IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT)
e-ISSN: 2319-2402,p- ISSN: 2319-2399.Volume 12, Issue 9 Ver. III (September. 2018), PP 18-26
www.iosrjournals.org

Gender Roles in Climate Change Adaptation of Crop Productionin Vihiga Sub-County, Kenya

Mukoya W, [1]Mulinya C.[1]
1. MasindeMuliro University of Science and Technology
Corresponding Author: Mukoya

Abstract: *Vihiga Sub-County like most of Western Kenya, is endowed with an equatorial climate, thus supports a rich diversity of flora and fauna. However, the area is susceptible to climate change impacts due to the changing weather patterns in the region. Temperatures have over time been increasing and rainfall decreasing as its patterns becomes more unpredictable. This has had major negative impacts conspicuously affecting the local population, which highly depends on natural resources for livelihood. The overdependence on rain-fed agriculture and inadequate coping mechanisms all combine to increase people's vulnerability to climate change. This phenomenon has subsequently affected the small scale farmers in the area, crop production yields have decreased over the years exposing the area to risks of food insecurity. Importantly, the extents to which these impacts are felt depend on adaption and coping mechanisms of individual vulnerable groups. Women are perceived to be more vulnerable than men yet they have enough indigenous expertise that can help in coping to these climatic changes. On the contrary, the vulnerability and role of women in crop production and climate change has been overemphasized leaving out men as if they are have no role to play. It is on this scenario that this research sought to investigate the gender roles in climate change adaptation of crop crop production in Vihiga Sub-county, Kenya. . A descriptive survey was adopted benefiting from both qualitative and quantitative approaches to data. The unit of analysis constituted a total of 379 households adopted from Krejice and Morgan table of sample size and sampled through purposive sampling technique. Key informant interviews and focus group discussions were used to augment data from household surveys. Statistical analysis of climate data shows that temperature has gradually increased over the years at a cumulative rate of 0.02^0C. Rainfall trends posted a negative trend line with a regression coefficient of -2.801. The coefficient of determinant (R^2) of annual rainfall was 1.60 % which means there was a 2% variation in rainfall amounts over the years under study. Rainfall was characterized as being bimodal with large inter-annual variability. The study revealed societal gender discrepancies in view of vulnerability to climate change, with women being highlighted as more susceptible to vagaries of changing weather conditions leaving out men as perpetrators of climate change. Access to productive farm inputs such land and extension services, is generally hampered, hence women's workload is increased which undermines their overall role in crop productivity and adaption to clime change. It is apparent that men are more likely to have access to these resources, the skills and power to use them and therefore may better equipped to adapt compared to women. Yet, their role in climate change adaption in crop production is minimal due to their engagement in other activities away from the farms. The study recommends government and stakeholder intervention through conservation and climate smart agriculture in the region and promotion of stress resilient crop varieties in the wake of climate change and variability. Forums deliberating climate change adaption issues should be enhanced with strict adherence to equal participation by both men and women as a best practice.*

Key words: *Climate Change, Gender roles, Crop production, Adaptation.*

Date of Submission: 03-09-2018 Date of acceptance: 18-09-2018

I. Introduction

Climate change is a defining challenge of our present time. Scientific evidence shows that even if greenhouse gases are cut to zero the world would still be on an inexorable course toward global climate change due to legacy of past emissions (Stern, 2006). On the other hand, as climate change becomes less of a hypothetical phenomenon and as its discussions shifts focus from potential impacts to observed impacts. There is a great focus on how variations in climatic conditions and their resultant environmental changes affect both males and females especially in crop production, Food and Agriculture Organization, (FAO, 2010).

Globally, it can be argued that the most critical social impact of climate change is human security. The reduction in food security and access to water will increase mortality and malnutrition (FAO 2007). Also related to this are the emerging social issues of health and welfare associated with climate change, particularly as climate change also threatens to increase poverty levels worldwide (Alston, 2007). This perspectives move

climate change away from purely scientific and technical discussion and brings it to the center of the 21st century sustainable development goals (Dankelman, 2010).

Undoubtedly, gender presents a compounding factor in dealing with the challenge of climate change. The socio-cultural differences between men and women in social roles, access to services, and access to and control of resources, and decision-making power particularly disadvantage women, United Nations Development Programme (UNDP, 2009). For instance, only 5% of women own registered land, yet women provide the bulk (86%) of Africa's agricultural labor force compared to 67% of men (World Bank, 2009). It is also the women who depend more on the natural environment for their livelihoods, and traditionally, women perform the bulk of domestic roles, such as fetching water, firewood, and child care, in addition to subsistence work. Thus, by increasing stress in performing these tasks, climate change is likely to lead to increased workloads for women as such hinder their engagement in other activities such decision making and income generating activities, United National Framework Convention on Climate Change (UNFCCC, 2007).

While climate change slows down progress towards gender equality and intensifies challenges to combating poor crop production practices and food insecurity efforts. Gender inequality roles can further worsen the effect of climate change on crop production, thus high risks of food insecurity which affects the agricultural market, International Fund for Agricultural Development (IFAD, 2000). Climate change has a strong impact on Crop production systems. Agricultural development and food production will be severely curtailed unless the risks posed by climate change are addressed (FAO, 2010).

The reduction in crop output due to the climatic changes basically, places the food security factors at risk. Food security factors include; food production, food distribution, food affordability, food exchange and food safety. Ones the food factors are at risk due to the low yields; the community's food security is questioned. Low yields have an impact to both men and women in the community. In Vihiga Sub-county community crop production activities at household level is majorly done by women as compared to men. At the same time women face barriers that significantly constrain their production and entangle them in a low productivity trap unlike their male counterpart farmers. These barriers range from societal norms, the gender division of labour, resource constraint- that is access to and use of land-, no or low use of inputs and limited access to information best crop production adaptability (Nyasimi, 2017).

Food insecurity, due to low yields will continue being on the rise if equality in gender roles in crop production and climate change adaptation is not realized (World Bank, 2009). Inequality in decision making on adaptive measure of crop production to climate change, leads to haphazard adaptation strategies which might not be efficient in curbing food insecurity. In most cases men are on the fore front of decision making leaving out women as vulnerable victims of climate change. Contrary, women are not only vulnerable but are also agents of change to both mitigation and adaptation. Women often have a strong body of knowledge and expertise that can be used in adaptation of crop production to climate change (Waktins, 2007).

Gender equality in crop adaptation to climate change is important as it shapes men's and women's roles and opportunities, and consequently determines their access to the resources and processes needed for dealing with climate change. Accurate climate information and the ability to interpret it allow farmers, community to plan and make better decisions on how to adapt to climate change (IPCC, 2007). Therefore it is an area of concern. It's important that everyone understands the gender differentiated roles in the adaptation of crop production to climate change and the existing coping strategies that must be strengthened and supported at community level (LEG, 2002).

II. Methodology

The study adopted both qualitative and quantitative research approach, using a descriptive survey.

2.1 Study Area

Vihiga Sub-County is located in Vihiga County in the former Western Province. Its largest market centre is Mbale, where the County Headquatres are located. Vihiga Sub-County is located on latitude $0^0$50' north and on longitude $34^0$42' east. It falls within the high potential agricultural lands which are also associated with some of the highest rural population densities in the country, with a population of about 91,616, with 34, 478 households and varying densities from 277 to 1064 persons per sq. (Population Census, 2009). The area comprises of four Wards, namely; Lugaga-Lumwamu, South Maragoli, Central Maragoli and Mungoma Wards. As shown in figure.1

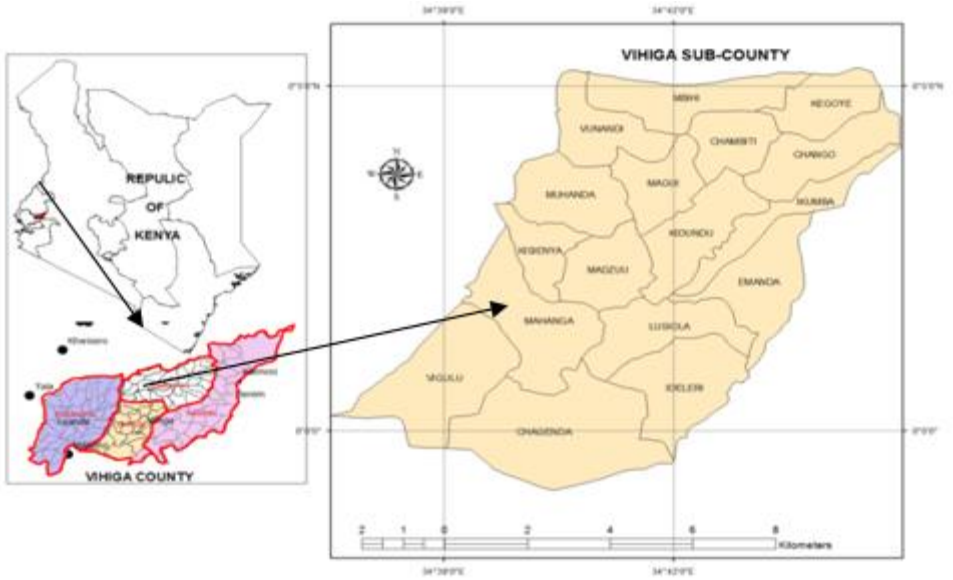

Figure 1.0: Map of Vihiga Sub-County. ESRI ArcGis 10.0

The area experiences high Equatorial climate, rainfall is distributed throughout the year with an average annual precipitation of 1900mm. The soils in the area are mainly sedimentary in nature, which support crop production. The type of soils and climate favors two planting seasons in the year. During long rains, crops such as maize, beans, sweet potatoes and sorghum are grown for subsistence use. Yet due to various reasons , such as; poor land use practices in the community and over dependence on natural resources the area now experiences climate change impacts (Mo D&P, 2013).

2.2 Sampling Procedure

Vihiga Sub-County consisted of four wards, namely: Lugaga-Lumwamu, Central Maragoli, South Maragoli, and Mungoma which have clans and thus different social constructed roles and responsibilities for males and females in climate change adaptation of crop production. Today, several researchers have come up with ways to ease the calculation of sample size from a given population. This study adopted the Krejcie and Morgan table of sample size tabulation, which give the population (N) and its corresponding equivalent sample size. Therefore, out of 34,478 households in Vihiga Sub-County a sample size of 379 households was derived.
The sample size was later randomly sampled in each of the four wards in Vihiga Sub-County. Stratified sampling was then used to apportion the 379 households to the various wards in the study area according to the number of households and thereafter simple random sampling was adopted to choose the households accordingly, as shown in table 1.0.

Table 1.0: Sample size Tabulations from Krejcie and Morgan (1970)

Sub-County Wards	No. of households	No. of Households randomly picked
Lugaga-Wamuluma	10, 200	112
Central Maragoli	9,114	100
South Maragoli	8,024	88
Mungoma	7,140	79
TOTALS	34,478	379

Source: KWBS (2009) population census
Adopted from Krejcie and Morgan Table (1970)

2.3 Data Collection and Analysis

Both primary and secondary data was collected. Secondary data on temperature and rainfall patterns for Vihiga Sub-County over the past years was obtained from the Meteorological department of Kenya. Primary data included; gender of respondents, age, levels of education, climate change awareness, gender roles in crop production, and gender roles in climate change adaptation of crop production. This was collected using questionnaires which were administered to house hold heads who were the respondents. Interview schedules from key informants such as the agricultural officers and gender officers in various capacities in the Sub-County

were also used. Focused group discussion with small scale farmers was used to get more information and validate the data collected from the questionnaires and interview schedules.

2.3.1 Analysis of Climate Change Adaptation Strategies in Crop Production

Quantitative data from the Meteorological Department of Kenya on temperature and rainfall trends in Vihiga Sub-County for the past 30 years was coded and analyzed using Microsoft Excel. The research further established the various climate change adaptation strategies employed by men and women in Vihiga Sub-County and ranked them from the most practiced to the least. The findings were then subjected to Spearman's rank correlation to determine whether there were any correlations between certain variables and the adaptation strategies.

III. Results And Discussions

3.1 Annual Rainfall Trends in Vihiga Sub-County

Findings indicated that there was majorly a decline trend in the rainfall amounts over the years under study. Although there were some years that posted an increase in the rainfall amounts, the general outlook of the findings depicted a decrease in the rainfall amounts as years went by. Results in figure 2: shows that there was a regression coefficient of -2.801 that clearly indicates a negative linear trend in annual rainfall amounts from 1968 to 2013. The coefficient of determination of (R^2) of the annual rainfall amounts is 0.016 that means there was approximately a 2%variation in rainfall amounts between the years (1968-2013).

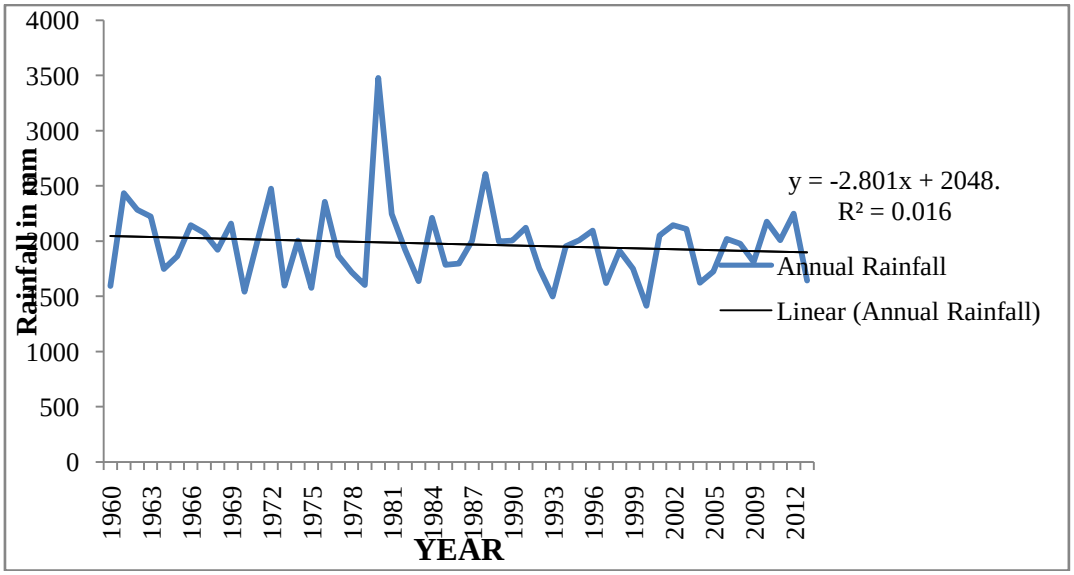

Figure 2: Annual Trends of Rainfall Amounts as from 1968-2013

3.1.1 Perceptions of respondents to rainfall trends on crop production

This study sought to find out the respondents opinion on rainfall trends in crop production. Findings indicated that 74.6% of females and 68.3% of males agreed that the rainfall intensity has been decreasing over the years. While another 24.3% of males and 22.4% of females were of the view that rainfall intensity has increased over the years. Further, a minimal 3.05% of females and 7.4% of males attributed that there were no variations in rainfall intensity over the past ten years. The high numbers of females agreeing rainfall has decreased over time can be attributed to their daily interactions with crop production activities. Thus, would easily know when their crops been insufficiently rain-fed. The study noted that maize and beans were the main crops grown in the area. Findings therefore indicated that these two crops have got their optimal water requirements for growth. Maize at itsmiddle stage of growth requires more water than at its initial stage of growth.It also needs an average of 500-800mm of seasonal water for better growth whereas; beans require 300-500mm of seasonal water for growth.

3.1.3 Annual Temperature trends in Vihiga Sub-County

The analysis of the annual mean temperatures for Vihiga Sub-County from 1979-2013 posted a positive linear trend as shown in figure 3: which indicates that there was a regression coefficient of 0.028 while the coefficient of determination (R^2) of the annual mean temperatures is 0.445 which means 44.5% of variations in temperatures over a period of (1979-2013). This indicates that as years went by the annual mean temperatures increased by 0.03^0C.

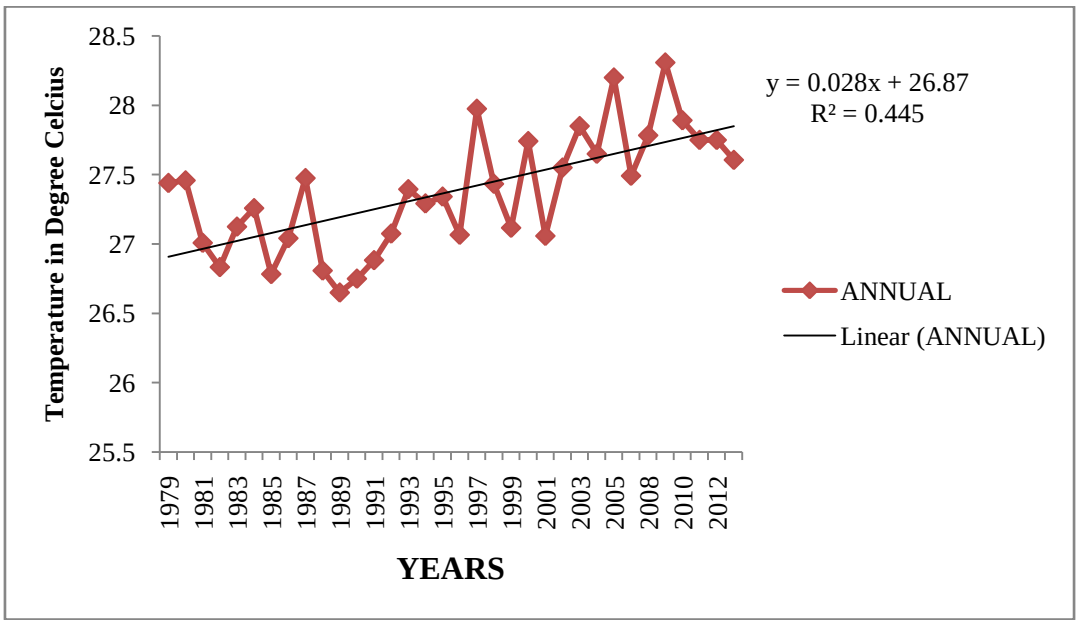

Figure 3: Annual mean temperature trends for Vihiga Sub-County from 1979-2013

This prediction implies that temperatures are likely to increase in the coming years. Although the rate of warming per year for the period of study overtime is small by 0.03 ^{0}C the cumulative effect would damage crop productivity, particularly when interacting with declining rainfall observed in Vihiga Sub-County station recordings. This prediction shows that there is likely to be an annual increase in temperatures in the years thus adaptation and mitigation on crop production is necessary

3.1.4 Perceptions of respondents on temperaturethresholdsin crop growth

The study sought to know the temperature trends in Vihiga Sub-County for the past 10 years. Findings revealed that 84.7% of both males and females felt that days been getting hotter over the years, while 13.1% felt the temperatures been decreasing and another 2.1% felt there was no variation in temperatures over the years. Respondents asserted that high temperature lead todrying up of their maize and beans crops and their initial stages thus the need to replant. The study further sorted to know the temperature threshold of the two main crops-maize and beans grown in the area. Maize requires an average daily temperature of 20^{o}C and an optimum temperature of around 30^{o}C for adequate growth and development, while beans requires an optimum temperature range from 20-25^{o}C for growth.

Commuri and Jones (2001) found out that, temperatures above 30^{o}C in maize crop will increasingly impair cell division and amyloplast replication in maize kernals, thus reducing the drain sink strength and yield. Similar findings were reported by Crafts-Brander and Salvucci (2002) in their study they stated that temperature above 35^{o}C are lethal to maize pollen viability.

3.2 Adaptation Strategies to Climate Change in Crop Production

Given the fact that the respondents agree that over time there has been a change in the quality and quantity of crops harvested, in that in both aspects there has been a decline, there's need for both male and female farmers involved in crop production to adapt to the changes in respect to the yields. Some of the adaptation strategies that they have adopted were given in table 2. Therefore, the study opted to give the frequency of these strategies according to each gender so as to help compare the roles of men and women in adaptation process.

Table 2: Distribution of Adaptation Strategies per Gender

Adaptation	Male headed households%	Female headed households%
Timely planting	23	26
Drought tolerant varieties	14.2	23
Use of irrigation	15	9
Agro forestry	13	5
Crop rotation	6	11
Cultivating short duration crops	2	6

Intercropping	2.2	9
Find off-farm jobs	15	5.3
Crop diversification	3.4	5.7
Soil conservation	4.2	0
Crop insurance	2	0
Total	100%	100%

From the findings in table 2: on the distribution of the adaptation strategies among the genders it can be noted that both male and female farmers have a role in climate change adaptation in crop production. Although there frequencies differ, this can be attributed to their exposure and socially constructed norms. The most practiced adaptation strategy among the males and females in Vihiga Sub-County was timely planting which stands at 23% and 26% respectively. The least practiced was acquiring of crop insurance with a 2% of male representation and none of the females respondents reported to have used this adaptation strategy. This could be attributed to lack of sufficient information on insurances or lack of enough funds to afford it since it is costly.
Findings from this study are in agreement with previous studies. For instance, in a study carried out by Mohammed Nasirin Bangladesh on where .it was noted that, in the ranking of adaptation strategies adopted by farmers in Bangladesh increased irrigation was ranked as the first and most important strategy among the farmers (Oluoch-Kosura, 2005). Since irrigation increases the yield of production and improves nutrients to the plants. Crop diversification was ranked third followed by integrated farming system (Mohammed *.et, al.,* 2014). Crop insurance was ranked the least important adaptation strategy due to several factors such as; lack of good management of finance institutions in the country underwriting agriculture and offering farm based insurance products. Another possible factor was said to be poor deployment of technical assistance and low levels of farmer's awareness about agricultural insurance (Mohammed *.et, al.,* 2014).

3.3 Factors influencing Adaptation

3.3.1 Gender of Respondents

This study sought to establish gender of the respondents; findings were tabulated and presented in the figure 4. From the results a slight majority of the respondents comprised of the female which accounted for 54.3% while the males constituted the remaining 45.7%. This portrays a balanced distribution with the slightly higher number of women being attributed to their availability both at household level and in the farms during the fieldwork.

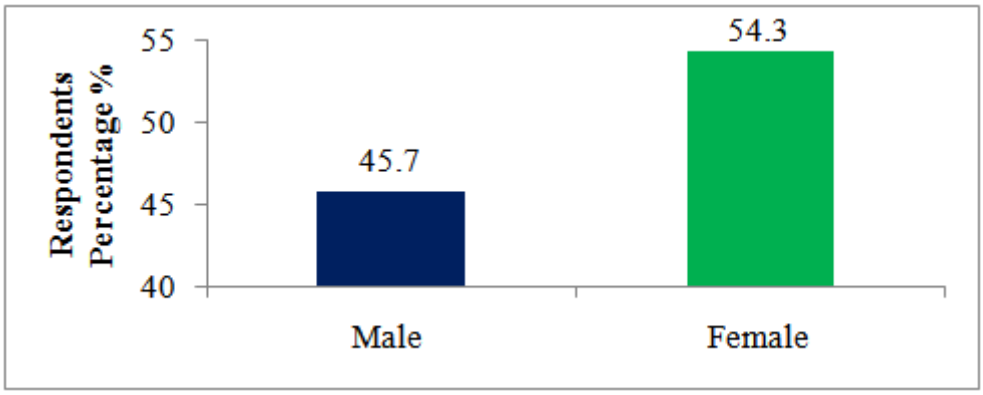

Figure 4: Gender of Respondents in Vihiga Sub-County Kenya

These findings contradict with (Mulinya, 2016), since in her study it was found out that. Majority of the respondents were male at 67.5% while 32.5% were female farmers. It is necessary to establish the gender of respondents so as to understand their differential gender roles in crop production and further climate change adaptation.

According to (IFPRI, 2015) gender differences are likely to influence males and females capacity to adapt to climate change as well influence their participation in agriculture. In this study it was realized that, although the position of the woman in rural communities has been perceived vulnerable and looked down upon. The Maragoli woman stands out to defy the odds; she is a more courageous woman and a go getter. The Maragoli women have control over their farms produce and can make decisions with or without consultations from their husbands. This contradicts, several studies that enunciate women are always left out in decision making yet they are the most overworked on farms.

3.3.2 Age of Respondent

The study sought to establish the age of the respondents and the results are shown in figure 5. The age distribution for the study respondents were as follows: the study revealed that 8.3% of the respondents were between 20-24 years, while another 16.9% was 25-29 years. A further 24.7% aged between 30-34 years, closely followed by 19.3% of respondents between 35-39 years. At the same time there were 9.5% of respondents between 40-44 years and 8.1% between 45-49 years. While another 7.2% aged between 50-54 years and finally 6.0% of the respondents were 55 years and above. From the results, it is clear that the majority of the respondents occurred in the age bracket of 30-34 years followed closely by 35-39 years. This range of age bracket 30 – 39 years happens to be the most productive age in any given economy the more reason they are found to dominate the crop production sector. These are the people who are likely to understand the benefits of incorporating gender equality roles in crop production andclimate change adaptation. It is the age bracket that is likely to be more updated on current issues on gender roles and climate change adaptation unlike the older people.

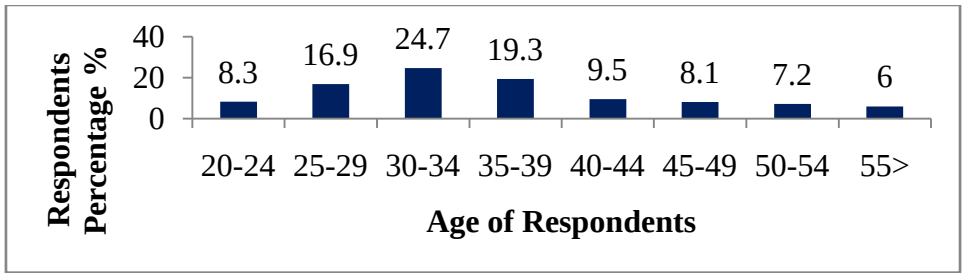

Figure 5: Age of Respondents in Vihiga Sub-County Kenya

In this study the age variable has a negative correlation with the gender roles in crop production and adaptation to climate change. This means that the probability of adapting to climate change in crop production among males and females decreases as age of the respondents increases. This could be contributed by the difficulties of understanding the integration of gender roles in crop production and climate adaptation among the older people. The older group might also be rigid to changes in societal responsibilities between men and women, thus making it difficult incorporate gender roles in crop production adaptation. Similar outcomes were found and discussed by (Mulinya, 2016). In her study it was noted that, the correlation between the age of farmers and adaptation strategies was negative. Since the probability of adaptation significantly decreased as the age of the farmers increased.

3.3 3 Level of Education of Respondents

The study further established the level of education of the respondents. The findings indicated that 9.6% of the respondents had attained primary education while a majority of 41.3% of the respondents had reached the secondary school level. Another 26.6 % 0f the respondents were of tertiary level and 22.5% of respondents were of university level as shown in Figure 6.

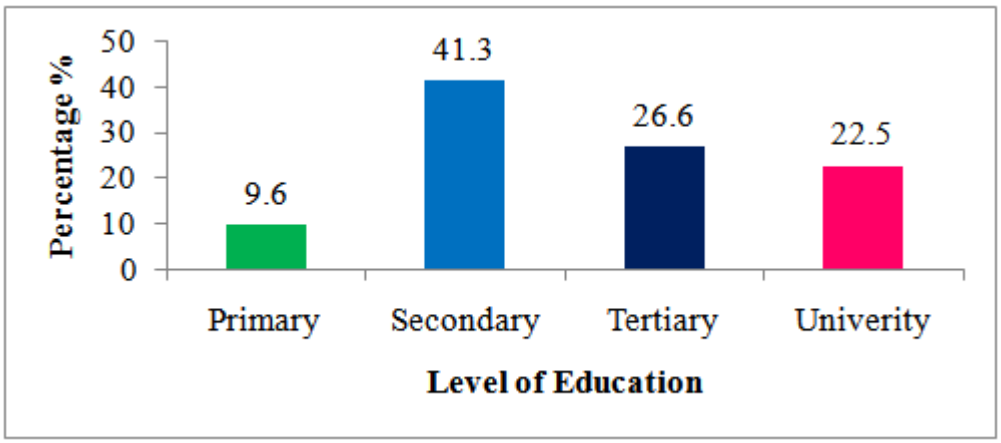

Figure 6: Education Level of Respondents in Vihiga Sub-County Kenya

There was need to determine if there was any significance in the level of education of the household heads, and their roles in the adaptation of climate change in crop production. Findings from this study show that there is a positive correlation between levels of education and the distribution of gender roles in the adaptation of climate change in crop production.

IV. Conclusions And Recommendations

Findings from this study indicated that there was majorly a decline trend in the rainfall amounts over the years under study. Results from rainfall data set showed that there was a regression coefficient of -2.801, which means every additional year rainfall reduced by approximately -3.00mm of rainfall. Temperature data set were computed and posted a positive trend line which indicates that there was a regression coefficient of 0.028 while the coefficient of determination (R^2) of the annual mean temperatures is 0.445 which means 44.5% of variations in temperatures over a period of (1979-2013). This indicates that as years went by the annual mean temperatures increased by approximately 0.03^0C.

Findings from this study on the distribution of the adaptation strategies among the genders showed that both men and women have a role in climate change adaptation in crop production. Although there frequencies differ, this can be attributed to differences in their exposure and socially constructed norms, age, level of education and levels of income. The study recommends the need for designing gender-responsive software and hardware for climate change adaptation strategies in agriculture which enable females to improve the crop productivity of their farms.

References

[1]. Adejuwon, J.O. (2005). *Food Crop Production in Nigeria: Present effects of Climate Variability.* Climate Research, inter-Research, Germany: 812.

[2]. Agwu, J., and A.A. Okhimamhe. (2009). *Gender and climate change in Nigeria*: A study of four communities in north-central and south-eastern Nigeria. Heinrich BöllStiftung, Nigeria. Available at: http://www.boellnigeria. org/downloads/Gender_Climate_Change_in_Nigeria.pdf (Accessed 17 Aug 2011)

[3]. Ahmed, S., and E. Fajber. (2009). Engendering adaptation to climate variability inGujarat, India. *Gender and Development* 17(1): 33–50.

[4]. Annecke, W. (2002).Climate change, energy-related activities and the likely socialimpacts on women in Africa.*International Journal of Global Environmental Issues*2 (3/4): 206–222

[5]. Arora-Jonsson, S. (2011). Virtue and vulnerability: Discourses on women, gender and climate change. *Global Environmental Change* 21 (2): 744–751

[6]. Barnett, J., and W. Adger.(2007). Climate change, human security and violent conflict.*PoliticalGeography*26 (6): 639–655.

[7]. Caballo, V. E., &Cardefia, E. (1997*). Sex differences in the perception of stressful life events in a Spanish sample*: some implications for the axis IV of the DSM-IV. *Pergamon, Vol. 23(2)*: 353-359.Great Britain: Elsevier Science Ltd. Retrieved fromhttp://hera.ugr.es/doi/15023953.pdf

[8]. Commuri, P. D., & Jones, R. J. (2001).High Temperatures Endosperm Cell Division in Maize.*Crop Science*. 41(4)

[9]. Dijksterhuis, A., &Bargh, J. A. (2001).*The Perception-Behavior Expressway: Automatic Effects of Social Perception on Social Behavior*. University of Amsterdam and New York University. Retrieved from http://www.unconsciouslab.com/publications/Dijksterhuis%20Bargh%20-%

[10]. FAO. (2007). *People-centred climate change adaptation: Integrating gender issues.* Retrieved fromftp://ftp.fao.org/docrep/fao/010/a1395e/a1395e00.pdf 63

[11]. FAO. (2011). *New research methods and training materials, gender and climate change research in agriculture and food security for rural development.* CGIAR, CCAFS, FAO. Retrieved from http://www.fao.org/climatechange /29830-0beb869615795a9960ada6400c62b3783.pdf

[12]. FAO. (2011). *The state of food and agriculture: women in agriculture-closing the gender gap for development*. Retrieved from http://www.fao.org/docrep/ 013/i2050e/i2050e00.htm

[13]. Gaye, I., Dioné, J., Laye, O., Tutu, K., &Akol, C. (2009).*Gender and climate change: women matter. Economic Commission for Africa.*Retrieved fromhttp://www.uneca.org/eca_programmes/sdd/documents/gender-and-climate-change.pdf

[14]. Hepworth, N. &Goulden, M. (2008).*Climate Change in Uganda: Understanding the implications and appraising the response (scoping mission for DFID Uganda).* Edinburgh: LTS International. Retrieved from http://reliefweb.int/sites/relief web.int/files/resources/7F1BF4A7CF37F6A54925756F0016ED29-Full_Report.pdf

[15]. Hepworth, N. D. (2010). *Climate change vulnerability and adaptation preparedness in Uganda*. Nairobi, Kenya: Heinrich Böll Foundation. Retrieved fromhttp://www.boell.or.ke/downloads/Uganda_Climate_Change_Adaptation_Preparedness.pdf

[16]. Hovorka, Alice J., and Diana Lee-Smith. (2006). "Gendering the Urban Agriculture Agenda." In *Cities Farming for the Future: Urban Agriculture for Green and Productive Cities*, ed. R. van Veenhuizen. Leusden: RUAF Foundation, International Institute of Rural Reconstruction, and International Development Research Centre.

[17]. IAASTD (2009).*Agriculture at cross-roads: synthesis report - a synthesis of the global and sub-global IAASTD reports*. Edited by McIntyre, B. D., Herren, H. R., Wakhungu, J., Watson, R. T. International assessment of agricultural knowledge, science and technology for development, Washington, DC: Island Press. Retrieved fromhttp://www.agassessment.org/reports/IAASTD/EN/Agriculture %20at%20a%20Crossroads_Synthesis%20Report%20(English).pdf

[18]. IFPRI Environmental and Protection Technology Discussion Paper No. 154, International Food

[19]. Policy Research Institute,Washington, DC

[20]. IPCC. (2007). *Climate Change 2007: 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. Retrieved fromhttp://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm

[21]. Krejice, R., & Morgan, D. W, (1970). *Determining Sample Size for Research Activities*. Educational and Psychological Measurement
[22]. Mulinya Caroline, (2016). Factors Affecting Small Scale Farmers Coping StrategiesTo Climate Change in Kakamega County In Kenya. *IOSR Journal of Humanities And Social Sciences (IOSR-JHSS)*, 22(2), 100-109.
[23]. NyasimiM,Wabonya E. (2017). *The Impacts of Climate Change on Food Securityand Livelihoods in Karamoja*. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).
[24]. Oluoch-Kosura,Willis, and Joseph T. Karugia. (2005). "Why the Early Promise for Rapid Increases in Maize Productivity in KenyaWas Not Sustained: Lessons for Sustainable Investment in Agriculture." In *The African Food Crisis*, ed. GoranDjurfeldt, Hans Holmen, Magnus Jirstrom, and Rolf Larsson, 181–96. Wallington: CABI
[25]. Stern, N. (2006). *Stern review on the economics of climate change*. Retrieved from http://webarchive.nationalarchives.gov.uk/+/http:/www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm
[26]. World Bank (2005).*Gender and 'Shared Growth' in Sub-Saharan Africa, Briefing notes on critical gender issues in sub-Saharan Africa*. Retrieved fromhttp://siteresources.worldbank.org/EXTABOUTUS/Resources/GenderGrowth.pdf
[27]. World Bank.(2009). *Gender in agriculture sourcebook*. Washington, DC 20433: The International Bank for Reconstruction and Development /The World Bank, 1818 H Street, NW. Retrieved from http://siteresources.worldbank .org/INTGENAGRLIVSOUBOOK/Resources/CompleteBook

Mukoya W " Gender Roles in Climate Change Adaptation of Crop Productionin Vihiga Sub-County, Kenya" IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT) 12.9 (2018): 18-26.