of awareness towards climate change may impact on adaptation of climate change mitigating strategies. Awareness of the people donates into their readiness to adapt effectively to climate change impact.

4.1.2 Perception of climate change on gender roles

The second specific objective of this study was, agro-pastoralists' perception on climate change and gender roles. The results of the analysis are also presented in the second paper of this dissertation. The findings shed light that, there was a gender difference on perceived climate change among men and women although the relationship was not statistically significant ($P>0.05$).This may affect the adoption of practices to mitigate the

impact of climate change. The overall perception of climate change shows that, the respondents had negative perception about climate change. Thus, their perceive climate change as a threat. Furthermore, the traditional roles of men and women activities are becoming unclear; some activities that were traditionally done by men are also done by women. Shared of activities between men and women have implication for women workload.

4.1.3 Coping and adaptation strategies taken by agro-pastoralists to minimize the impact of climate change

The third specific objective of this study was to determine the coping and adaptation strategies undertaken by agro-pastoralists to minimize the impact of climate change. The results of the analysis are presented in the first paper of this dissertation. The result showed that, agro-pastoralists adapted some coping strategies in the study area.However, theadaptation and coping strategies on climate change among agro-pastoralists community in MvomeroDistrict has not been of beneficial to farmers and livestock keepers and thus the society remain vulnerable to climate change. Timing strategy adopted by crop producers was ambiguous, resulting into loss of inputs due to wrong timing. Reducing strategy as adopted by livestock keepers enabled the survival of few animals but this is not clear. Furthermore, silage making can be an appropriate coping strategy for livestock keepers, but it seems that, they are not using it.

4.2 Recommendations

According to the empirical results presented in the first and second paper in this dissertation and the conclusions above, the following recommendations are made.

i. There was a gender difference on awareness of climate change among men and women. This may affect the adoption measures to mitigate the impact of

climate change. Therefore it is recommended to the government and nongovernmental organizations to increase the knowledge on climate change and on how to mitigate its impacts.

ii. The perceptions on climate change differed between men and women although the relationship was not statistically significant.The study recommends to the government and nongovernmental organizations that, gender sensitive approaches should be introduced when training and assisting rural households' decision to adopt coping and mitigating strategies to positively impact on gender roles.

iii. The coping strategies adapted by agro-pastoralists were not sustainable and some household became more vulnerable to climate change due to their ineffective coping strategies. Therefore, the study recommends to government and nongovernmental organizations to improve agro-pastoralists access to extension services for the access of reliable information and knowledge on predicting weather forecast using both local/indigenous and improved means.

APPENDICES

Appendix 1: Questionnaire

Impact of Climate Change on Gender Roles in Agro- Pastoralists Communities in Mvomero District, Tanzania

Mollel, Regina

Part A: Questionnaire Identification

Date of interview ….…….

Questionnaire No……...

Ward.....

Village..... Hamlet.....

Part B: Background Information

Please answer the following questions honestly

1. Sex

1. Male 2. Female ( )

2. Marital status

1. Married
2. Single
3. Widow/er ( )
4. Separated
5. Divorced

3. What is your age (in years) ……...

4. Number of people in the household.....

5. What is your main economic activity?

1 .Farmer

2. Formal employment

3. Petty business ( )

4. Farmers business

6. Level of education

1. No formal education

2. Primary education ( )

3. Secondary education

4. Post-secondary education

7. Place of origin

1. Born in the village

2. Born outside the village but within the district ( )

3. Born outside the district but within the region

4. Born outside the Region

8 .If you moved into this village when did you settle in this village? ..... (Year)

Part C: Awareness of climate change, patterns and indicators of climate change.

9. What do you understand by the term climate change?

……

10. Are you aware that climate change have changed or is changing?

1. Yes 2.No ( )

11. How did you know about climate change?

1. Owen observation
2. Medias ( )
3. Research institute
4. Relatives

12. When did you hear about climate change?

…… (In years)

13. What do you consider to be the causes (s) of climate changes?

1. Human activities
2. Natural occurrence ( )
3. A combination of the above
4. Don't know

14. Have you witnessed any change in rainfall over the past 5 years?

1. Yes 2. No ( )

15. If yes what has been happening in terms of the number of days/months of vuli rains in the past 5 years?

1. Have increased
2. Have stayed the same ( )
3. Have decreased
4. Don't know

16. If there are changes how long (days/months) have vuli rains been lasting in a year in the past 5 years?

    1. Less than a month
    2. One month
    3. Two months
    4. Three months ( )
    5. More than three months

17. What has been happening in terms of the number of days/months of masika rains in the past 5 years?

    1. Have increased
    2. Have stayed the same
    3. Have decreased ( )
    4. Don't know

18. How long (days/months) have the masika rains been lasting in a year in the past 5 years?

    1. Less than a month
    2. One month
    3. Two months ()
    4. Three months
    5. More than three months

19. What is the trend of rainfall in general during the last 5 years? (Tick the appropriate)

    1. Is increasing
    2. Is decreasing

3. Have stayed the same ( )

4. No change

5. Do not know

20. Have you observed any changes in temperatures during the last 5 years? (Tick the appropriate)

1. Yes 2. No ( )

21. If yes what kind of changes?

1. Increasing of temperature

2. Decreasing of temperature ( )

3. Do not know

22. What used to be the situation of temperature since 2000s?

1. Cool

2. Warm ( )

3. Don't know

23. Have you ever experienced droughts in the area for the past 5 years?

1. Yes 2. No ( )

24. If yes, what has been the frequency of drought occurrence in the recent year (now up to 5 years ago)?

1 .Increased

2. Decreased ( )

3. No change

4. Do not know

25. Agro-forest's activities are one of the factors causing the climate change?

1. Yes 2. No ( )

26. If yes, please explain how.....

Part D:Likertscale on the Perception of Climate change and gender roles scale

Part D: i. Kindly use the option below to answer the following question to your level of understanding: 1.Srongly Agree=SA, 2.Agree=A, 3.Undecided=U, 4.Stroghly Disagree=SA, 5.Disagree=D

S/N	Statements	1	2	3	4	5
27	Climate change brought about shared activities that were traditionally women's/men's role.					
28	Climate change has influence women to participate in petty business to get family food as they are core bread winner.					
29	Climate change necessitates men to perform domestic activities like milking and selling milk.					
30	Climate change leads men to help their wives in collection of firewood and pastures using bicycles.					
31	Climate change stabilized gender roles in agro-pastoralists community.					
32	Some crop varieties lead women to less responsibilities of weeding.					
33	Due to drought women spend short hours searching for pastures and water.					
34	Climate change made women to be lazy on tedious work like drawing line and land tillage.					
35	Climate change forces women and men to spend a short time and labor in agricultural production.					
36	Climate change increases the use of new crop varieties that guides men to involve in weeding.					

Part D: ii Distance to follow water, pastures and firewood and hours to spend.

37. How many kilometers do you use to follow the following needs during the dry season?

i. Water.....

ii. Pastures.....

iii. Firewood.....

38. How many hours do you use to follow the following needs during the dry season?

i. Water.....

ii. Pastures.....

iii. Firewood.....

Part E: Climate Change and Coping Strategies.

39. Does climate variation have any impact in your farming activities?

1. Yes 2.No ( )

40. If yes have you made any adjustment so as to reduce the impact?

1. Yes 2. No ( )

41. If yes below are the statement in adapting fluctuation in climate. State whether you practice or not.

1. Planting different varieties of crops

1. Yes 2.No ( )

2. Switching from farm to non-farm activities

1. Yes 2.No ( )

42. Others, Please mention.....

43. What do you recommend to be done that will help people to better cope with the problem caused by climate variation? .....

44. Have you happened to experience any crop loss in the past 5 years due to climatic change?

1. Yes 2. No ( )

45. Please indicate what loss was:

1. Food and cash crops loss
2. Livestock loss ( )

46. Does climate variation have any impact in your livestock activities?

1. Yes2.No ( )

47. If yes have you made any adjustment so as to reduce the impact?

1. Yes 2. No ( )

48. State whether you practice or not.

1. Moving animals to other places permanently
2. Moving animals to other places temporarily
3. Silage making ( )
4. Zero grazing
5. Reducing the number of livestock keeping

THANK YOU FOR YOUR COOPERRATION

Appendix 2: Key informants'' checklist and focus group discussion

Study Topic: Impact of climate change on gender roles in agro- pastoralists communities in Mvomero District, Tanzania

Respondents' number..... Sex.....F/M

Respondent' position.....

1. What do you know about the term climate change?

.....

.....

2. What has happened over the past 5 years ago concerning climate change?

.....

.....

3. How serious was the problem of climate change?

……

……

4. What were the responses of the agro- pastoralists due to the impact of climate change?

.....

.....

5. Has the rain frequency changed for the past 5 years ago?

.....

6. Have the temperature been increasing over the past 5 years ago?

.....

7. Which off-farm activities do you undertake to reduce the risk?

.....

8. What do you think that it's the causes of climate change?

……

……

9. What impacts do you think climate change may have in your livestock and crops production?

……

……...……

10. What do you think can be done by agro-pastoralists communities to adapt climate change and variability?

……

……

11. Are the women more affected by climate change than men?

…….....

12. If yes, explain how are they affected?

…….....

.....

13. Is the impact of climate change caused the scarcity of pastures, water and fuel wood and lead to the long time to fetch them?

……

14. Are both heavy rainfall and drought are the major causes of crop failure and reduction of livestock and caused agro- pastoralists to diversify their economy?

……

15. If yes, please explain how?

……

……

16. Is the impact of climate change leads men to do some activities that were traditionally done by women?

……

17. If yes, please mention

……

……

18. How many kilometers do you use to follow the following needs during the dry season?

i. Water.....

ii. Pastures.....

iii. Firewood.....

19. How many hours do you use to follow the following needs during the dry season?

i. Water.....

ii. Pastures.....

iii. Firewood.....

THANK YOU FOR YOUR COOPERRATION