



CLIMATE CHANGE EFFECTS ADAPTATION STRATEGIES OF THE FEMALE HEADED HOUSEHOLDS: A CASE OF KAHE WARD IN MOSHI DISTRICT, TANZANIA

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ABSTRACT

The aim of the study was to examine strategies used by female headed households in west Kahe in adapting climate change effects. The study objectives were, to identify activities performed by female headed households, to determine socio-economic effects of climate change on female headed households, to identify adaptation strategies of climate change implemented by female headed households and to assess key actors and their roles toward enhancing adaptation strategies of the climate change effects. The study employed cross-sectional research designs. Data and information were obtained through administration of questionnaires to 94 female headed households in Oria, Mawala, Ngasini and Kisangesangeni villages. Interviews, observations and documentary review were used in the data collection. The findings revealed that climate change effects have been observed and proven to affect different livelihood activities including agriculture activities in the study area. Change in rainfall patterns, drought and temperature increase are attributed to climate change effects in West Kahe. The study recommends that female headed households should be empowered to increase resilience capacity to climate change effects and hence improved wellbeing of the most marginalised communities.

Keywords: Adaptation, Climate Change, Family Headed Households

1.0 INTRODUCTION

Adaptation strategies to climate change are basic issue so as to maintain environmental sustainability and sustain our daily life with coping to climate change. Female headed households are more vulnerable to climate change because of nature of activities conducted by women. Women charged with securing water, food and fuel for cooking and heating face the greatest challenges of climate change (UNDP, 2010). Also (JoDee, 2009) argue women are responsible for food, fuel and water in most households in developing countries. Specifically in the field of agricultural and food security, women constitute about 90% of the labour force in Africa (AWDF, 2015). Therefore, female headed household are vulnerable to climate change hazards because of nature of activities depend on, but they have limited livelihood option so they are more affected with climate change. Supporting the activities and needs of women is essential for socio-economic development (UNCTD, 2011). Economic sectors that largely depend on weather conditions either directly or indirectly most notably agriculture is increasingly subject to the effects of climate change (IPCC, 2012). Female headed households are mostly affected by climate change impact due to the fact that most of them depend on climate sensitive sectors. Climate change can have major effects on the social and economic welfare of a population and often pose serious obstacles in the achievement of sustainable social and economic development of female headed household. UNFCCC (2007) urges that developing countries should priorities climate change adaptation due to their higher vulnerable. HDR, 2011 observed climate change is a global issue impacting growth and development of



people, especially poor people. Effects of climate change can be seen on health, nutrition, education and basic services (UNDP, 2010).

The government of Tanzania and other institutions in the country has taken some measures to address challenges of climate change. Among the measures include creation of relatively sound policies and operationalising of several institutions dealing with climate change and environmental management (Shemsanga *et al.*, 2010). According to URT (2012) the government of Tanzania has undertaken several efforts including National Communication to the UNFCCC in 2003, CDM Guide for Investors in 2004, preparation of the National Adaptation Programme of Action (NAPA) in 2007 and the initial undertaking a Quick Scan on the Effects of Climate Change in 2009. Despite of the effort made by the government still vulnerability to climate change effects is alarming especially to women and children due to lack of livelihood diversification and less adaptive capacity. Rural communities are highly susceptible to climate change due to limited adaptive capacity. Therefore, this study aimed at examining the adaptation strategies to climate change effects by female headed households in Kahe ward Moshi District-Tanzania. This is paramount for informed decision making on enhancing resilience capacity to the evidenced climate change effects on rural communities.

This conceptual framework (Fig. 1) first shows actual stimulus of climate change such as increase of temperature and decrease of rainfall pattern also indicate shocks associated with impact of climate change impact like floods, drought, pest and disease. However, intervening variable shows how female headed households exposed to climate change effects. Final the conceptual framework show the dependent variable which is adaptation strategies which female headed households take active response to the climate change effects. Finally, adaptation responses to climate change facilitate to improve the livelihood of female headed household.

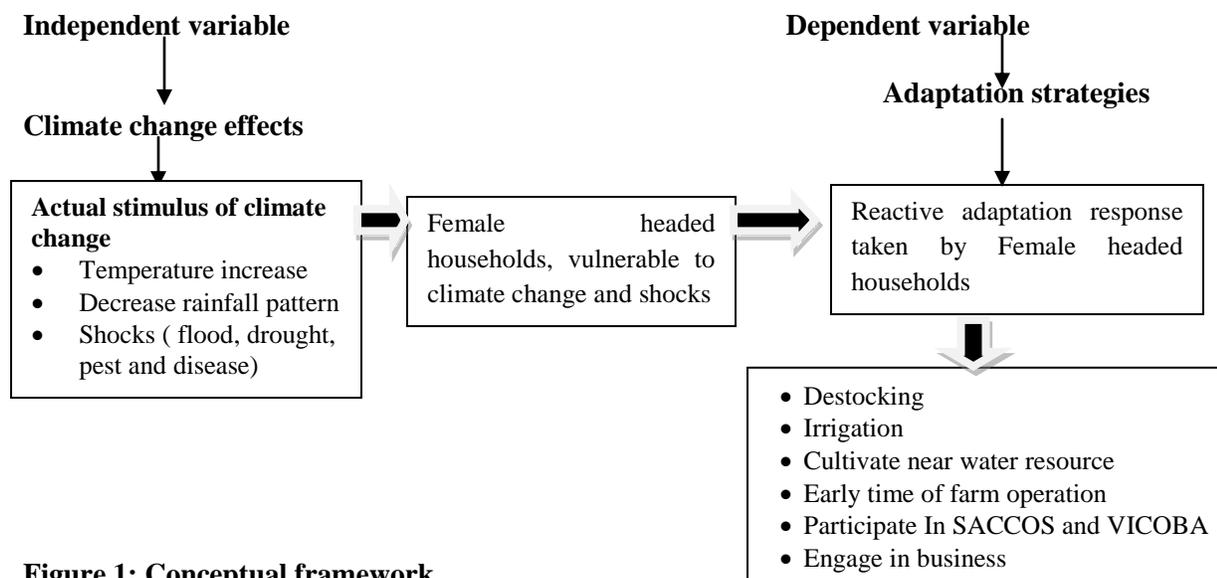


Figure 1: Conceptual framework



2.0 RESEARCH METHODOLOGY

2.1 Description of the of the Study Area

The study was conducted in Kilimanjaro region particularly in West Kahe Ward, in Moshi District. The district lies between longitude 37° to 38° East and latitude 2° 30' - 50° South of the Equator. The study area has a population of 19142 and the average household's size of 4.4 (URT, 2012). Kahe is among of ward in Moshi District that experiencing the climate change effects (TMA, 2014).

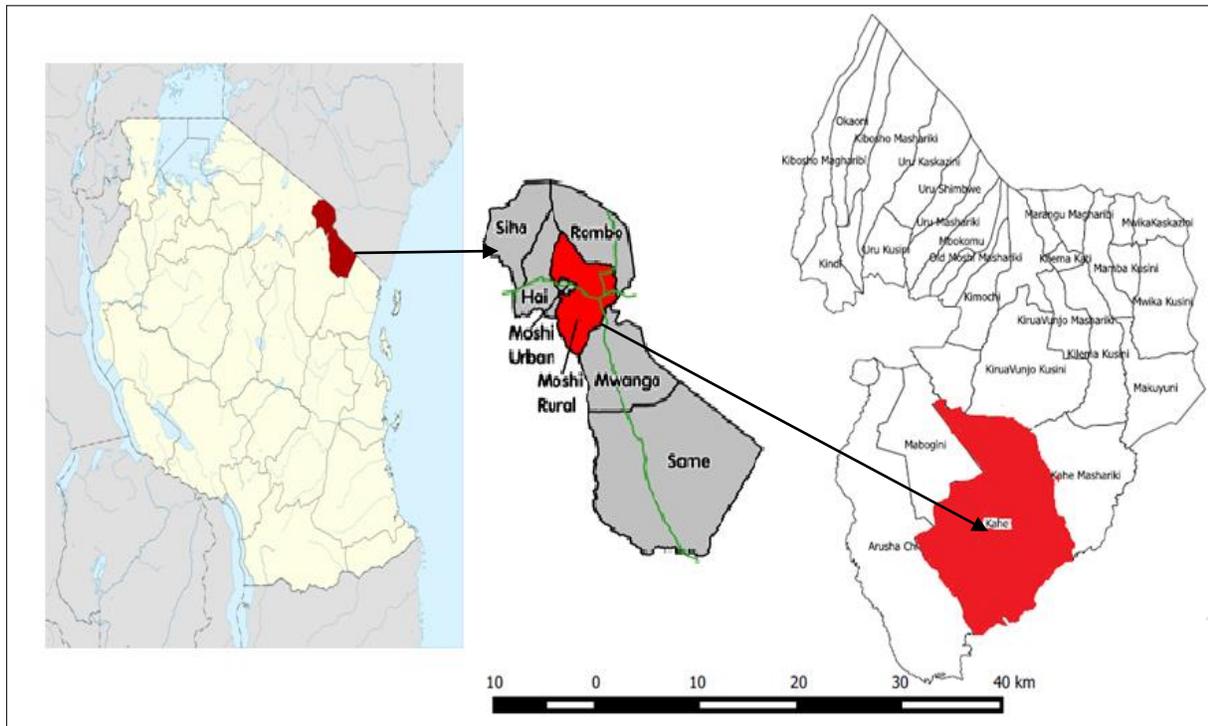


Plate 1 : Location of West Kahe Ward

Source: QGIS

2.2 Research Design and Sampling Procedure

The study used cross-sectional research design. This type of study design was adopted because it gave the researcher an opportunity to intensively explore and analyse the information over the life of single unit. The design was broadly identifying strategies used by female headed households in West Kahe ward to adapt to climate change effects. The targeted population of this study was female headed households live in West Kahe Ward in Moshi District. The study used purposive sampling technique, a sample of 94 FHHs was taken to represent the entire FHHs in West Kahe. Villages employed are Oria, Mawala, Ngasini and Kisangesani.

2.3 Types, Source and Data Collection Procedure

Both primary and secondary data were collected. Primary data were obtained through interview, both structured and unstructured, personal observation and household survey. Primary data include; adaptation



strategies to climate change, social economic effects of climate change and activities performed by female headed households. Secondary data were obtained from documentary analysis from different relevant sources. Secondary data include historical climate data, number of female headed households in West Kahe ward as well as the population size of the district.

2.4 Data Analysis and Interpretation

The data were analysed using Statistical Package for Social Sciences (SPSS version 26) and presented through charts and tables. Qualitative data were analysed through content analysis so as to draw the understanding of adaptation strategies by female headed households in the study area. Descriptive statistics were generated for making sound conclusions. Cross tabulations between variables were done to understand the relationship of study variables. Analysis of variance (ANOVA) was applied to test the significance of the study variables.

3.0 FINDINGS AND DISCUSSIONS

3.1 Respondents' Demographic Characteristics

3.1.1 Education level, marital status, occupation, age and duration of respondents

The education level of respondents is the key factor to measure general understanding of the climate change adaptation and mitigation. The findings showed that, out of 94 respondents 58(61.7%) of FHHs had primary education, 27(28.7%) of FHHs had secondary education, 5(5.3%) of FHHs had vocation education and 4(4.35) had university education (Table 1). This implies that, easy sharing of climate change effects adaptation knowledge because of generally level of education of female headed households. This information is supported by other similar studies. For example Hizza (2013), primary education were 70%, secondary were 10% and post education were 17%. This implies that most of female headed households in Kahe had access to education and therefore it is easy for them to control their environment.

Climate change affect both men and women. Studies shows that women are very vulnerable to the climate change impact because of their livelihood/daily activities depend more on the environmental resources. This study used only female headed households as respondents to examine adaptation strategies of climate change performed by female headed households. The findings show that 45.7% of respondent were widow, 31.9% never married, 19% separated and 2.1% divorced (Table 1). This implies that 100% of respondent were female headed households and majority of respondent were widow and therefore it justifies the targeted population.

The respondents' occupation were mainly farming and livestock keeping activities while very few FHHs were permanent employed. The findings revealed that 55.3% of respondents engage in farming, 31.9% engage in both farming and livestock keeping and 11.7% were employed (Table 1). This implies that, the occupation and activities FHHs depend on farming and livestock keeping are mostly threatened by climate change effects and therefore effective adaptation and coping measures are paramount for enhancing resilience capacity to the observed effects of climate change. The findings show that 9.6% were aged from 18-30 years, 23.4% were aged from 31-40 years, 30.9% were aged from 41-50, 31.9% were aged from 51-60 years and 4.3% were aged from 61+ years of all respondents (Table 1). This result implies that respondents had adequate information on the trend of climate change in the study area.



Furthermore, the study found that most of the respondents have stayed longer in the study area (below 5 years were 12.8%, 5-10 years were 8.5%, 10-20 years were 26.6%, 20-30 years were 26.6% and 30+ years above were 25.5%) as indicate in (Table 1). This finding implies that most of the female headed households lived more than 30 years in the study area and therefore they could clearly explain the historical information on climate trends.

Table 1 : Respondents Particular (N=94)

	Response	Frequency	Percent
Education	Primary	58	61.7%
	Secondary	27	28.7%
	Vocational	5	5.3%
	University	4	4.3%
	Total	94	100%
Age	18-30	9	9.6%
	31-40	22	23.4%
	41-50	29	30.9%
	51-60	30	31.9%
	61+	4	4.3%
Total	94	100%	
Marital status	Widow	43	45.7%
	Divorce	2	2.1%
	Separated	19	20.2%
	Never married	30	31.9%
	Total	94	100%
Employment	Employed	11	11.7%
	Animal keeping	2	2.1%
	Farmers	52	55.3%
	Livestock and farming	29	30.9%
	Total	94	100%
Duration	Below 5 years	12	12.8%
	5 -10 years	8	8.5%
	10 -20 years	25	26.6%
	20-30 years	25	26.6%
	30+ years	24	25.5%
Total	94	100%	

3.1.2 Livelihood activities by female headed households

The livelihood activities undertaken in the study area found to be climate sensitive like farming and livestock keeping. The findings shows that 46.8% of the FHHs depend in both farming and livestock keeping as the main source of income (Fig. 2). Animal keeping and farming is common in Oria and Mawala villages. However for activities that female headed households depend on, observed to be very vulnerable to climate change effects like floods and severe drought which occurs in West Kahe ward. This implies that communities' livelihoods are more likely to be threatened by the effects of climate change if there are no appropriate adaptive strategies to overcome the future effects of climate change. This information is supported by other similar studies carried in different parts of Tanzania. For example



(WHO, 2008), although the effects of climate change are global, the most vulnerable are the poor and marginalised people from developing countries who depend most directly on their ecosystems for livelihood, these are the same people who have the least capacity to mitigate and adapt to climate change effects. Also Hizza, (2013) found that, 60 respondents, 30 (50%), 10 (17%), 14 (23%) and 6 (10%) practice one or more livelihood activity such as farming, farming and government employment; farming and livestock keeping; farming, livestock keeping and business activities respectively as adaptation strategies to the observed climate change effects (Fig. 2).

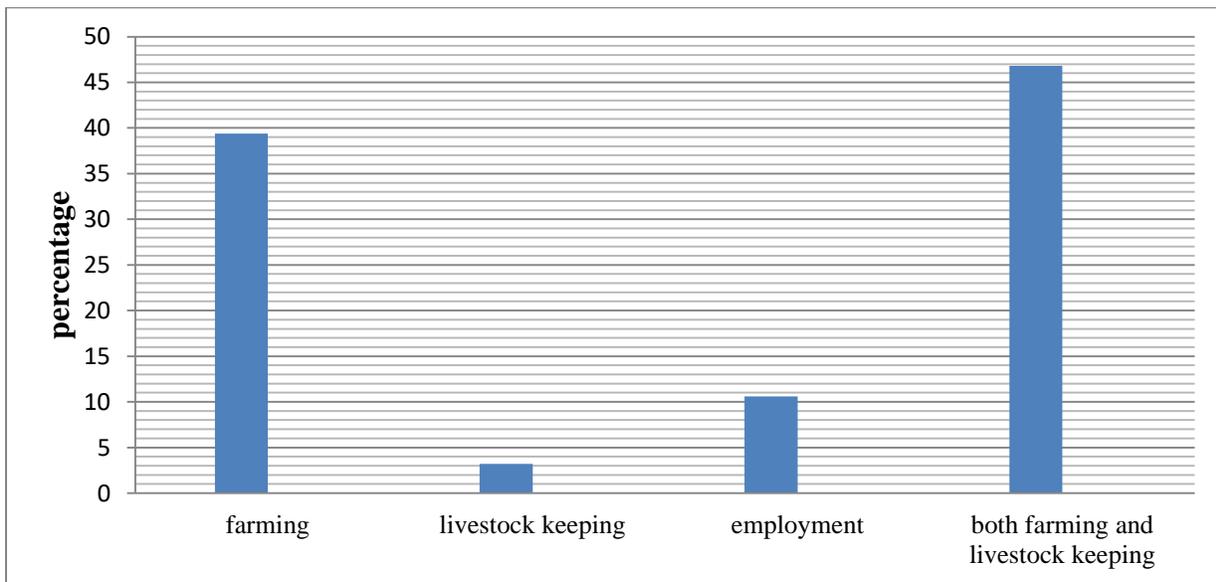


Figure 2: Main economic activities conducted by female headed households

3.1.3 Trend of activities after experiencing climate change effects

Understanding trends of female headed household’s activities after experiencing climate change effects is of paramount importance for establishing appropriate strategies to counter act the observed effects. About 76% of respondents showed that the trend of activities is declining after experiencing climate change effects and 21% proved unchanged while 3% proved trend of activities is increased. This implies there is the needed for coping and adapting to climate change effects because the effects contribute to the decline of agricultural produces. During the fous group discussion One of the respondents pointed out that *“the rain-fed agriculture is no longer promising due to the changes in rainfall patterns and amounts in the area and therefore production of corn is decreasing over time and hence most families are not food secured and hence impoverishment”*.

3.1.4 Economic status of female headed households

The study found that majority of FHHs are low income earners. It was indicated that out of 94 respondent 60 (63.8%) were poor, 25 (26.6%) were very poor, 9 (9.6%) were better-off (Fig. 3). The finding provides evidence that female-headed households in Kahe tend to have lower household income because of lower average earnings from their daily activities. However, households with single women as the head can potentially face even a higher risk of poverty because of the cultural and social stigmas attached to their



marital status. Female-headed households have become increasingly connected with poverty and dependency. This rise in female-headed households has obvious social and economic consequences. Single mothers are far more vulnerable when it comes to poverty than other family structures. The findings supported by Barros *et al.* (1997) argues that female-headed households have worse social, economic and demographic features compared to male-headed counterparts and are thus more likely to be poor. Also Diop (2005) confirm that in Tanzania like in most other African countries poverty has a gender face with income poverty being more prevalent in FHHs than in male-headed households (MHHs). According to HDR (2011) observed climate change to be a global concern that impacting growth and development of people, especially poor people.

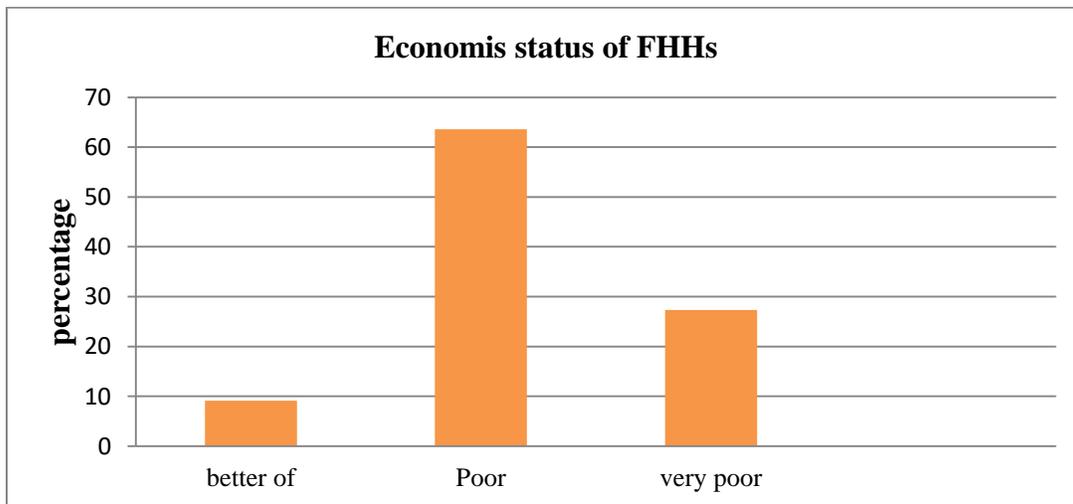


Figure 3. Economic status of female headed households in west Kahe ward

3.2 Social Economic Effects of Climate Change on Female Headed Households

The study employed ANOVA to determine the socio-economic effects of climate change (Table 2). The reason for doing an ANOVA is to see if there is any difference between groups on some variable. For example, social economic effects of climate change as well as drivers to social economic effects. The reason is to see if social economic effects are related to food insecurity, unreliable harvest, shortage of rainfall, health problem, poor living standard, high cost of adaptation and drought.

Table 2. Statistical significance between social economic impact and drivers of social economic effects of climate change (n=94)

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	8.285	8	1.184	2.644	.016 ^b
	Residual	38.492	86	.448		
	Total	46.777	94			

Table 2 indicates the output of ANOVA analysis and whether the variables have a statistically significant. Therefore, the significance level is 0.016, which is low than p-value 0.05. Therefore, the study has enough



evidence to reject the null hypothesis that the correlation between variable is zero. Variables included in the analysis include; unreliable harvest, food insecurity, shortage of rainfall, health problem, poor living standard, high cost of adaptation and drought.

Female-headed households tend to have fewer resources to cope with and adapt to stresses of all kinds and rely on more climate sensitive resources and livelihoods. Climate disturbances are projected to increasingly pressurize poor rural and urban communities in many areas of the world (IPCC, 2012). Economic implications of climate events such as global warming, floods and drought facilitate poor social effects of FHHs in Kahe ward. The study found that 80.9% agreed on the experience of social economic challenges of climate change like food insecurity and health problems, 13.8% were not sure about social economic effects of climate change to FHHs (Fig. 4). The finding implies that climate change effects hit hard FHHs in Kahe ward. FHHs were mostly affected by climate change because of poor technologies to enhance adaption mechanisms to climate change effects. Also this findings supported by IPCC (2012) which observed that the effects of gradual climate changes and extreme weather events in the recent past have undermined progress in the alleviation of poverty and food insecurity, while also having a negative effect on overall development efforts. Economic sectors that largely depend on weather conditions either directly or indirectly most notably agriculture and fisheries are increasingly subject to the effects of climate change. However, UNDP (2010) found that effects of climate change can be seen on health, nutrition, education and basic services.

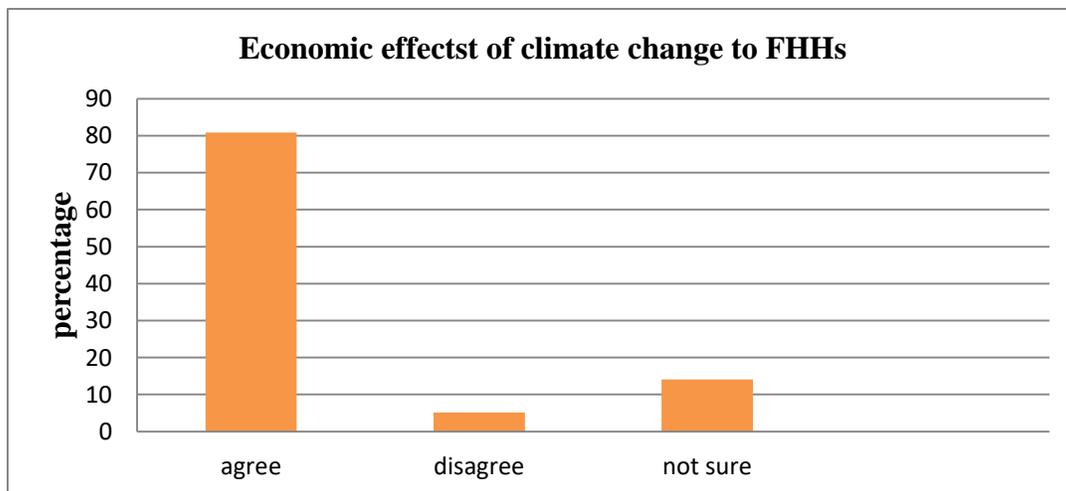


Figure 4: Social economic effects of climate change on the female headed households

3.2.1 Food insecurity

Lowered agricultural production from increased climate variability has resulted to lower incomes and smaller harvests from subsistence agriculture. This leads to decreased food consumption, which could have gendered human capital outcomes. Climate-extreme events such as drought may lead to food insecurity and malnutrition in households. The study show that 83% of female headed households agreed to experience food insecurity, while 17% disagreed that they did not experience food insecurity. The finding indicates that the majority of FHHs were food insecure due to climate change related disasters like floods and extreme increase in temperature. The findings is supported by Mason *et al.*, (2014), argued that



lack of access and ownership to resources greatly constrains and poses a challenge to the FHHs. It was found that FHHs were vulnerable as compared to male-headed households (MHHs) because of the lack of access, control and ownership of resources like land. This limits their food production and consumption. But also Sakamoto (2011) found that Female-headed households (FHHs) tend to be discussed as vulnerable groups, but its vulnerabilities are also being questioned in Tanzania and throughout the African continent. This article analyses FHHs as well as single mothers of two village centers in southeast Tanzania, especially on their access to food and their livelihood strategies within the community. FHHs, especially elderly women, tend to be vulnerable in terms of access to food because of lack of capacity to engage themselves into the production activities.

3.2.2 Poor living standard

The majority of respondents 88% agreed to experience poor living standard, 12% disagreed. Poor living standard is the social-economic problem to FHHs resulted to climate change effects. The finding indicate the high level of poor living standard of FHHs in Kahe ward due to different stress in daily life while climate change effects is among of the reasons for this burden. However, the standard of living include factors such as income, quality and availability of employment, class disparity, poverty rate, quality and affordability of housing, gross domestic product, affordable access to quality healthcare, quality and availability of education, environmental quality, climate and safety.

3.2.3 Drought

The study found that, 63.8% of the respondents have experienced increased drought in recent years. The results indicate that drought as major of social economic effects because it affect the development of agricultural produce. However, difficulties in accessing fuel sources are often indirect effects of climate change caused by drought. Moreover deforestation has severely reduced the availability of trees for fuel wood. Women have to walk a longer distance to collect fire wood. This finding supported by Tanzania meteorological agency (2013) climate data which shows the increased temperature, evaporation, wind speed and decreased rainfall over time.

3.2.4 Shortage of Rainfall

Based on the findings obtained from the study 71% of the respondents said that rainfall has been decreasing compared to past years. The findings indicates that, shortage of rainfall will lead to social economic impact to FHHs who depend on agriculture produced to sustain their livelihoods. Rainfall pattern decreasing over time for example monthly rainfall trend over 30 years therefore it shows that there is no correlation between years. This findings supported by Tanzania meteorological agency data which show decline of monthly rainfall over years for example 126.1mm on January 1973 while 97.7 mm on January 2013.

3.2.5 Health Problem

Climate change affects the human capital of FHHs in form of mortality and in terms of their physical and psychological health, some of which is indirectly related to food insecurity. A more severe climate impact on health may occur for women and children due to indirect effects of malnutrition, which make them additionally susceptible to diseases. This is most evident in poor developing countries. The study found that 65% of respondent agreed that health problem is among of social-economic impact of climate change in Kahe ward, while 35% of all respondents disagreed. The result implies that climate change can present



short-term effects for women’s health, but-long term effects for children’s growth. Because women are the main providers of food and meals for their families therefore women may bear a greater burden to fulfill this task when climate events occur.

3.2.6 Unreliable harvest

The study found that 81% of all respondent agreed to experience unreliable harvest, while 19% of respondents disagreed to experience unreliable harvest. The finding implies that the FHHs were more like to face social economic challenges because of poor and unreliable harvest because of the observed changes in climate parameters.

Table 3: Effects of climate change to the female headed households (n=94)

Social economic effects of climate change to FHHs	Frequency		Percentage	
	Agree	disagree	Agree	Disagree
Food insecurity	78	16	83%	17%
Poor living standards	83	11	88%	12%
Drought	60	34	64%	36%
Shortage of rainfall	67	27	71%	29%
Health problems	61	33	65%	35%
Un reliable harvest	76	18	81%	19%

3.4 Adaptation strategies towards climate change effects in west Kahe ward

The study found climate change is real in the area and communities have developed various adaptation strategies to reduce the risks associated with climate change effects. It was necessary to examine the long term strategies developed by FHHs as a response to climate change effects for ensuring sustainability of livelihoods. Such adaptation mechanisms include; destocking 59.6% cultivation in wetland areas 22.3%, cultivation near water sources 78.7%, irrigation 58.5%, rainwater harvesting 18.1% and engage in business 53.2% as a livelihood diversification to reduce risks related to climate change (Table 4).

Table 4. Adaptation strategies towards climate change effects in west Kahe ward (n=94)

Measures taken to adapt to climate change	Frequency		Percentage	
	Agree	Disagree	Agree	Disagree
Destocking	56	34	59.6%	40.4%
Cultivation near water sources	74	20	78.7%	21.3%
Cultivation in wetland areas	21	73	22%	78%
More spending on irrigation	55	39	58.5%	41.5%
Rainwater storage	17	77	18%	82%
Using scarce water resources more efficiently	43	51	46%	54%
Engage in business	50	44	53%	47%
Participate in SACCOS and VICOBA	61	33	65%	35%
Employed in rice farms	38	56	40%	60%
Early timing of farm operation	62	32	66%	34%



3.5 Challenge of adaptation to climate change effects

Despite the observed adaptation strategies to the effects of climate change in the study area, still there are challenges that weaken the adaptive capacity. Respondents reiterated that; poor technology, low prices of drought resistant crops, low level of income and lack of environmental education are the key challenges for effective adaptation to climate change effects. The findings is in line with Masika (2002) who argued that the adaptive capacity of people depends on how they can draw from resources to maximise their livelihood outcomes. (IPCC, 2007; 2012) found that adaption depends on factors such as economic status, technology, health, education, information, skills, infrastructure, access to assets and management capabilities. Climate change can be seen in many ways depending on geographical location, different change in climatic parameters such as rainfall, temperature, wind speed and moisture help to understand different indicators of climate change.

Table 5 : Climate change indicators in the study area (n=94)

Climate Change Indicators	Frequency		Percentage	
	Agree	Disagree	Agree	Disagree
Shortened farming season	75	19	80%	20%
Decrease of rainfall pattern	85	9	90.4%	9.6%
Increased drought events	79	15	84%	16%
Temperature increase	73	21	77.7%	22.3%
Crops failure	80	14	85%	15%
Disappear of forest	77	17	82%	18%
Occurrence of floods	86	8	91.5%	8.5%
Food shortage	80	14	85%	15%

3.5.1 Drought

This is among the major problem in the study areas which hinders agricultural productions of food crops as well as livestock due to poor availability of water and pastures. The study found that 84% of respondents agreed that occurrence of drought event indicate climate change impact in the study area. However, drought has severely threatened food security in West Kahe specifically in Oria and Mawala villages. This implies that measures must be taken to overcome the problem because drought would facilitate desertification in the study area. This information is supported by TMA 2013, reported that temperature of Moshi District is increasing over time and it has significantly contributed to drought in the study area. Drought has contributed to crop failure in most seasons and the most affected crop is maize.



Plate 2 : Crop failure in Oria village at west Kahe



3.5.2 Increase in Temperature

The study found that, about 77.7% of all respondents have noticed the increase in temperature in the study area over time. These findings are supported by historical temperature data which shows the increasing trend. For example the average temperature in 1973 and 2013 were 29.34°C and 31.2°C respectively. This implies that water dependent sectors would be greatly affected by such increased and hence drought in most parts of the study area.

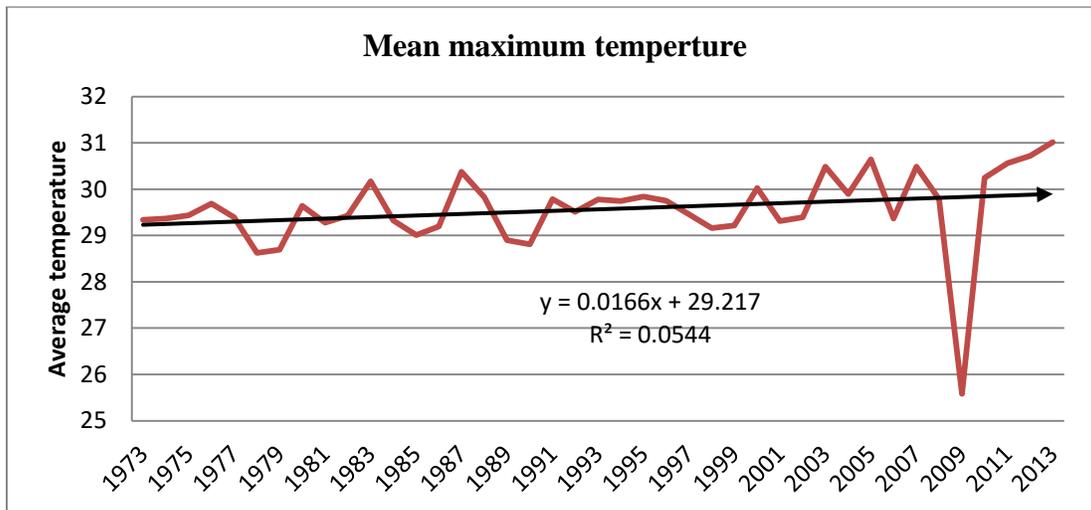


Figure 5: Mean maximum temperatures
Source: TMA

According to Tanzania meteorological agency data prove that the minimum temperature of Moshi District has increased from 17.91°C in 1973 to 19.21°C in 2013 which further implies the increases of temperature at the rate of 1.3°C. This proves that the climate change is occurring in the study area (Fig. 5).

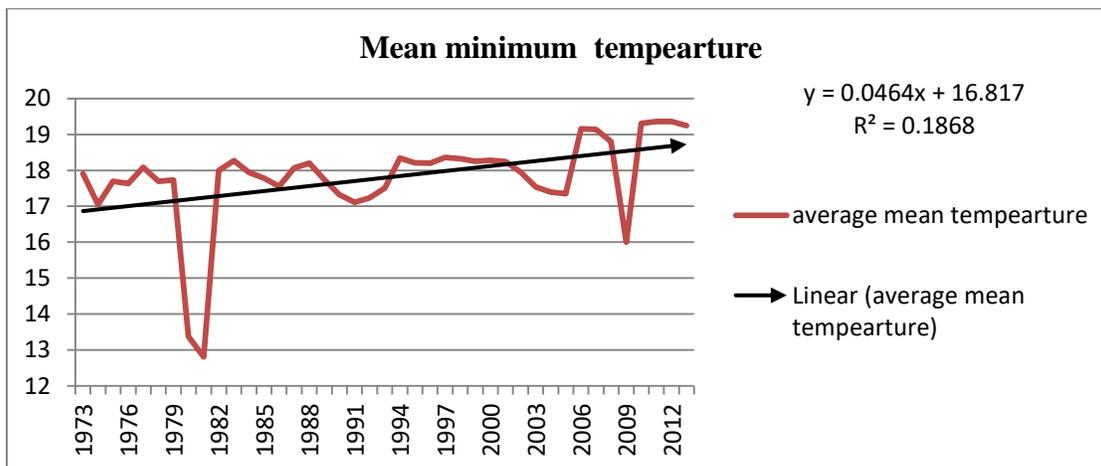


Figure 5: Mean minimum temperatures
Source: TMA



Respondents reiterated that, rainfall amount has been decreasing over time in their area. This fact was supported by 90.4 % of all respondents. On the other hand, historical rainfall data shows the decreasing trend of rainfall amount from 44 mm to 34 mm in 1973 to 2013 (Fig. 6). This decrease has a significant effect to both surface water and groundwater systems due to poor recharge. This affect negatively water sources that support community livelihoods through irrigation during dry periods.

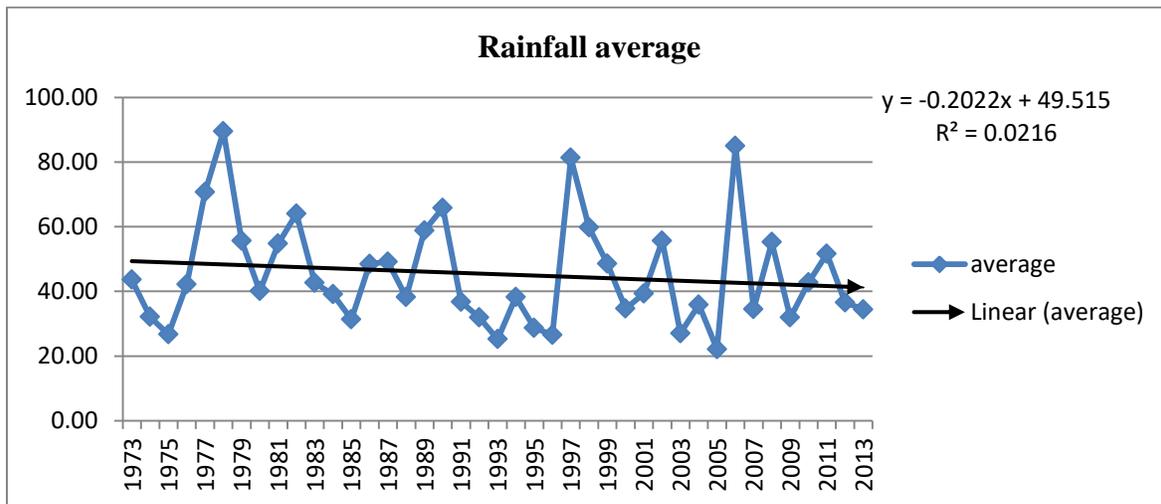


Figure 6: Rainfall average trend over 30 years

Source: TMA

3.5.3 Occurrence of floods

Flood have been observed to be threaten community livelihoods and properties in west Kahe ward. About 91.5% of the all respondents are aware of flood events to occur in the area. The findings is supported by the citizen newspaper on 1st May 2016 which state that Kilimanjaro regional commissioner Saidi Meck Sadik has ordered that flood victims of west Kahe ward to occupy a 3,000 acres farm that was not under production for the last 40 years for relocation. This indicates that, the study area is a prone to climatic events that have social-economic costs to the communities.

3.5.4 Food shortage

The decrease in precipitation has resulted in inadequate soil moisture for crops which contributes to crop failure and hence poor agricultural production. It was indicated that 85.1% of all respondents have experienced decreased agricultural produce that threatens food security. The decrease in food production has led to increased food prices for rice, maize and beans. In addition World Bank,(2008) reported that higher food prices are unlikely to create a major dent in the food expenditures of the poor which create a possible food security problem especially for some commodities such as rice and sugar, prices are forecast to increase for about 80 percent. But also (Keyyu, 2012) found that one million people in Tanzania were food insecure following droughts from 2008-2012 and there has been crippling drought since 2008 in various areas.



Table 6. Challenges of FHHs on adaptation to climate change (n=94)

Challenges of adaptation to climate change effects	Frequency		Percentage	
	Agree	Disagree	Agree	Disagree
High cost of adaptation	74	20	78.7%	21.3%
Poor access of drought tolerant crops	41	53	43.6%	56.4%
Lack of technology	80	14	85%	15%
Poor price of alternative agriculture produce	59	34	63%	37%
Lack of environmental education	26	68	27.7%	72.3%

7.4.3 Indicators for Climate Change in Moshi District

Table 7: mean of relative humidity, wind speed, minimum temperature, maximum temperature and rainfall in Moshi District

Years	Relative humidity	wind speed	Min Temp	Max Temp	Rain fall
1990	79.33	173.0	17.10833	28.80833	65.77
1991	75.67	173.6	17.23333	29.78333	36.76
1992	77.00	172.7	17.50833	29.50833	31.92
1993	76.08	174.3	18.34167	29.775	25.20
1994	77.83	174.0	18.20833	29.74167	38.23
1995	76.42	174.8	18.2	29.84167	28.71
1996	77.08	175.3	18.35833	29.75	26.53
1997	78.50	174.9	18.325	29.45833	81.27
1998	79.00	173.9	18.25	29.15833	59.73
1999	78.17	175.0	18.275	29.21667	48.51
2000	75.33	176.0	18.24167	30.025	34.63
2001	78.83	175.6	17.95	29.30833	39.32
2002	79.67	173.8	17.53333	29.39167	55.67
2003	75.25	175.8	17.39167	30.48333	27.01
2004	77.08	175.0	17.35	29.89167	35.90
2005	76.00	177.4	19.15833	30.64167	22.11
2006	77.75	177.2	19.14167	29.36667	84.93
2007	77.00	175.4	18.8	30.48333	34.53
2008	79.25	175.8	16	29.78333	55.23
2009	67.25	173.7	19.30833	25.58333	31.89
2010	77.17	171.8	19.35833	30.24167	42.74
2011	70.00	175.6	19.35833	30.55833	51.64
2012	61.08	174.8	19.24167	30.71667	36.58

Sources: Tanzania Meteorological Agency

4.0 CONCLUSION

The findings reported in this study clearly indicate that climate change effects have been observed and proven to affect different activities including agriculture activities in the study area. Change in rainfall



Journal of Co-operative and Business Studies (JCBS)
Vol. 6, Issue 1, April 2021 ISSN: (Online) 2714-2043, (Print) 0856-9037
Full Issue and Text Available at: <http://www.mocu.ac.tz>

patterns, drought and temperature increased is the linking issues to climate change in west Kahe ward. However community has developed adaptation strategies which help to reduce vulnerability especially to FHHs. These adaptation strategies including destocking, cultivation near water sources, more spending in irrigation, engage in business and participation in SACCOS and VICOBA also early timing of farming operation. Moreover, despite of the presence of adaptation strategies there are challenges which face these adaptation strategies like high cost of adaptation, lack of enough education and poor price of alternative agriculture produced. However some opportunity has been observed through adaptation strategies like regulate food availability and improve livelihood economic of FHHs.

5.0 RECOMMENDATIONS

The development and implementation of a successful climate change adaptation strategy will need to employ an iterative adaptive management approach, incorporate significant stakeholder engagement and promote sharing of knowledge among experts and the community

Female headed households as the administrators of natural resources and food producers, women are seen as the caretakers, innovators, educators, in possession of essential knowledge and organizers, but climate change affects women the most, women's voices should also be heard and they should be equally involved in the decision making processes regarding climate change. In addition, in the elaboration with policies regarding climate changes, it is important to include gender specific analysis on climate change. However there is a need to mainstream CC agenda in MKUKUTA, this needs to be inclusive in key sector strategies and actions.

Address the role of key sectors in contributing to adaptation for climate change. There is a need to broaden the dialogue to have a coordinated response from all the sectors to joint problem. Climate change is a cross cutting issue affecting a number of sectors including forestry, agriculture, water, lands, energy, infrastructure and many others so together, these sectors can co-operate to reduce the problems.

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Vol. 6, Issue 1, April 2021 ISSN: (Online) 2714-2043, (Print) 0856-9037
Full Issue and Text Available at: <http://www.mocu.ac.tz>

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