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Farmers Perception of Impact of Climate Change on Food Crop Production in Ketu North District in the Volta Region of Ghana

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Abstract

The present study analyses farmers' perception of impact of climate change on food crop production and the adaptation strategies to cope with climate change. An interview schedule was the main tool for data collection whilst descriptive statistics was the main analytical tool applied. A random sampling technique was used to select 100 crop farmers for the study. The study revealed that most farmers perceived an increase in temperature, decrease in precipitation and an increase in wind temperature in Ketu North district. Major impacts of climate change were perceived as weed and pest challenges, decline in crop quality, changes in land, soil and water quality, increased risk of food shortage, stunted growth of crops and drying of seedlings after germination. Results suggest changing of planting dates, use of different crop varieties and the use of drought and heat resistant varieties as the widely used adaptation measures. Despite the use of adaptation techniques, lack of information, lack of credit, lack of access to water, expensive nature of adaptation, insecure property right, insufficient access to inputs and shortage of land were important constraints to the adaptation process.

Keywords: climate impacts, perception, adaptation, barriers, descriptive statistics

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1. Introduction

Agriculture is a mainstay in the economy of many African countries including Ghana where it contributes about 35% of Gross Domestic Product (GDP) and supports the livelihoods of about 55% of the population (Ghana Fact Sheet, 2010). Reduction in agricultural production will impact strongly on poverty and food security of the country. Climate is one of the key factors influencing agricultural production in Ghana and has enormous impacts on food production and the economy as a whole. Global warming cause's climate related disasters thereby adversely affecting agriculture, food security and water resources. Irrespective of production systems, climate related events contribute to farmer vulnerability and impact on national food security. The impact of climate change on agriculture could result in problems of food security and may threaten the livelihoods activities upon which much of the population depends. The impact may be significant and negative and requires farmers to adapt.

In order to adapt to climate change and mitigate its negative effects, it is imperative that farmers perceive changes in climate and appreciate the impact of climate change on agriculture. In effect, farmers' perception is a necessary condition for their level of adaptation responses to mitigate against the effect of climate change.

This study therefore analyzes the perceived impacts of climate change on crop production in the Volta Region of Ghana. Specifically, it seeks to (1) describe the socioeconomic characteristics of the farmers, (2) analyze the level of perception of temperature, precipitation and wind behaviour, (3) analyze the perceived impacts of climate change on crop production, (4) identify the adaptation measures employed by the farmers to cope with climate impacts, (5) analyze the barriers to adaptation and (6) derive the implications for policy.

Literature Review

There is undeniable fact that the extent of adaptation is a vital ingredient of reducing climate impacts on agriculture and crop production in particular. As a result, farm households implement various measures to reduce the vulnerability of climate change impacts. Deressa et al. (2009) identified changing crop variety, soil and water conservation, water harvesting, planting of trees, changing planting and harvesting periods as some of the methods employed by food crop farmers in Ethiopia. Among these, tree planting was dominant method adopted by most of the farmers.

However, about 42% of the farmers did not use any adaptation method for climate change impact. Information on climate change, social capital, age of households head, wealth and agro ecological settings significantly impact on farmers' perception to climate change (Deressa et al., 2009). Farmers in areas with higher annual mean temperature were more likely to adapt to climate change. Madison

(2006) and Nhemachena and Hassan (2008) showed that access to information through extension increases the chance of adapting to climate change.

Lack of information on choice of adaptation options, lack of financial resources, shortage of land, poor potential irrigation and labour constraints are factors inhibiting climate adaptation (Deressa et al., 2008).

Adverse climate changes are likely to influence farm output at any stage from cultivation through the final harvesting. These effects among others include stunted growth of crops, ease of spread of weeds and pests, drying of seedlings after germination, increasing risk of flooding, food shortage, decline in crop yield and quality.

2. Methodology

Study Area Description

Ketu-North District is one of the 18 districts that lie in the northern part of the Volta region. Dzodze is the capital town of the district. It has a land mass of 754 square kilometer that falls within its latitude between 6^0 3'N and 6^0 20' N and 0^0 49'E and 1^0 5'E respectively with a broad longitudinal range of diverse ecological lands in the south to the interior upland plateau and highlands in the North.

The District experiences the dry equatorial type of climate. The average monthly temperatures vary between 24^0C and 3^0C, which are generally high for plant growth throughout the year. The mean annual rainfall for the District is around 1,270mm. The rainfall is of double maxima type occurring from April to July and September to October. The dry season, which is mainly dominated by the dry harmattan winds, extends from December to February in the district. Generally rainfall in the District is considered low and erratic particularly during the minor season.

Ketu-North District has a total population of 94000 which comprises 46.3% and 53.7% of male and female respectively (Ghana Statistical Services, 2010). Majority of the people are Christians, however, traditional worshiping still has a place in the district. The main occupation of the district is farming contributing about 60% of the incomes of the people. Other income generating activities of the district include trading and crafting. Crops grown in the district include maize, cowpeas, cassava, potato, sugarcane, vegetables, with rice being the dominant crop produced for both domestic and commercial uses. Livestock rearing is also predominant practice especially by female farmers in the district.

Sampling and Sample Size

The sample for the study consists of 100 farmers in Ketu North District in the Volta Region of Ghana. The population for the study was all crop farmers in Ketu North District. The district was purposefully

selected because of the high crops productive capacity of the area. A simple random sampling technique was used to select 100 crop farmers for the study.

Data Analysis

An interview schedule was the main tool of data collection while descriptive statistics was the main analytical technique. Data was analyzed using the Statistical Product and Service Solution (SPSS) version 15.0. Results of the study were presented in tables, pie and bar charts whilst frequency, percentages and means were used to discuss the results.

3. Results and Discussion

Socioeconomic Characteristics of Farmers

Analyses of the socioeconomic characteristics of the farmers revealed an average age of 42.91 years implying that most of the farmers interviewed in Ketu North District were in their productive age and are expected to have the strength needed for farming.

68% of the farmers were males whilst 32% were females. The average household size was 7 persons. 37% of the farmers had obtained basic level of education, 15% had junior high school education, 9% had senior high school education and 9% had obtained tertiary education.

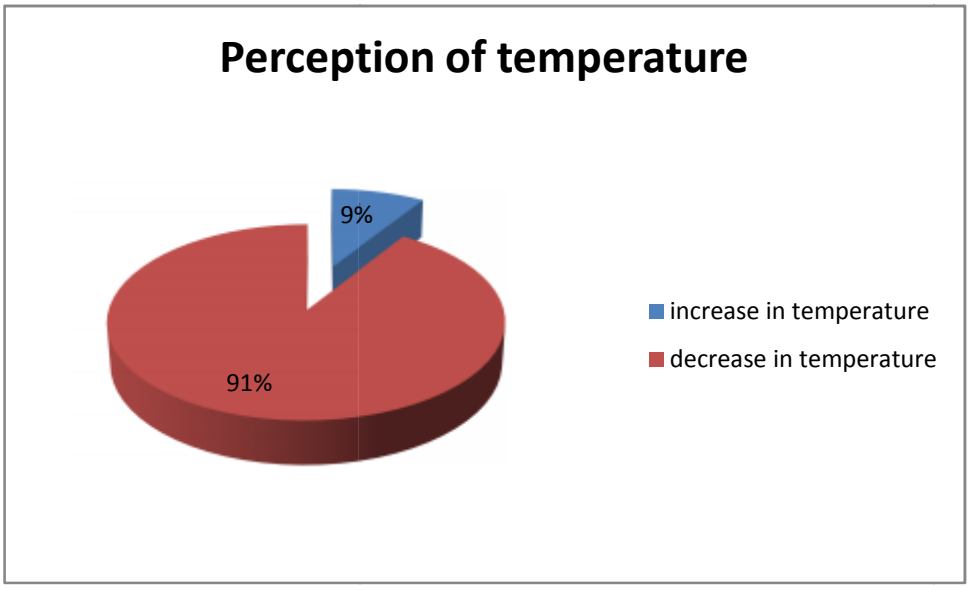
Given the relatively low level of formal education of the farmers, their perception of climate impacts and adaptation are expected to be low. The distribution of years of farming experience revealed an average of 19 years. Average farm size was 4 acres. The types of crops grown among the farmers in Ketu North District included maize, rice, cassava, potato, sugarcane and vegetables. However, only 48% of the farmers interviewed, farm on their own lands. Analysis of the distribution of annual farm incomes revealed an average of [1]GH¢1374.

[1] 1 US Dollar is equivalent to 1.529 Ghana Cedis.

Table 1. Distribution of Respondents by Socio-economic Characteristics n = 100

Characteristics	Frequency	Percentage
Age (Years)		
< 30	14	14.0
31- 46	51	51.0
47- 62	26	26.0
> 63	9	9.0
Mean age = 43years		
Education		
Non- formal	30	30.0
Basic	37	37.0
Middle school/ J. H. S	15	5.0
O. Level/ S. H.S	9	9.0
Tertiary	9	9.0
Sex		
Male	68	68.0
Female	32	32.0
Farming experience (Years)		
< 10	16	16.0
10 – 20	52	52.0
21 – 30	18	18.0
31 – 40	7	7.0
> 40	7	7.0
Mean = 19years		
Farm size (Acres)		
1-3	38	38.0
4- 7	57	57.0
8- 11	5	5.0
Mean = 4acres		
Land ownership Status		
Owner of farm land	52	52.0
Non-owner of land	48	48.0
Household size (persons)		
1- 4	24	24.0
5-8	40	40.0
9-12	28	28.0
13-16	8	8.0
Mean = 7 persons		
Annual Income (GH¢)		
<1000	33	33.0
1000-2000	53	53.0
2001-3000	11	11.0
3001- 4000	1	1.0
> 4000	2	2.0
Mean (income) = GH¢1374		

Figure 1.



The farmers' perception on climate variables such as temperature, precipitation and wind behaviour of the area in recent times was investigated. With regards to temperature, 91% of the farmers perceived a decrease in general temperature of the area whilst 9% perceived an increase in temperature.

With regards to precipitation, 3% of the farmers perceived an increase in precipitation, 51% perceived a decrease in precipitation and 46% perceived an irregular pattern of precipitation in recent times.

Figure 2

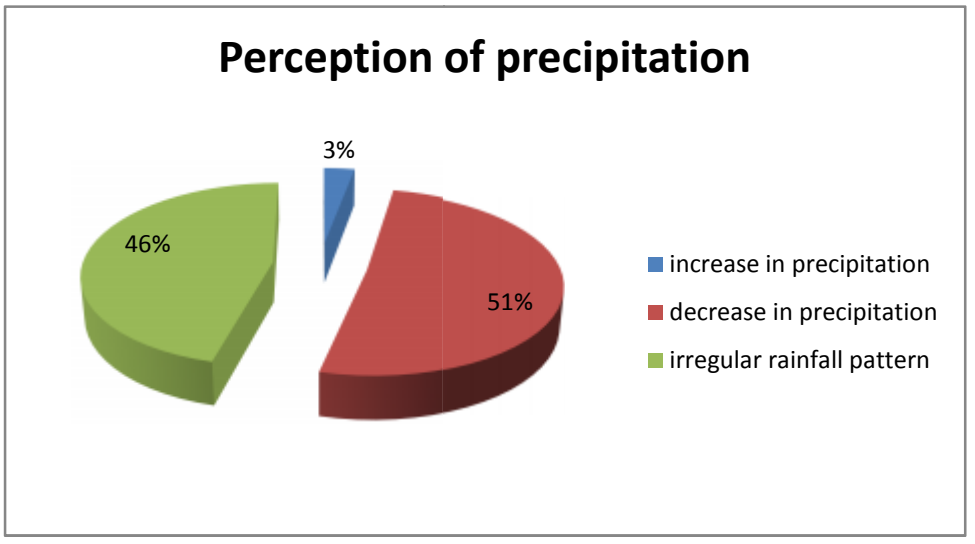
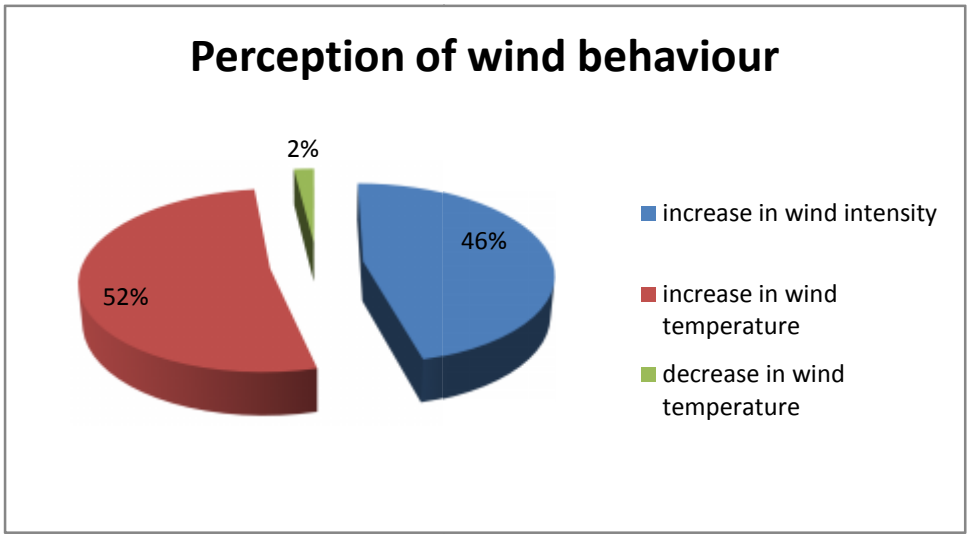


Figure 3



With regards to wind behaviour, 46% perceived an increase in wind intensity, 52% of the farmers perceived an increase in wind temperature whilst 2% perceived a decrease in wind temperature in the area. Importantly, farmers perceived changes in climatic variables such as temperature, precipitation and wind.

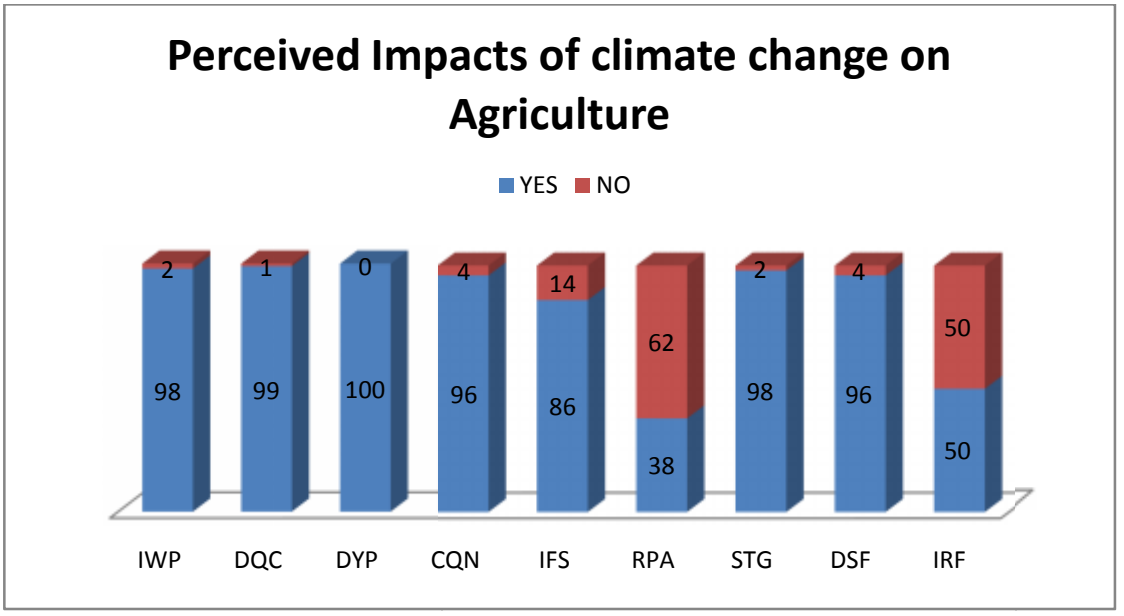
Perceived Impacts of Climate Change on Agriculture

In an attempt to examine climate change impacts on crop production, farmers were asked questions relating to that. Results revealed increase in weed and pest challenges, decrease in quality of crop yield, decline in crop yield and production, decline in land, soil, and water resource quality, increased risk of food shortage, stunted growth and drying of seedlings after germination as the major impacts of climate change on crop production and agriculture in general in the Ketu North District of the Volta region of Ghana.

Results as shown in figure 4 revealed that the farmers perceived various impacts of climate change: 98% of the farmer's perceived weed and pest challenges; almost all (99%) indicated a decline in quality of crop in recent times; All the farmers have indicated a decline in crop production; 96% of the farmers identified changes in land, soil and water quality as an impact of climate change; 86% indicated increased risk of food shortage; 98% indicated stunted growth of crops as a negative impacts of climate change and 96% of the farmers indicated drying of seedling after germination. However, 50% of the farmers indicated the risk of flooding as a result of climate change whilst 38% of the farmers indicated that climate change has resulted in an increase in prices of agricultural products and is likely to continue due to projections of long run food shortage.

The findings suggest that climate change impacts negatively upon crop production in the Ketu North District and that climate adaptation and mitigation measures are required to reduce the long term vulnerability and food security of the area.

Figure 4



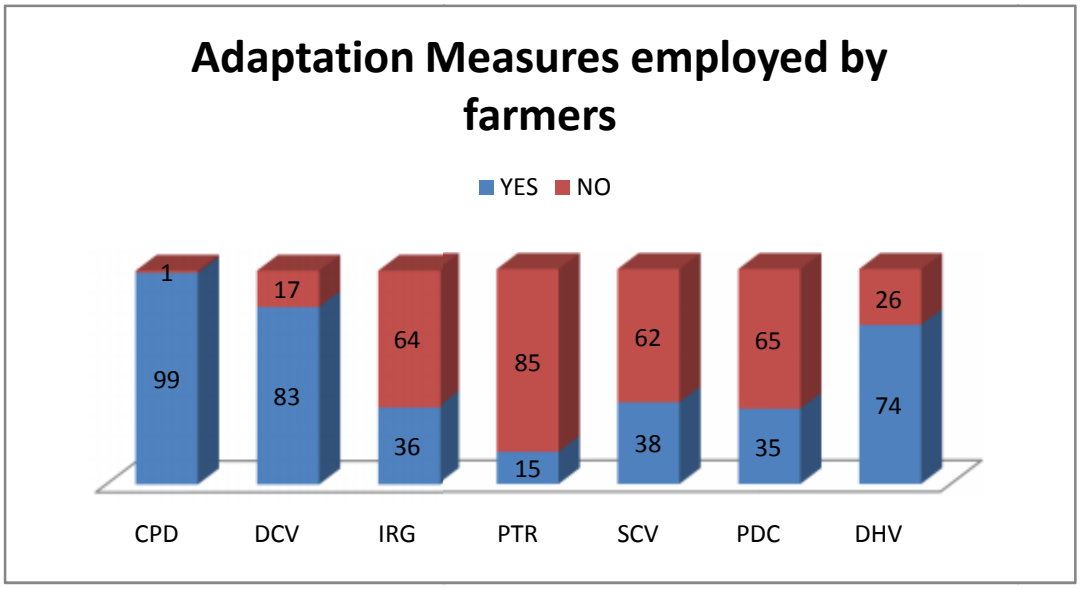
Note: **IWP=** Increase weed and pest challenges, **DQC=** Decline in quality of crop yield, **DYP=** Decline in crop yield and production, **CQN=** Changes in quality of land, soil and water resources, **IFS=** Increased risk of food shortage, **RPA=** Rise in prices of agricultural products, **STG=** Stunted growth, **DSF=** Drying of seedlings after germination, **IRF=** Increase risk of flood

Climate Adaption Measures Employed By Farmers

Climate adaptation measures are crucial if the long term impacts of climate change on crop production and livelihoods of farmers are not to be compromised. In an attempt to investigate the extent of adaptation to climate change, farmers were questioned on their adaptation measures. All the farmers interviewed used one or more methods of adaptation. The adaptation measures identified were changing planting dates, using different crop varieties, irrigation and water harvesting, tree planting, soil conservation, prayers, pest and disease controls, and use of drought and heat resistant variety.

Change of planting dates was the method commonly used by the farmers representing 99% of respondents, 83% used different crop varieties, 74% of the farmers used drought and heat resistant varieties. However, only 15% of the farmers employed tree planting method. Widely used adaptation measures are change of planting dates, use of different crop varieties and the use of drought and heat resistant varieties.

Figure 5

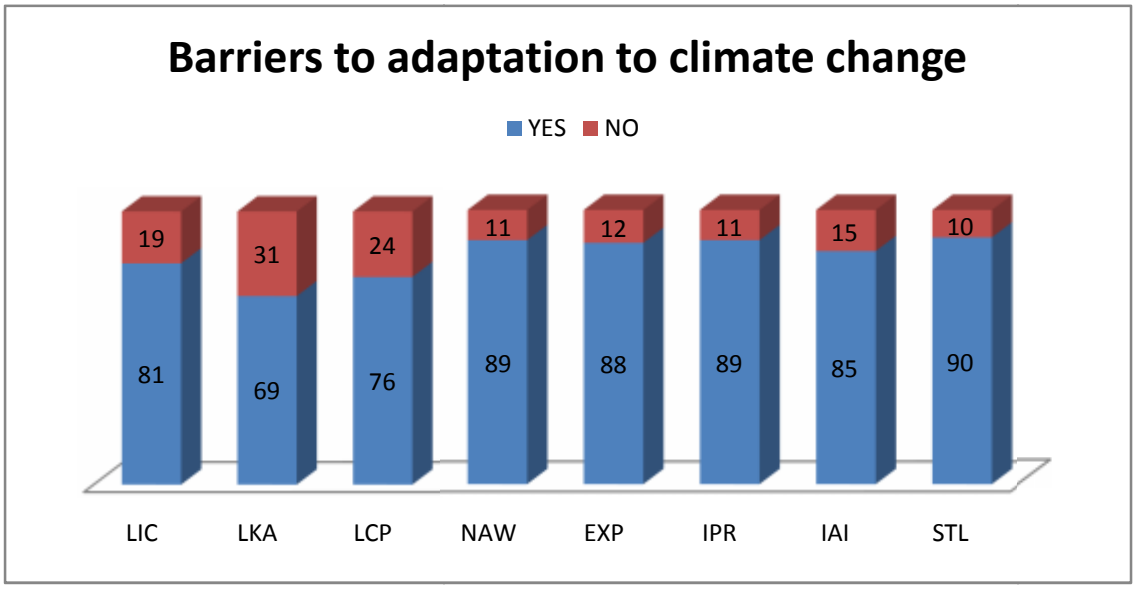


Note: CPD= Changing planting dates, **DCV=** Using different crop varieties, **IRG=** Irrigation and water harvesting, **PTR=** Planting trees, **SCV=** Soil conservation, **PDC=** Pest and disease control, **DHV=** Using drought and heat resistant variety

Barriers to Adaptation

Despite farmers in Ketu North District having some form of adaptation, a number of factors were identified as barriers to adaptation process. 81% of the farmers identified lack of information about climate change; 76% indicated lack of credit for adaptation; 89% of the farmers do not have access to water and this poses a lot of constraints to their level of adaptation. 88% of the farmers interviewed were constrained by the expensive nature of adapting to climatic changes. Insecure property right and insufficient access to inputs necessary for adaptation were respectively identified by 89% and 85% of the farmers. However, shortage of land was identified by 90% of the respondents as a barrier to adaptation.

Figure 6



Note: LIC= Lack of information about climate change, **LKA**= Lack of knowledge about adaptation, **LCP**= Lack of credit/poverty to adapt, **NAW**= No access to water, **EXP**= Changes are expensive, **IPR**= Insecure property rights, **IAI**= Insufficient access to inputs, **STL**= Shortage of land

4. Conclusions

Farmers' perception of climate change and its impacts on agriculture and crop production is an important condition for farmer's adaptation responses to cope with climatic changes and impacts. This study therefore examined crop farmers' perception of impact of climate change on food crop production in Ketu North District in the Volta region of Ghana. Specifically, the study investigated the socioeconomic characteristics of the farmers, their perception of temperature, precipitation and wind behaviour, their perception of the impacts of climate change on crop production, the adaptation measures employed by the farmers to cope with climate impacts, the barriers to farmer's adaptation techniques and the implications for policy. A simple random sampling technique was used to select 100 crop farmers for the study. An interview schedule was the main tool for data collection whilst descriptive statistics was the main analytical tool applied.

Empirical results revealed that the socio-economic characteristics of the farmers were mostly characterized by active labour force, small farm sizes, low annual income distribution, high farming experience, large household size, and low level of formal education. The study revealed that most farmers perceived an increase in temperature, decrease in precipitation and an increase in wind temperature in Ketu North district. Major impacts of climate change were perceived as weed and pest challenges, decline in crop quality, changes in land, soil and water quality, increased risk of food shortage, stunted growth of crops and drying of seedlings after germination. These findings imply that

the impacts of climate change on crop production in Ketu North District is negative and that climate adaptation and mitigation measures are required to reduce the long term vulnerability and food insecurity of the area.

Results suggest changing of planting dates, use of different crop varieties, and use of drought and heat resistant varieties as the widely used adaptation measures. However, tree planting was the least method of adaptation employed by the farmers. Despite having some form of adaptation, lack of information, lack of credit, lack of access to water, expensive nature of adaptation, insecure property right, insufficient access to inputs and shortage of land were barriers to adaptation process. Implications of the study for the government and Non Governmental Organizations are the need to enact policies that support farmer adaptation to climate change and effectively address the barriers to adaptation. Credit institutions must be encouraged by the government to lend to farmers in order to meet the cost of adaptation. The Ministry of Food and Agriculture should implement educational programs to educate and encourage farmers to undertake massive tree planting exercise in order to increase the adaptive capacity of farmers to climate change impacts on agriculture.

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Conflict of Interest

"The authors declare no conflict of interest".

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