Assessing Women Domestic Chores and Vulnerability to Climate Variability in Chepseon Sub-Location, Nakuru County, Kenya

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Abstract

Climate change is a major challenge of mankind in the 21st century. Women are considered to be more vulnerable to climate change than men because of their socially ascribed roles which make them come into close contact with the natural resources. This study was conducted to assess women domestic chores and their vulnerability to climate variability in Chepseon sub location, Nakuru County, Kenya. Descriptive survey was used to solicit data on women domestic chores and their vulnerability to climate variability. A sample size of 90 households was selected through stratified random sampling. Questionnaires were used to collect data. Climate variability data spanning 1982 to 2011 were obtained from Kenya Meteorological Department. Findings indicated that climate in Chepseon sub location has been varying and that women domestic chores are vulnerable to climate variability. This necessitates capacity building to improve women's resilience to climate variability.

Keywords: Climate variability, Adaptive capacity, Vulnerability, Sensitivity, Exposure

1.0 Introduction

Over the recent decades climate change and global warming have become issues of global concern. The world's temperatures are slowly rising, rainfall patterns have changed over the years, and the same applies to wind patterns and ocean currents (IPCC, 2007). As a result, the earth is experiencing melting of glaciers, expansion of oceans, floods, droughts, destructive hurricanes, heat waves, changes in growing seasons which are becoming a major challenge to mankind (UNDP, 2007). According to estimates by IPCC (2007), global temperatures are expected to rise by 2- 3 ^{o}C by the year 2100. Similarly, sea level is expected to rise by 10-90 cm by 2100 (IPCC, 2007). These calls for immediate action to mitigate climate change in order to avoid related catastrophes that threaten to erode human freedoms and limit choice.

According to UNDP (2009), climate change has been experienced all over the world and has had serious threats on sustainable human development. It further states that, even if Green House Gas (GHG) emissions are cut to zero at the moment, the world would still experience the effect of global warming from the heritage of past emissions. The harmful effects of climate change will be experienced much by developing countries, were millions of the world's poorest people are already being forced to cope with its impacts, yet it contributed less to historic GHG emissions (UNDP, 2010).

Although Africa contributes negligibly to total GHG emission (only 4%) compared to worlds largest emitters like China which contributes 23.5%, United States of America (USA) which contributes 18.27% and European Union (EU) which contributes 13.98%, it is hardest hit making it hard to alleviate poverty (UNECA, 2010).The poor suffer the brunt of climate change in present world because of their dependence on climate sensitive resources and their lack of financial capacity to adapt to climate change while in future it will be humanity as a whole that will face the risk that comes with global warming (UNDP, 2007). Africa is mostly affected by climate change because of poverty, its geographical location and its dependence on climate-sensitive resources.

It is characterized by rain-fed agriculture which comprises 23% of Gross Domestic Product (GDP) and employs 70% of the population except South Africa (World Bank, 2010). Most of the people who live in rural Africa comprises the poor whose main economic activity is subsistence which relies on rain-fed agriculture. Africa lacks property and financial measures to adapt to climate changes (FAO, 2010). According to ROK (2010), climate change has been evident in Kenya from early 1960s with rainfall patterns becoming irregular and unpredictable. There has also been a rise in minimum temperature by 0.7 to 2.0 ^{o}C and maximum temperature by 0.2 to 1.3 ^{o}C. Kenya is vulnerable to climate variability due to the fact that most of her people's economic activities are dependent on climate-sensitive natural resources. However, vulnerability across the country needs to be determined since vulnerability across different groups and regions in the country varies and that women, children and pastoralists are more vulnerable to damage caused by climate change. From the available literature, little information on impact of climate variability on women domestic chores in Sub-Saharan Africa is available. This study was intended to fill this gap by analyzing women domestic chores and vulnerability to climate variability in Chepseon Sub Location.

2.0 Methodology

2.1 Study Area

The study was carried out in Chepseon Sub Location of Nakuru County. It is located within a latitude of 0.03 (00° 01' 60'' N) and a longitude of 36 (36°00' 00'' E). A square kilometer has an approximate population of 115 persons and average altitude of 1912m above the sea level. Agricultural land use includes ranching, dairy cattle farming, maize, wheat, millet, beans and some sisal production (Anthony, 2011).

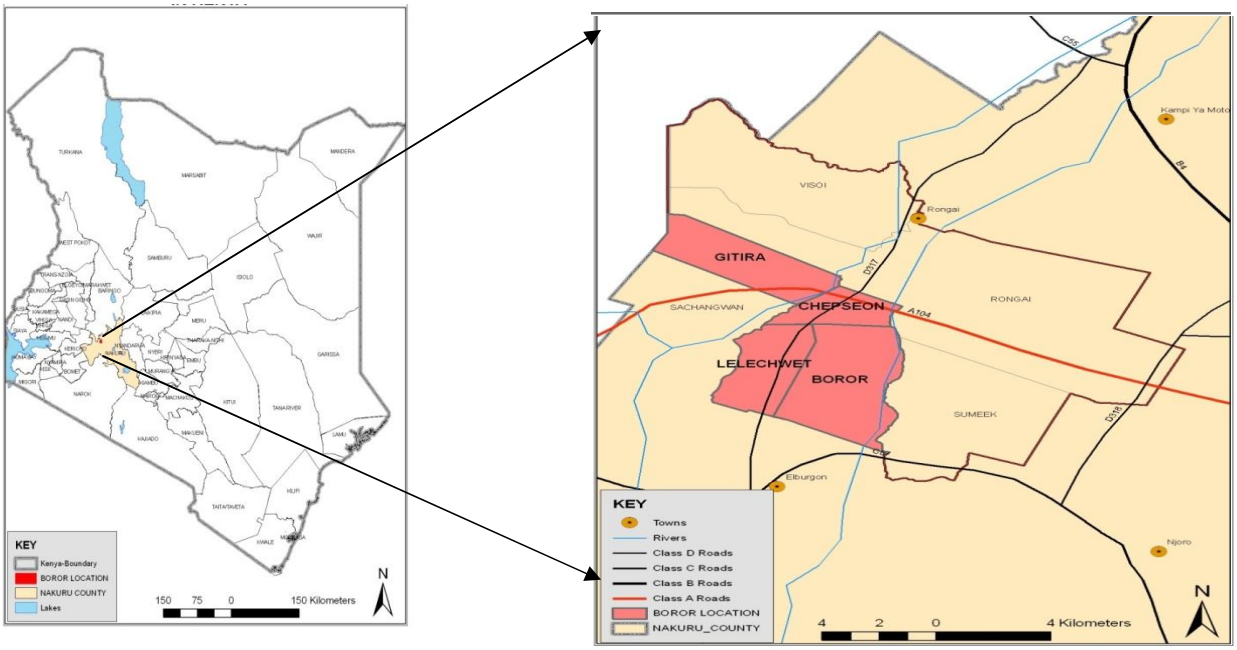

Figure 2.1: Study Area Map (Source: Anthony (2011)

2.2 Research Design

Descriptive research design was employed in this study. The population under study was composed of 5 villages: Chepseon, Boror, Moyaset, Lelechwet and Gitira farm of Deloraine estate (897 households). Assumption being that they were the most vulnerable to the effects of climate change. Each village represented one stratum. Therefore, there were 5 categories of strata. Stratified random sampling procedure was used in selecting the sample population of the study. The desired sample size was therefore 10% (90 households) of the entire population. To arrive at exact number of households in each village to be included in the sample, specific number of households per village were taken divided by the total number of households in the entire sub-location and multiplied by the sample size taken i.e. **N/T×90**

Where: ***N*** represented number of households in a particular village, and ***T*** represented total number of households in the study area. The number of households in each individual village included in the sample is shown in table 2.1 below.

Table 2.1: Number of Households Included in the Sample

Village	Stratum No.	Number of households	Number of households included in the sample (N/T×90)
Chepseon	1	147	15
Boror	2	254	26
Lelechwet	3	224	23
Moyaset	4	209	21
Gitira	5	45	5

After obtaining the desired household numbers in each stratum, specific households were sampled using random sampling which involved giving a number to every subject or member of the accessible population. The numbers were placed in a container and picked at random. The subjects that corresponded to the numbers picked were included in the sample. A pilot study was conducted to test the suitability of the questionnaires prior to actual data collection. Five women from the study area were randomly selected and interviewed. These excluded the ones from which data was collected. Assistant agricultural officer and assistant environmental officer were also interviewed. Results from the pilot study were used to correct vague questions in order to collect relevant data to answer research questions. They were also analysed to check if the methods of analysis suggested were appropriate. Actual data collection was conducted whereby data on general information about the respondent, climate variability awareness ,climate change adaptation, sensitivity and exposure among women in Chepseon sub location were captured using both open-ended and close-ended questionnaires which were administered to the respondents. Data on access to credit and saving facilities by women in Chepseon sub location were administered to Chairladies of*: Rongai Social and Economic Organization, Silver ladies* and *Kas ak Icham* women groups (one questionnaire each). Data collected from Nakuru district agricultural officer included: awareness on climate variability, its effects on agricultural production and access to subsidized farm inputs by women subsistence farmers in Chepseon sub location. Data collected from Nakuru district environmental officer included: awareness on climate variability, its effects on natural resources and sustainable resource use by women in the district.

Monthly temperatures and precipitation data for Nakuru Meteorological Station (Station number 9036261) were collected from Kenya Meteorological Department in Nairobi for a period of 30 years (1982 to 2011). Thirty year period of time was chosen because it was long enough to have substantial data to determine climate variability in Chepseon sub location.

Results were discussed and presented as descriptive statistics in tables and graphs. Temperatures and precipitation were analyzed for significant variability. Relationship between women domestic chores, level of education, vulnerability, adaptive capacity and climate variability awareness were determined statistically.

3.0 Results and Discussion

3.1 Determining Climate Variability in Chepseon Sub location

3.1.1 Precipitation Analysis in Chepseon Sub location from 1982-2011

Precipitation distribution and amounts of a particular place determines the availability of water for various functions (Gicheru *et al* 2006). These are: for crop use, domestic use and commercial use. Most of women domestic chores involve use of water. These chores include: cooking, washing, subsistence farming and animal keeping. Limited amounts of precipitation therefore mean that most of women domestic chores would be affected. To determine whether there has been variability in the amounts of precipitation received in Chepseon Sub location, the total annual precipitation were calculated and presented in fig 3.1.

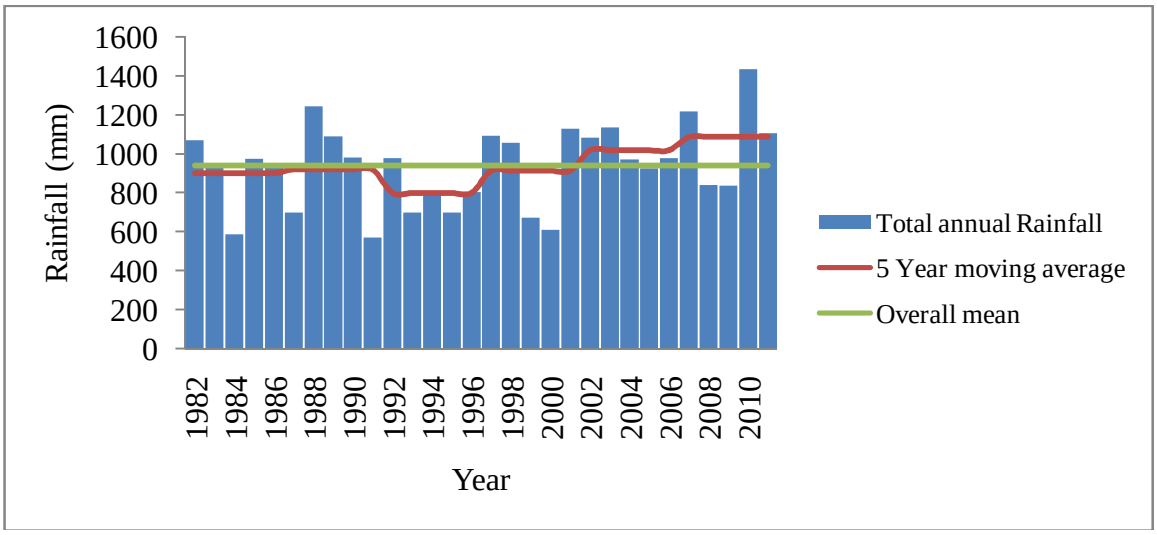

Figure 3.1: Precipitation Flow Using 5-Year Moving Averages (1982-2011): Nakuru County, KMD: Nakuru Station No: 9036261

The graphs above shows a general increase in precipitation from1982 to 2011 whereby rainfall had increased over the years from 1071.5mm to 1106.5 mm. However, there were drastic changes in rainfall amounts within the 30 year period, with the lowest amount of annual precipitation (573.2mm) recorded in the year 1991and the highest amount of total annual precipitation(1434.9mm) recorded in the year 2010. The mean for the 30 year period of time was 939.43mm. Five year moving averages were calculated and presented in table 3.1.

Table 3.1: Five- Year Moving Averages for Total Annual Rainfall (mm):1982-2011.Nakuru County

Year	Average Rainfall (mm)
1982-1986	900.54
1987-1991	918.60
1992-1996	797.96
1997-2001	913.24
2002-2006	1018.98
2007-2011	1087.24

From the table above, in every five years, the average rainfall has greatly changed, with the first five years rising from 900.54mm to 918.60mm in the next five years then decreasing to 797.96mm in the next five years that followed. Average rainfall then rose to 913.24mm in the next five year. The last decade showed a drastic increase in the average annual precipitation from 1018.98mm to 1087.24mm (Table 3.1 and fig 3.1). This trend showed variability of rainfall over the years which were also unpredictable. Deviations of precipitation from the total 30 year mean are shown in figure 3.2.

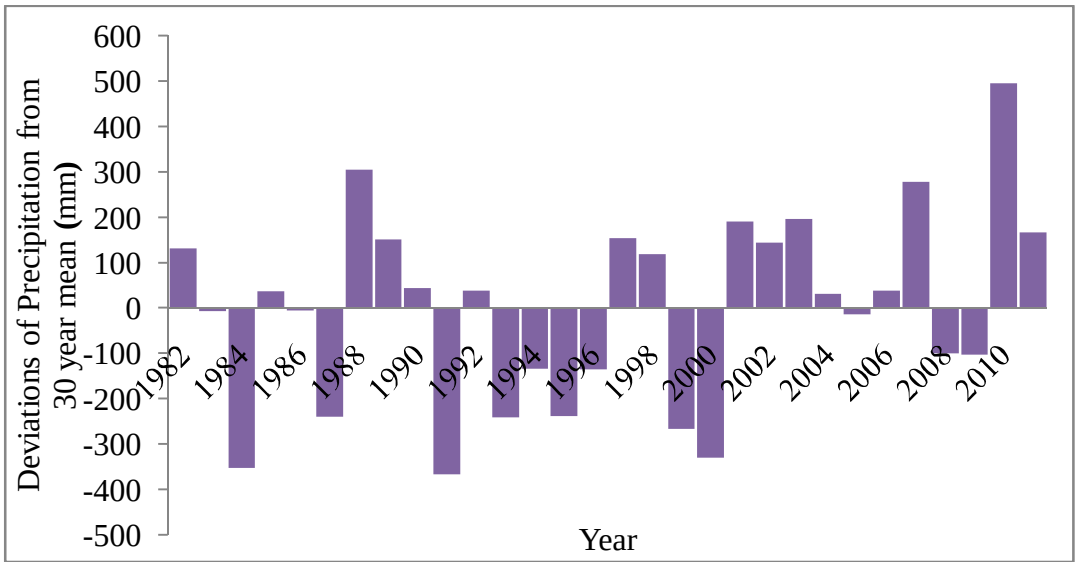

Figure 3.2: Deviations of Precipitation from 30 Year Mean (1982-2011): Nakuru County, KMD: Nakuru Station No: 9036261

The year 2010 had the highest deviation from the mean of 495.47. This was the year in which the highest total annual precipitation of 1434.9mm was recorded. In the year 1991, the lowest amount of precipitation (573.2mm) was recorded with deviation of -366.23 from the mean. Greater deviations from the mean were also observed within the 30 year period of time. Results from total monthly precipitation for the 30 year period of time showed increased variability from one month to another as shown in fig 3.3.

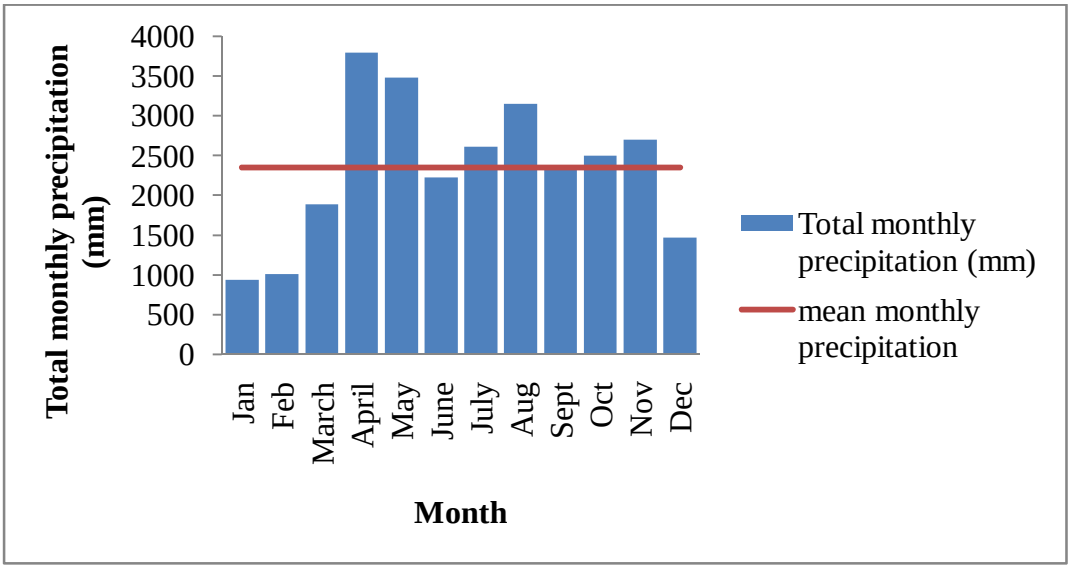

Figure 3.3: Total Monthly Precipitations (1982-2010): Nakuru County, KMD: Nakuru Station No: 9036261

From the figure above, the highest amount of precipitation (3802mm) was recorded in the month of April and the lowest amount (945mm) recorded in the month of January. However, there was increased variability in the total amounts of precipitation received from one month to another with sharp inclines and sharp declines. Sharp inclines were recorded in the months of March, April, July and August while sharp declines were recorded in the months of June, September, December and January. Deviations from mean monthly precipitation are shown in fig 3.4.

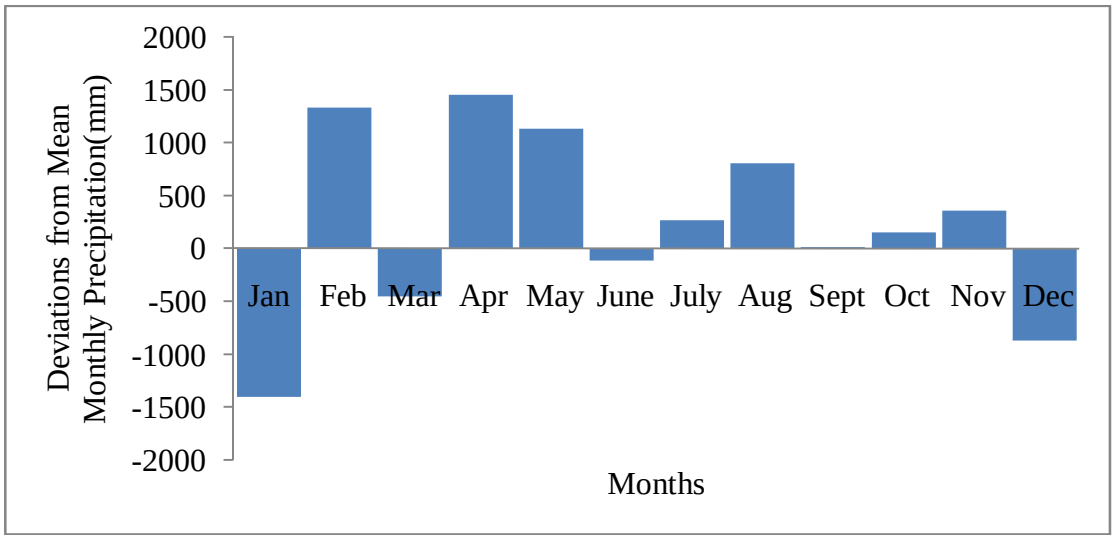

Figure 3.4: Deviations from Mean Monthly Precipitation (mm) (1982-2011): Nakuru County, KMD: Nakuru Station No: 9036261

From fig 3.4, the Lowest deviation from the mean (-1404) was recorded in the month of January. This was the month in which precipitation recorded was at its lowest (945mm). The highest deviation from the mean was recorded in the month of April (1453.4) when the highest amounts of precipitation (3802mm) were recorded. This showed increased rainfall variability from the mean.

The results from the above analysis indicated an increased variability in the amounts of precipitation received in Chepseon sub location year after year and within the year. This therefore indicates that Chepseon sub location is exposed to changes in precipitation amounts and hence climate variability.

3.1.2 Analysis of Average Temperature Trends in Chepseon Sub Location (1982-2011)

In general, average temperatures have been falling from January (18.845˚C) to December (18.185˚C) in the entire 30 year period of time. However, variability in average temperatures was also recorded one month after another as shown in figure 3.5.

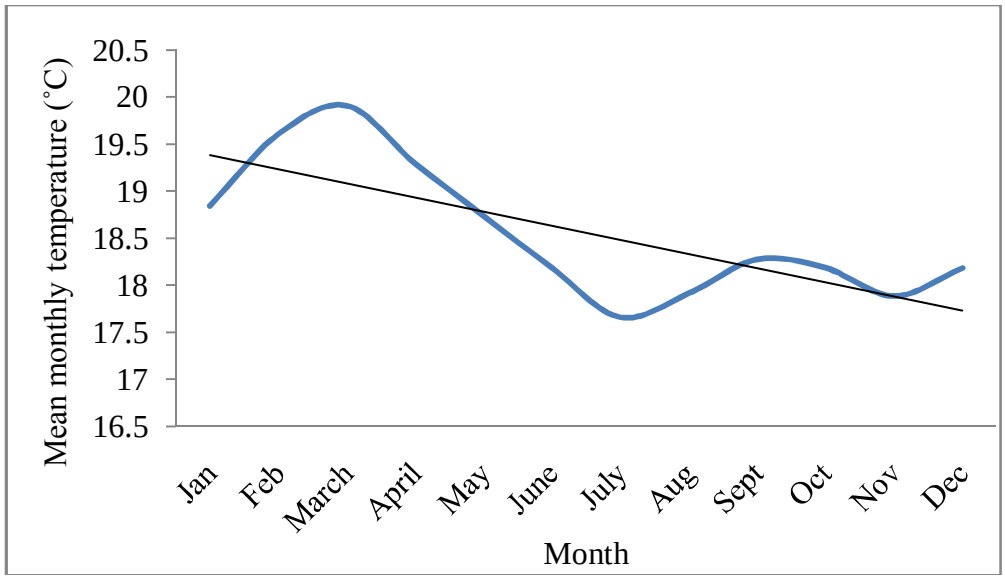

Figure 3.5: Average Temperature Trends for Chepseon Sub Location (1982-2011): Nakuru County, KMD: Nakuru Station No: 9036261

From fig 3.5, the highest average temperatures of 19.91˚C were recorded in the month of March and the lowest of 17.66˚C were recorded in the month of July.

3.1.3 Variability of Annual Mean Maximum Temperature for 30 Year period for Chepseon Sub location

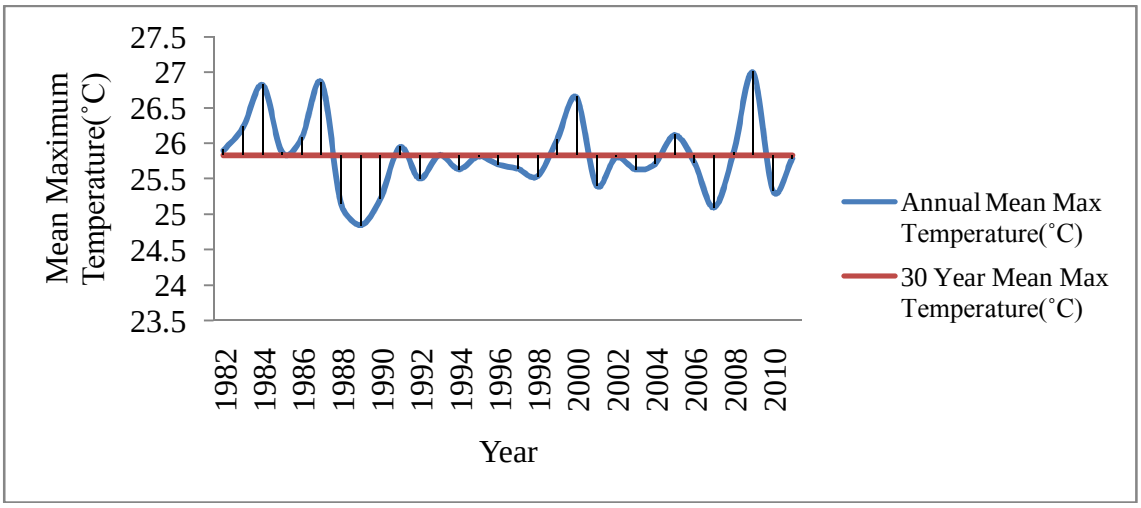

Figure 3.6: Variability of Annual Mean Maximum Temperature from the 30 Year Mean from 1982-2011: Nakuru County, KMD: Nakuru Station no: 9036261

From the table above, the year 2009 had the highest annual mean maximum temperature of 27.0 ˚C. This was the year in which the highest deviation of annual mean maximum temperature from the 30 year mean(25.83˚C) was recorded.The lowest deviation of annual mean maximum temperature of 24.80˚C from the mean was recorded in the year 1989. This variation of annual mean maximum temperature from the mean therefore affects the ecosystem stability leading to shortage of resources for both human and wild animals (Lovelock, 2009).This will therefore affect availability of resource for women to carry out their domestic chores leading to their increased vulnerability to climate change.

3.1.4 Maximum Temperature Trends for Chepseon Sub Location from 1982-2011

According to R.O.K (2010), Kenya has generally experienced increasing temperature trends over many areas. However, the increase in minimum temperature is higher than the increase in maximum temperature. Increase in mean monthly maximum temperature varies from one month to another as shown in Fig 3.7

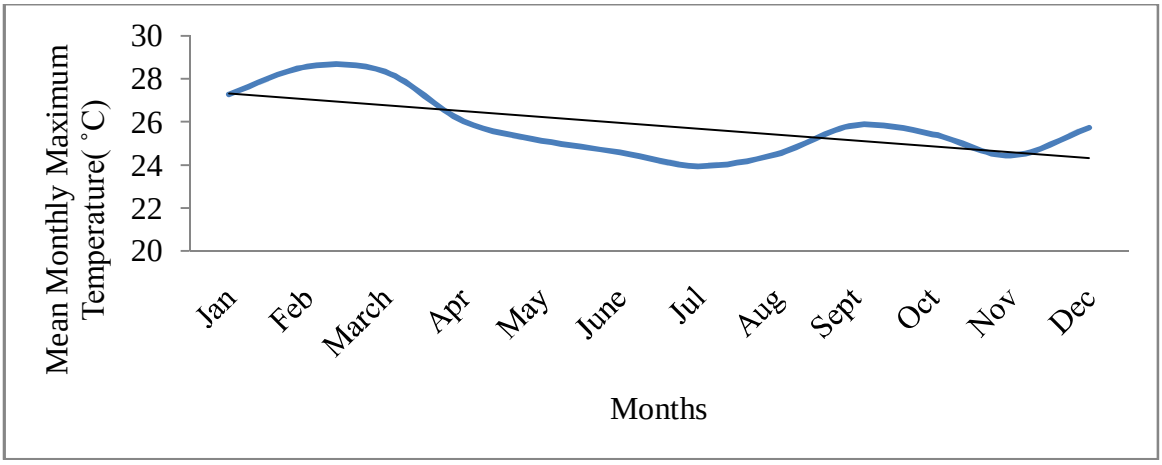

Figure 3.7: Mean Monthly Maximum Temperature (˚C) from 1982-2011: Nakuru County, KMD: Nakuru Station no: 9036261

In general, the mean monthly maximum temperature were observed to be decreasing over the years from 27.3˚C in the month of January to 25.73˚C in the month of December with the month of February having the highest mean maximum temperature of 28.58˚C, followed by the month of March with an average of 28.34˚C. The month of July recorded the lowest mean maximum temperature of 23.95˚C. There were sharp increases and decreases in temperatures from one month to another in the entire 30 year period of time.

This variability in the mean maximum temperature from one month to another affect the availability of natural resources which are vital for women's day to day tasks.

The year 2009 was identified to have had the highest maximum temperature extremes compared to the mean in four months i.e. June (26.3˚C), July (26.1˚C), August (27˚C) and November (25.8˚C). It also recorded the lowest maximum temperatures in the entire 30 year period of time in the months of November (25.8˚C) and December (25.7˚C) as shown in fig 3.8.

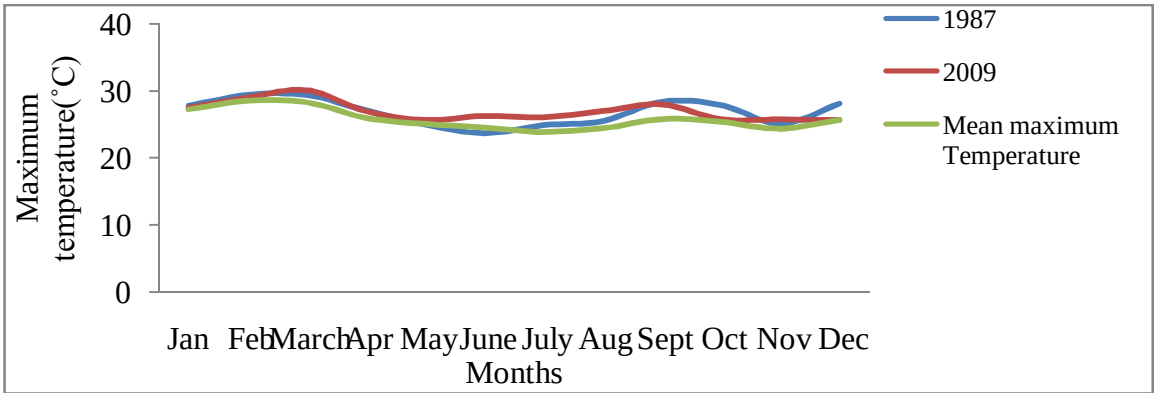

Figure 3.8: Mean Maximum Temperature Extremes from 1982-2011: Nakuru County, KMD: Nakuru Station no: 9036261

According to the figure above, in the year 1987 the highest maximum temperatures were recorded in the months of September (28.4˚C), October (27.9˚C) and December (28.1˚C) in the entire 30 year period of time compared to the mean temperature for those months. In the year 1990, the lowest temperatures were also recorded in the months of February (25.7˚C) and March (24.9˚C) in the entire 30 year period of time.

The results from the above analysis showed increased variability in maximum temperatures recorded in Chepseon sub location. Maximum temperature extremes were recorded in the years 1987 and 2009.This variability in the maximum temperature exposed women domestic chores to climate variability making them vulnerable to effects of climate change.

3.1.5 Variability of Annual Mean Minimum Temperature for 30 year period for Chepseon Sub Location

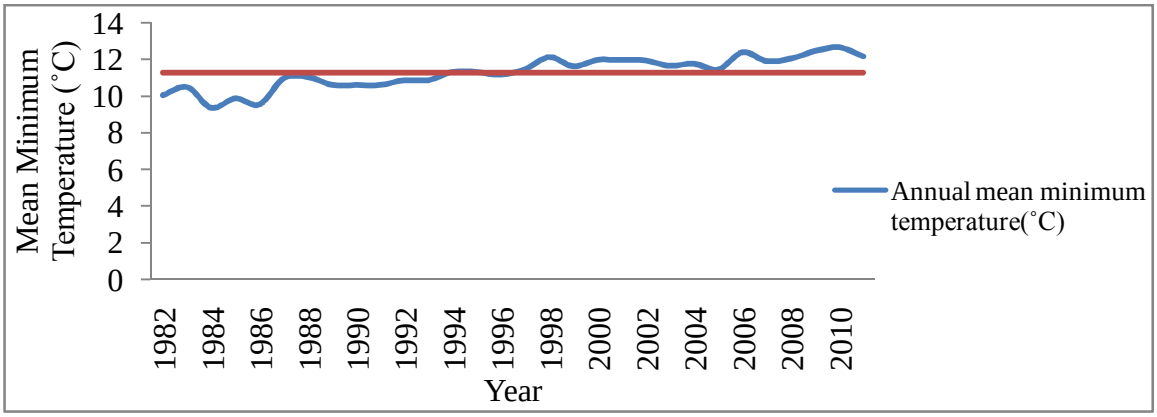

Figure 3.9: Variability of Annual Mean Minimum Temperature from the 30 Year Mean from 1982-2011: Nakuru County, KMD: Nakuru Station no: 9036261

From the figure above, the highest annual mean minimum temperature was recorded in the year 2010 of 12.68 (˚C). This was the year in which there was greater variability of annual mean minimum temperature from the 30 year mean minimum temperature. The lowest annual mean minimum temperature of 9.36(˚C) was recorded in the year 1984.The above figure depicts a general warming of minimum temperature through the 30 year period of time.

3.1.6 Mean Monthly Minimum Temperature Analysis

According to R.O.K (2010), Kenya has experienced increasing temperatures over vast areas. The trend of minimum temperatures (night time/ early morning temperatures) depicts a general warming through time. This has been proven to be true by this study as shown in fig 3.10.

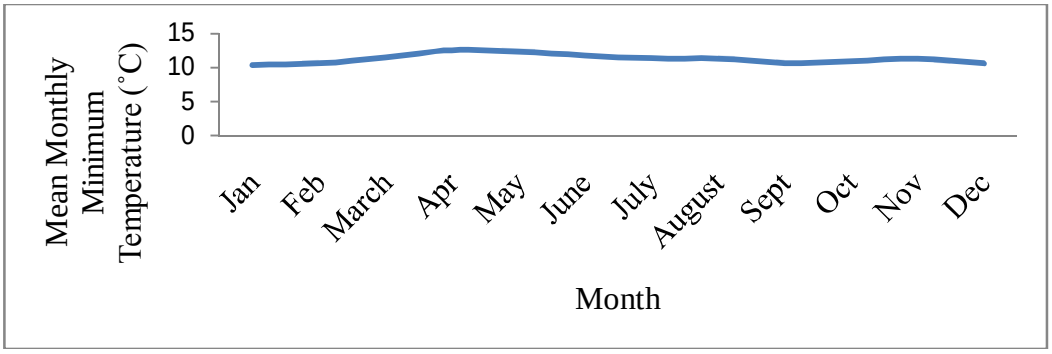

Figure 3.10: Mean Monthly Minimum Temperatures (1982-2011): Nakuru County, KMD: Nakuru Station no: 9036261

In general, the mean monthly minimum temperature has been rising over the entire 30 year period of time from 10.39˚C in the month of January to 10.64˚C in the month of December. However there has been variations in the mean minimum temperature values whereby the mean monthly minimum temperature has been at its highest in the month of April (12.56 ˚C) and at its lowest (10.39˚C) in the month of January. Mean monthly minimum temperatures have been increasing from January (10.39˚C) to April (12.56˚C) and then dropped in May (12.34˚C) until September (10.7˚C) and then gradually rose in October (10.93˚C) to 11.33˚C in November and then dropped in December to 10.64˚C. However, mean minimum temperature extremes were also recorded in the years 1984, 1985 and 2010 as shown in fig 3.11.

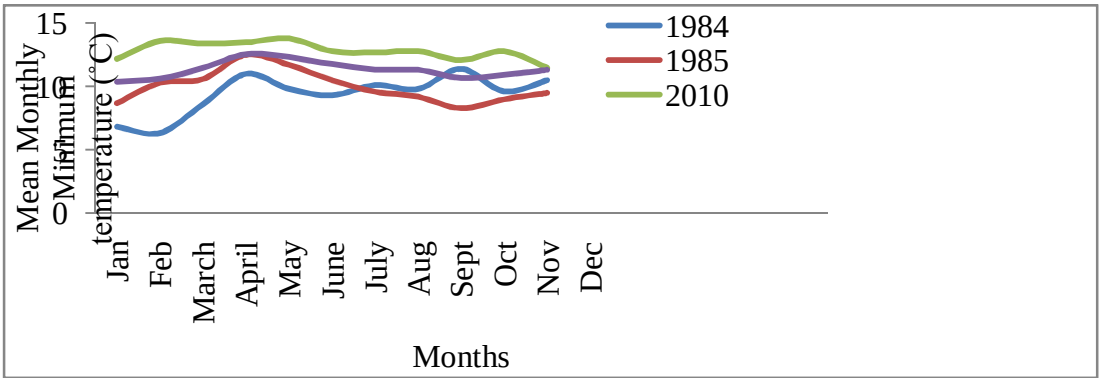

Figure 3.11: Minimum Temperature Extremes (1982-2011): Nakuru County, KMD: Nakuru Station No: 9036261

From the figure above, in 1984 lowest mean minimum temperature extremes were recorded in the months of January (6.8 ˚C), February (6.3˚C), May (9.8˚C) and June (9.3˚C) as compared to the mean minimum temperatures for the 30 year period of time. They were also recorded in the year 1985 in the months of September (8.3˚C), October (9.0˚C) and December (8.6˚C). Highest mean minimum temperature extremes were recorded in the year 2010 in the months of February (13.6˚C), March (13.4˚C) and August (12.8˚C)

In general, in the entire 30 year period of time, February 1984(6.3˚C) was the month with the lowest mean minimum temperature ever to be recorded and the highest mean minimum temperature of 14.4˚C was recorded in May 1998. Mean Minimum temperatures for Chepseon sub location have been varying in the entire 30 years period of time.

3.2 Relationship between Climate Variability Awareness and Womens' Level of Education

Climate variability awareness is a major factor in determining women's vulnerability to climate variability. Chi-square test was done to determine the relationship between women's level of education and climate variability awareness.

Results showed that there was no significant relationship between the level of education and climate variability awareness in Chepseon sub location (χ^2 =2.595, df= 4, 89 and p=0.458). Majority (49%) of those who were aware of variability in climatic conditions had only completed primary school level as shown in fig 5.5

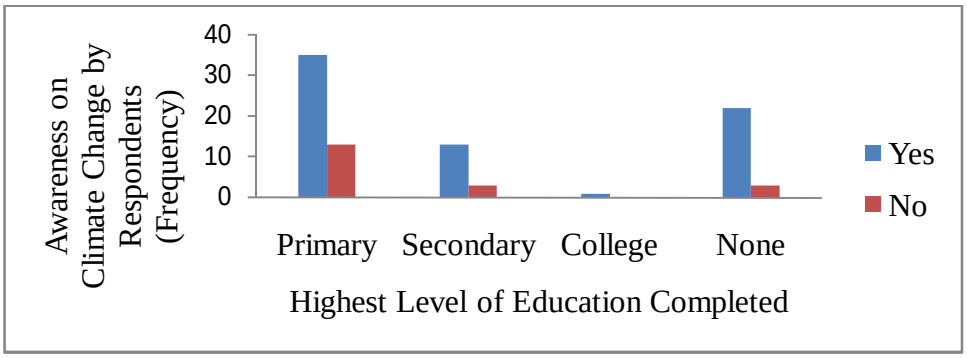

Figure 5.5: Level of Education in Chepseon Sub Location

The possible explanation for this was that the lesser the level of education the more an individual interacted with environment in trying to meet one's daily needs. This makes the less educated women more aware of changes in climatic conditions than those that are educated and are not in close contact with natural resources.

3.3 Adaptive Strategies That Women Had in Place to Cushion Them from Harmful Effects of Climate Change

These were subdivided into various categories because various indicators were chosen to reflect women's adaptive capacity:

i. **Level of education:** The number of women respondents who completed primary education in Chepseon sub location was higher (53%) than those who proceeded to secondary school and completed (18%). Only 1% of women respondents went for tertiary education and completed while 28% of women respondent population never went to school. This would limit them from gaining access to formal employment and to crucial climate change information that would help them in adapting to climate change.

ii. **Irrigational facilities:** Majority of the respondents (83%) did not irrigate their crops. Those who did so was in a very small scale in plots of less than 1 acre and the crops that were being irrigated included: kales, cabbages, spinach, and bananas. They used overhead sprinklers and pipes that would irrigate a very small area at a given time. This showed that they were ill prepared in terms of irrigating their crops.

iii. **Availability of infrastructure:** The only village that was extremely satisfied with road network was Gitira village which was located along Nakuru-Eldoret Highway. The other villages (apart from some parts of Chepseon village) had rough roads that were not passable in rainy days. Chepseon sub location was therefore not prepared in terms of infrastructure to adapt to climate variability. The only time you could access most parts of Chepseon sub location was during dry seasons. This posed a challenge in accessing market for agricultural inputs.

iv. **Changing climatic conditions:** the two parameters that were used to determine climate variability in Chepseon sub location were rainfall and temperature. These parameters showed increased variability year after another and within the year as discussed in section 3.1 above.

3.4 Suitable Adaptation and Coping Strategies to be Employed by Women in Adjusting to Climate Variability in Chepseon Sub Location

The following are some of the adaptation and coping strategies that should be employed by women in adjusting to climate variability:

a) Water harvesting and storage in times of heavy rains in order to use during dry spells
b) Installing of irrigation facilities to irrigate crops during dry weather conditions and to avoid depending on rains entirely to feed their crops
c) Planting of drought tolerant, early maturing and disease resistant crop varieties
d) Diversification of income sources
e) Crop diversification(changing the crop mix) to counter the impact of short variation in weather conditions
f) Use of alternative sources of energy e.g. biogas, solar energy for heating and cooking.

4.0 Conclusion and Recommendations

4.1 Conclusion

Women in Chepseon sub location were not well adapted to variability in climatic conditions. There is need therefore to build their capacity to adjust to changes in climatic conditions. This could be done through the following ways:

i. Provision of subsidized farm inputs that can reach all subsistence farmers regardless of their location.
ii. Increased access to micro- finances with reduced interest rates.
iii. Access to government medical facilities with reduced costs which should also be well equipped with medicine and medical personnel.
iv. Creating awareness on changes in climatic conditions and the need to harvest water for use during dry seasons.

4.2 Recommendations

i. Training programs should be offered on the use of new technologies e.g. energy-efficient cooking stoves and ovens and renewable energy systems.
ii. Weather- indexed crop insurance should be made available to women subsistence farmers. This insures farmers against losses in crop yields resulting from weather-related stresses. As climate impacts become increasingly critical to agricultural production in Kenya, insurance is likely to play a great role in absorbing shocks and spreading risk.
iii. Access to downscaled weather information should be made available to women in order to prepare in advance to cope with climate variability.

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