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Effects of climate changing on food crop production system in Ghana

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Climate change is a threat to agriculture and food security because of the loss in food production through crop failure and increase in disease and mortality rate of livestock. One of the main elements of climate change for agriculture is the variability in rainfall and temperatures that directly impact soil moisture. This study addresses the effect of climate changing on food crop in Ghana between 2001 and 2010. Some of the crops grown by farmers in this study are cassava, soybean, maize and millet. The effect of climate changing on the yield of cassava was 13.80Mt/Ha and that of the achievable yield was 48.70Mt/Ha, average yield of soybean was 1.5Mt/Ha and its achievable yield 2.30Mt/Ha, maize average yield was 170Mt/Ha and achievable yield 6Mt/Ha and that of millet 1.3Mt/Ha and achievable yield 2Mt/Ha. The highest rainfall in the regions was recorded in 2003 12,229mm and the least in 2004 9,928mm. The types of livestock from this study include cattle, sheep, goats and poultry. There is a positive co-variation between poultry population and the rainfall 30-year average under consideration, a perfect negative significant correlation between goat population and rainfall 30-year average, a positive co-variation between sheep population and the rainfall 10-year and 30-year average and a positive co-variation between cattle population and rainfall 30-year average.

Keywords: climate changing, food production, fisheries, agriculture.

INTRODUCTION

Climate change is a threat to agriculture and food security because of the loss in food production through crop failure and increase in disease and mortality rate of livestock. United Nations Framework Convention on climate change (UNFCCC) (1992) defines climate change as a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods. According to De Chavez and Tauli-Corpus (2008) global warming is the average increase of the earth's surface temperature and oceans as compared to previous centuries. According to Zhu (2005) climate change has both positive and negative effects on farming, but there could be a more negative influence in the long run which may lead to food scarcity if there are no immediate efforts to confront these problems. Crop yields are affected by many factors associated with climate change which includes: temperature, rainfall, extreme weather events, climate variability and even carbon dioxide concentration in the atmosphere which is predicted to cause global warming that will have a significant impact on crop production (USDA, 2007). According to Deressa (2008) and

Table 2. Correlation of livestock population and climatic variables

Variable	Rainfall(10-year average)	Rainfall(30-year average)
Poultry	0.01(0.12)	0.42(0.001)**
Goats	0.16(0.241)	-0.32(0.002)**
Sheep	0.2(0.14)**	0.20(0.00)**
Cattle	-0.20(0.25)	0.3(0.004)**

Kurukulasuriya and Mendelsohn (2006), agriculture in Africa is negatively affected by climate change and care need to be taken to avert this situation. Ontoyin (1993) and Stephens (1996) empirically established the evidence of climate change in Ghana by qualifying the significant changes in temperature. Stephens (1996) and stutley (2010) indicated that high temperatures reduce crop yield in Ghana. A study conducted by Mabe (2011) indicated that climate change is evident in Northern Ghana. Mendelsohn (1998) and Smit and Skinner (2002) have demonstrated that without adaptation, agricultural production will be severely affected by climate change with the resultant effects of making farmers more vulnerable. According to (Brett, 2009) some soils are likely to form impenetrable caps, increasing the risk of run-off and subsequent pollution events and floods are projected to affect local crop production negatively, especially in subsistence sectors at low latitudes. This study addresses the effect of climate changing on food crop in Ghana between 2001 and 2010.

METHODOLOGY

Data Type, Source and Sampling

A descriptive analysis was employed in describing the effect of climate changing on yield of cassava, soybean, millet and maize and also the effect of climate changing on population of livestock such as cattle, sheep, goat and poultry between2001 and 2010 from Ministry of Food and Agriculture (MoFA). Also trends of climate changing for the ten regions of Ghana were employed by using rainfall data in mm between 2001 and 2010 from Ghana meteorological agency. These food items were selected because; they account for a large share of overall household food budgets in Ghana. At the national level, cereals constitute the highest share of the overall food budget in all localities. The Pearson Correlation was used to compare livestock population to climatic variables. Secondary sources include published and unpublished information about the study area and from the internet.

RESULTS AND DISCUSSION

Climate changing effect on yield of selected food crops under rainfed conditions

Some of the crops grown by farmers in the study were cassava, soybean, maize and millet. The achievable yield from the Table 1 indicates yields that have been achieved in cases where more effective extension was and use of recommended technologies have occurred. From Table 1, the impact of climate on the yield of cassava was 13.80Mt/Ha and that of the achievable yield was 48.70Mt/Ha, average yield of soybean was 1.5Mt/Ha and its achievable yield 2.30Mt/Ha, maize average yield was 170Mt/Ha and achievable yield 6Mt/Ha and that of millet 1.3Mt/Ha and achievable yield 2Mt/Ha. From the data, cassava has the maximum average yield of 13.8Mt/Ha, followed by maize 1.7Mt/Ha, soybean 1.5Mt/Ha and 1.3Mt/Ha of millet. Cassava also has the highest achievable yield of 48.7Mt/Ha, maize 6Mt/Ha, soybean 2.3Mt/Ha and lastly, millet 2Mt/Ha. These food crops are therefore vulnerable to the damaging effects of climate change. It has already been projected that high temperatures in Ghana will lead to low cereal yields throughout the country, especially maize and millet, which is a key staple crop in the north (Mofa, 2010). This fall in cereal crop yield will mainly be due to a reduction in the growing period and an increase in evaporation rates.

Analysis of Trend in Livestock Population ('000)

Figure 1 below reports the trend in livestock population between 2001 and 2010. The types of livestock from this study include cattle, sheep, goats and poultry. There was decrease in cattle population between 2001 and 2002 and an increase in sheep population within that same period. Between 2002 and 2010 and 2001 and 2005 there was decrease in sheep population. There was an increase in goat population and a decrease between 2002 and 2003, between 2003 and 2004 and 2004 and 2010, and a total decrease in poultry population from 2001-2010. However, the decrease in these livestock population could be attributed to changes in climatic factors such as temperature and precipitation and the

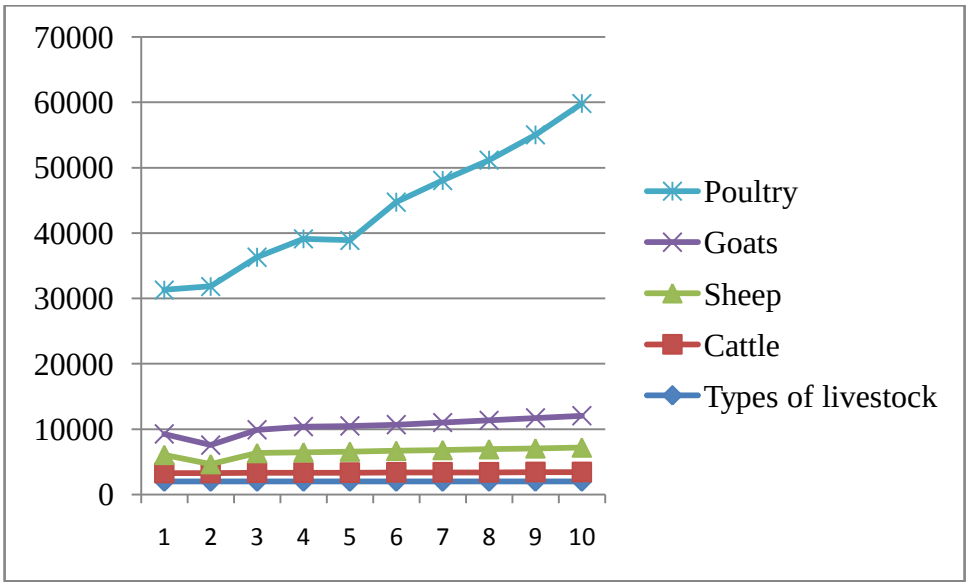

Figure 1: Trend in livestock population between 2001 and 2010.

frequency and severity of extreme events like droughts, floods, and wind storms. Specifically, livestock can be affected in two ways by climate change: the quality and amount of forage from grasslands may be affected and there may be direct effects on livestock due to higher temperatures.

Analysis of Trends in Climate Change

Climate scenarios for Western, Central, Greater Accra, Eastern, Volta, Ashanti, Brong Ahafo, Northern, Upper East and Upper West Region was developed with the base year (2001-2010) rainfall data for 10-year average, 30-year average, % change 2010/30-year average and % change 2010/2009 (MoFA, 2010).

The rainfall for 2001 for the regions is 10,431mm, 12,775mm in 2002, 12,229mm in 2003, 9,928mm in 2004, 10,478mm in 2005, 11, 619mm in 2006, 12,656mm in 2007, 12,757mm in 2008, 11,598mm in 2009, 11,598mm in 2010 and 10-year average rainfall for the regions is 11,680mm, 30-year average rainfall 11,796mm, % change 2010/30-year average is 37.6 and % change 2010/2009 rainfall is 54mm.This indicates from the data that the highest rainfall in the regions was recorded in 2003 12,229mm and the least in 20049, 928mm (MoFA, 2010).

Correlation Analysis of livestock population and the climatic variables

Table 2 reports the correlation analysis of the four livestock reared in Ghana. The table uses the average rainfall for 10-year average, 30-year average between 2001 and 2010 to ensure comparison. The data are the average rainfall for 10-year average, 30-year average between 2001 and 2010.

Considering the values for poultry, it is clear that the Pearson Correlation that there is a positive co-variation between poultry population and the rainfall 30-year average under consideration. There is a perfect negative significant correlation between goat population and rainfall 30-year average. There is a positive co-variation between sheep population and the rainfall 10-year and 30-year average. There is a positive co-variation between cattle population and rainfall 30-year average.

CONCLUSION

Some of the crops grown by farmers in this study are cassava, soybean, maize and millet. The achievable yield from the Table indicates yields that have being achieved in cases where more effective extension and use of recommended technologies have occurred. From Table 1, the impact of climate on the yield of cassava was 13.80Mt/Ha and that of the achievable yield was 48.70Mt/Ha, average yield of soybean was 1.5Mt/Ha and its achievable yield 2.30Mt/Ha, maize average yield was 170Mt/Ha and achievable yield 6Mt/Ha and that of millet 1.3Mt/Ha and achievable yield 2Mt/Ha. The highest rainfall in the regions was recorded in 2003 12,229mm and the least in 2004 9,928mm. The types of livestock from this study include cattle, sheep, goats and poultry. Between 2001 and 2010, there was decrease in cattle

population, between 2001 and 2002, there was an increase in sheep population as there was decrease in population between 2002 and 2010, between 2001 and 2002, 2004 and 2005, there was increase in goat population and a decrease between 2002 and 2003, 2003 and 2004, 2004 and 2010, and a total decrease in poultry population between 2001 and 2010. There is a positive co-variation between poultry population and the rainfall 30-year average under consideration, a perfect negative significant correlation between goat population and rainfall 30-year average, a positive co-variation between sheep population and the rainfall 10-year and 30-year average and a positive co-variation between cattle population and rainfall 30-year average.

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