Civil and Environmental Research
ISSN 2224-5790 (Paper) ISSN 2225-0514 (Online)
Vol.7, No.5, 2015

Farmers Perception of Climate Change in Michika Local Government Area of Adamawa State

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Abstract
The study examines farmers' perception on climate change in Michika local government area of Adamawa State. The primary data were obtained through the use of structured questionnaire survey of 369 farmers from the 8 district of the study area and 21 years of rainfall and temperature data were obtained from Adamawa State Agricultural Development Programme Michika. The data collected were analysed using descriptive statistics in terms of tables, percentage, and trend analysis. The rainfall and temperature trend in the study area showed an increasing trend, while the onset trend of rainfall showed a down ward trend indicating that onset date is earlier and cessation of rainfall is also earlier than before. The farmers have revealed evidences that support their awareness of climate change such as, dryness of rivers and ponds 22%, unusual early rainfall 19%, long period of rainfall in August and September and erratic rainfall pattern 14%. The farmers are aware of the impact of climate change on their livelihoods, and they are employee various adaptation strategies in other to cushion the effect.

Introduction

Climate change has been defined by the inter-governmental panel of climate change (IPCC, 2007) as statistically significant variations that persist for an extended period, typically decades or longer. It includes shifts in the frequency and magnitude of sporadic weather events as well as the slow continuous rise in global mean surface temperature. Climate change manifests in a number of ways. They include; changes in average climatic conditions, some regions may become drier or wetter on average, then changes in climate variability, rainfall events may become more erratic in some regions, also with changes in the frequency and magnitude of extreme weather events and changes in sea levels.

Climate change is predicted by scientists to have the main impact on agriculture, economy and livelihood of the population of under-developed world and mainly in sub-Saharan Africa (Kandji *et al*., 2006). It has been reported that there is a large deficit of information and knowledge in this vulnerable region which impedes decision making and assessment of climate related risk and adaptation (McSweeney *et al*., 2010).

Smith and Skinner (2002) asserted that climate plays a dominant role in agriculture having a direct impact on the productivity of physical production factors, for example the soil moisture and fertility. Adverse climate effects can influence farming outputs at any stage from cultivation to the final harvest. Even, if there is sufficient rain, it's irregularity can affect the crucial growing stage of the crops (Molua and Lambi, 2007). Interest in this issue has motivated a substantial body of research on climate change and agriculture (Lobell *et al.,* 2008) .Climate change is expected to influence crop and livestock production.

It is evident that climate change will have a strong impact on Nigeria particularly in areas of agriculture, land use, energy consumptions, biodiversity, health and water resources (Apata *et al.,* 2009). Nigeria like all the countries of sub-saharan Africa is highly vulnerable to the impact of climate change.

The food crop farmers in Michika local government area of Adamawa State provide bulk of arable crops that are consumed locally but they experienced environmental problems in the course of their daily farming activities. With numerous scientific assessment of various problems, such as soil erosion, flood, deforestation and drought in Adamawa State have been carried out (Ekwve and Tashiwa, 1993, Adebayo, 1998, Tukur and Ray, 2000 and Adebayo 2000) but, very little attention have been focused on farmers perception on climate change. Therefore the farmers experience climate change but have not consider its deeper implication.

The local farmers view climate change perception from different perspectives based on their understanding, but Ban and Hawkins (2000), defined perception as the process by which we receive information or stimuli from the environment and transform it into psychological awareness. In other words, perception is the understanding of environmental quality, effect of the environmental stress, area image, hazard and other agents responsible for polluting the environment. This paper therefore among other things try to appraised the following:

a. Evidence of climate change in the study area
b. Farmers perception of climate change
c. Farmers adaptation strategies on climate change

The study area

Michika local government area is situated in north eastern corner of Adamawa State between latitude $10^{0}36^{l}$N –

$10^0 40^1$N and longitude $13^0 21^1$E – $13^0 35^1$E (Google Map data 2011), see figure 1. It share common boundaries with Madagali local government area to the north, Lassa (Borno State) to the west, Republic of Cameroun to the east and to the south, Mubi north and Mubi south local government area. It has a land area of about 142,199 km^2. Michika local government is divided into 8 districts, 16 electoral wards and 145 polling units, with a total population of 155, 238 according to 2006 population census. Dry season last for a minimum of five months (November to March), while wet season's spans from April to October. The mean annual rainfall in Michika ranges from 900 – 1050 mm (Adebayo 2004). Generally planting of crops begins earlier in the mountainous area due to orographic factors. Agriculture is the mainstay of about 80% of the inhabitants of the local government area.

Methodology

Data for this study was obtained through structural questionnaire survey of 369 farmers from all the eight districts of the study area. The questionnaire sort information on farmers' evidence of climate change, farmers' perception of climate change and adaptation strategies employed by farmers. Then, 21 years of rainfall and temperature data (1992 - 2012) from Adamawa State Agricultural Development Programme was analysed.

In selecting the sample size, 10% of the villages in each district were purposively selected. Then, random sampling was used to select villages in which questionnaire will be administered. This formed the sample size of 14 villages out of the 8 districts.

Due to disparity in population distribution in the selected villages and the need for adequate representation, Cochran (1977), proportional technique formula was used to determine the number of respondent in each selected villages as indicated in table 1. Data collected were summarized using graphs, descriptive statistics in terms of mean and percentage.

$$nh = \frac{Nh \times n}{N}$$

Where nh = the number of the individual sample villages

Nh = the number of farmers in the individual villages

N = the total number of farmers in all the sample villages (22,488)

n = the number of questionnaire to be distributed among the sample villages (393)

Table 1. Number of Farm families in each sampled village with their sample sizes. The total number of questionnaire is = 393

S/N	District	Selected villages	No. of farmers in each selected village (Nh)	Sample size (nh)
1	Michika	Tumbara Ngabili Dzuruk Kwabapale	1497 1113 840	26 19 15
2	Madzi	Madzi	1704	29
3	Nkafa	Dlaka Moda	2498 1314	43 23
4	Bazza	Jigalambu Tsukumu	2342 1341	41 24
5	Vi – Boka	Tili	802	14
6	Zah	Buppa	2260	40
7	Futu	Himike Debki	1450 1091	25 20
8	Garta	Garta Ghumchi	2494 1744	44 30
	Total	14	N = 22,488	n = 393

Source: (AADP) Michika, 2006

Result and Discussion

a. Evidence of Climate Change in the Study Area

The evidence of climate change was based on the trend assessment of six climatic elements namely, annual rainfall, maximum temperature, minimum temperature, onset date of rainfall, cessation dates of rainfall, and length of rainy days.

The figure 1-6 below show the trend of climatic variables. The annual rainfall, maximum and minimum temperature, shows an upward trend (figure 1-3). This implies that rainfall and temperature in the study area is increasing.

On the other hand, the trend for onset in figure 4, show a downward trend indicating that onset date for rainfall is earlier and the cessation trend in figure 5 below show a decrease pattern, ie rainfall

end earlier than before, then figure 6, show the length of rainy days is increasing in the study area.

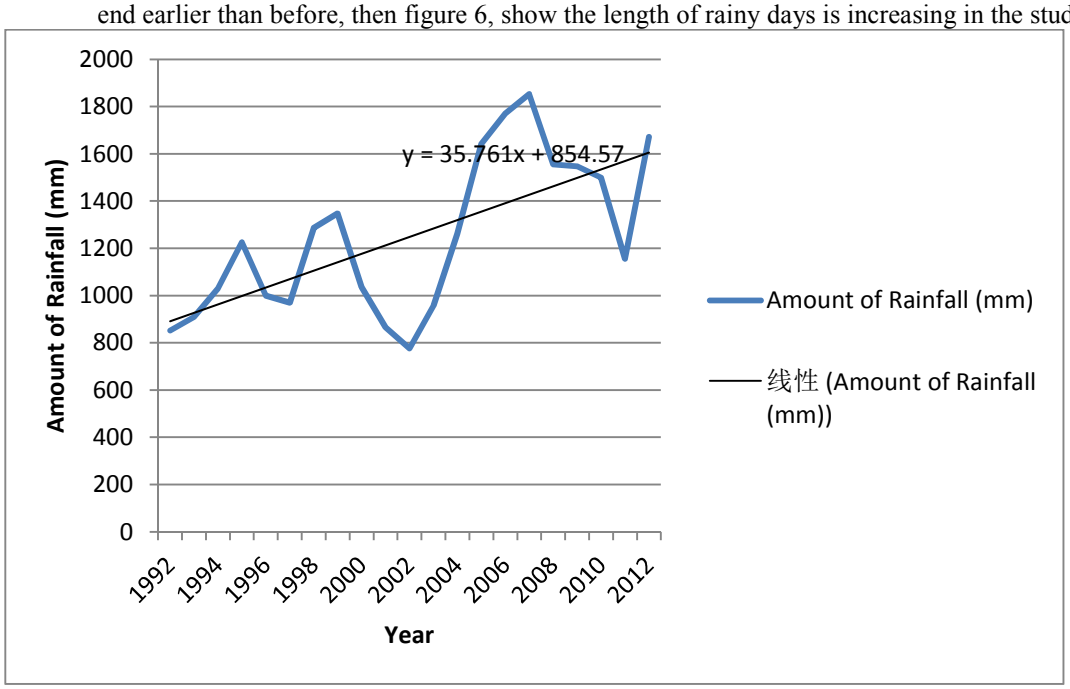

Figure 1: Trend in Total Annual Rainfall (mm) in Michika for 21 years (1992-2012).

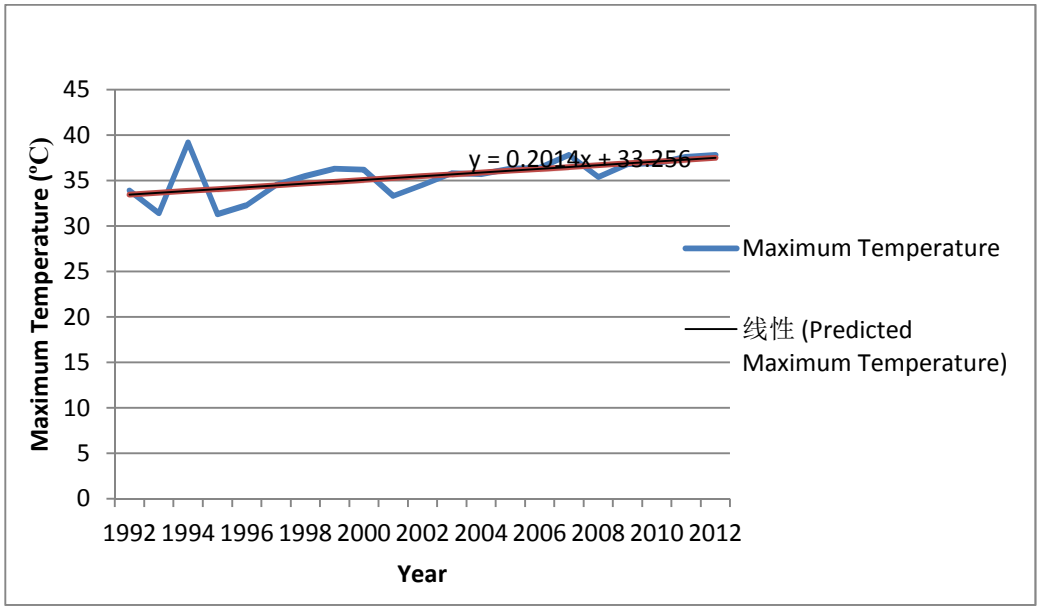

Figure 2:Trend of Maximum Temperature for Michika (1992-2012)

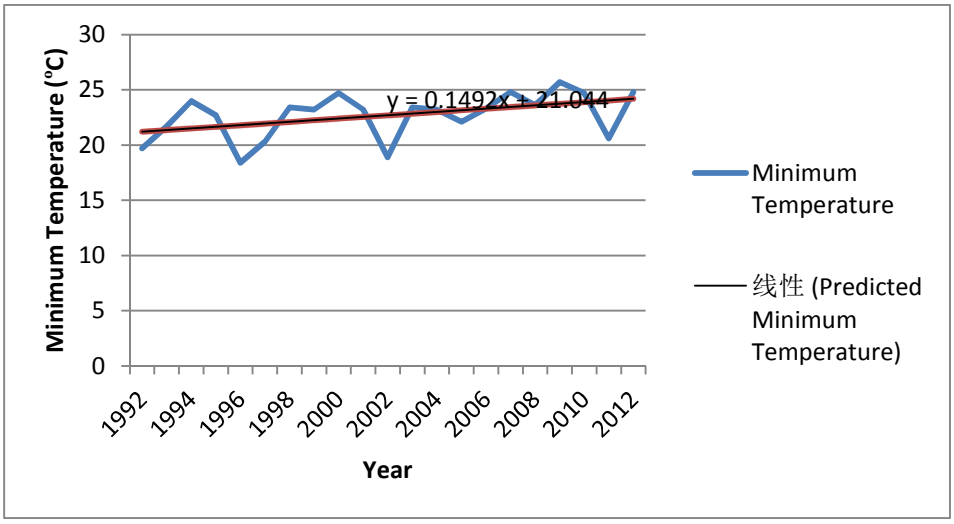

Figure 3: Trend of Minimum Temperature for Michika (1992-2012)

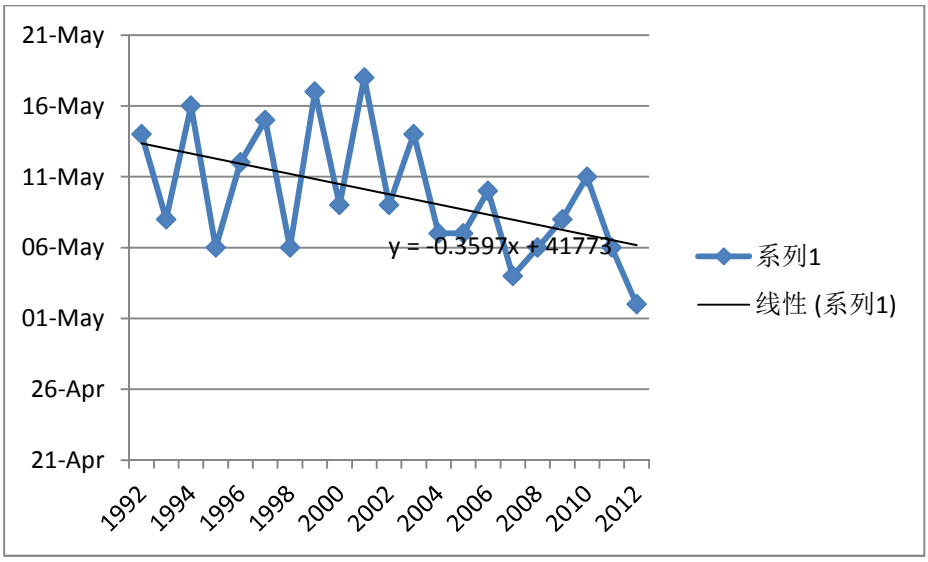

Figure 4 Trend of Onset Date of Rainfall in Michika (1992-2012)

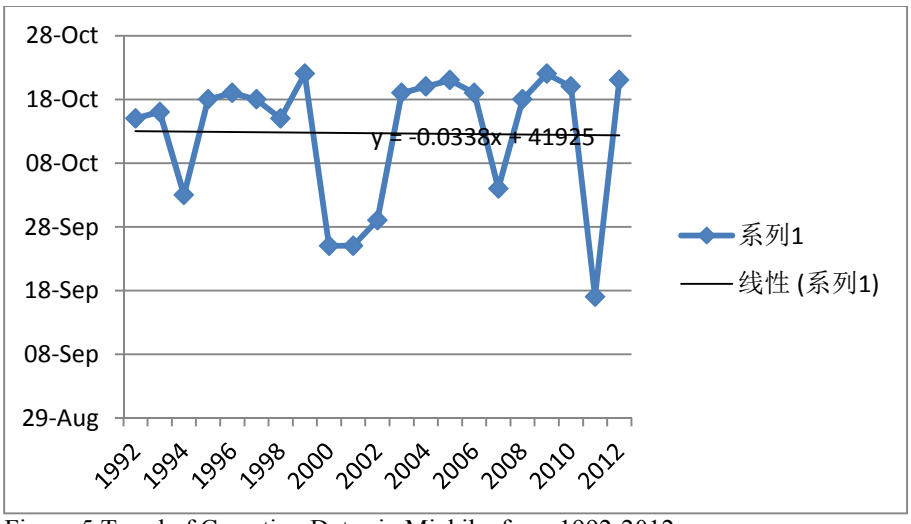

Figure 5 Trend of Cessation Dates in Michika from 1992-2012

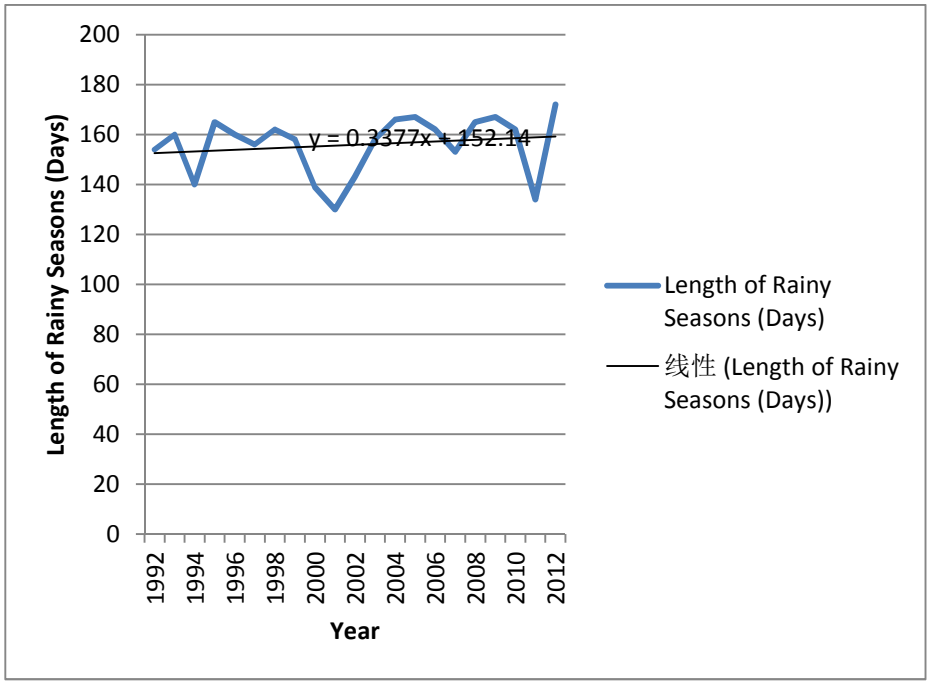

Figure 6: Trend for length of Rainy Days in Michika (1992-2012)

b. Farmers Perception of Climate Change and its Causes

Figure 7 below revealed perceived factors that support the local farmers' awareness to climate change in the eight (8) districts. The sampled farmers' response indicated dryness of rivers and ponds 22%, unusual early rainfall 19%, long period of dry season 17%, heavy and long period of rainfall in August and September 15%, erratic rainfall pattern 14%.

These mean that the indigenous local farmers have their traditional indicators or local measures to determine or perceive changes in their environment. The response of the sampled farmers of heavy and long period of rainfall in August and September, with erratic rainfall pattern is in conformity with the meteorological rainfall data. Also, the finding agrees with Ban and Hawkin (2000) that perception is the process by which we receive information or stimuli from the environment and transform it into psychological awareness.

Though, other indices contribute to local farmer's method of measuring perception and awareness of an environment, which includes educational level, level of information, exposure, age, gender, occupation and farming experience, (Adebayo 2012 personal communication).

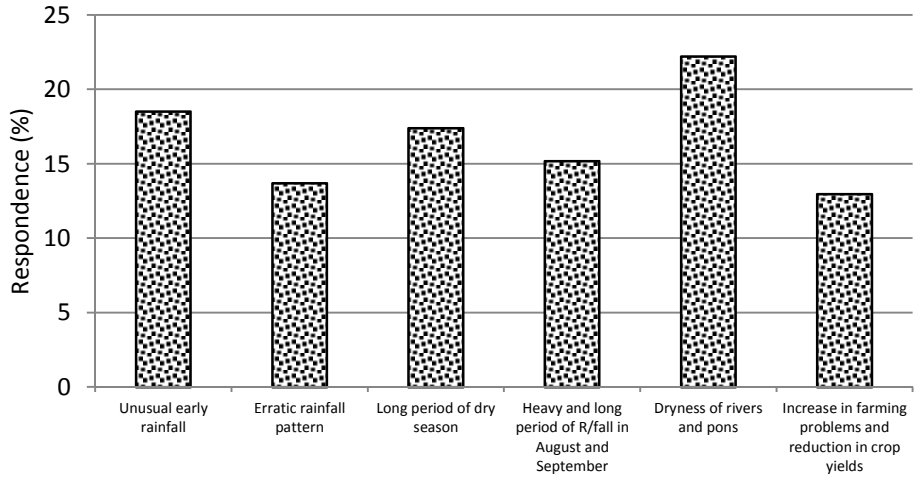

Figure 7: Factors that Support Local Farmers Awareness to Climate Change

In addition, Figure 8 below shows the distribution of respondents with regards to perceived causes of climate change in the eight (8) districts of the study area. Increasing population 21%, burning of fire wood 20%,

uses of chemicals 17% (herbicides, pesticides e.t.c.), deforestation 14%, bush burning 11%, over grazing 12% and excessive use of water for irrigation 7%. This result is in agreement with the fact that increasing population growth led to higher rate of deforestation for urbanization, agriculture and industrial usage. Generally these human activities alter the composition of the atmosphere and contribute to climate change.

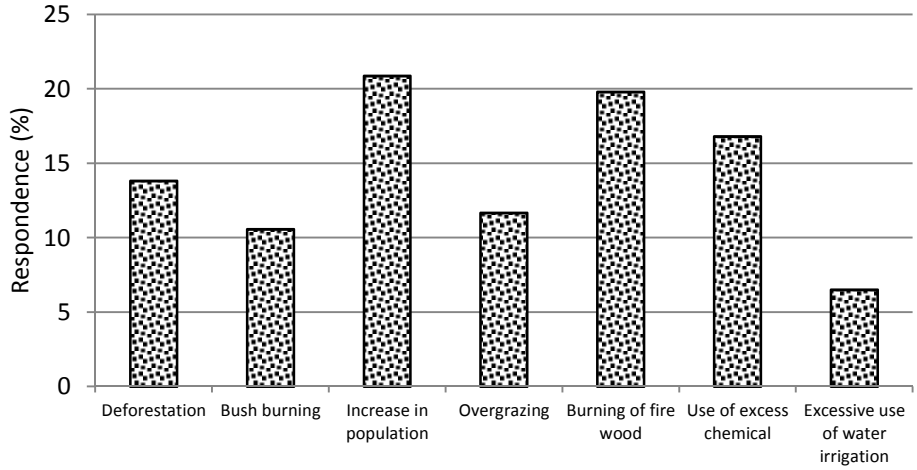

Figure 8: Perceived Factors of Causes of Climate Change

Table 2 below shows the response of local farmer's perception on climatic variables. The local farmers' perception shows that 70% perceived increasing temperature, 7% decreasing temperature, 6% no change in temperature and 17% don't know. The result of the local farmers' perception of increasing temperature in the study area agreed with the statistical analysis of the study area and consistence with the scientific trend. Which shows that temperature is increasing as indicated in figure 2.

Also, 70% of the local farmers perceived change in temperature from 2 – 5 years, 15% from 6 – 9 years, 34% from 10 – 14 years and 44% 15years and above. The local farmers' perception is in agreement with the statistical trend of maximum temperature in figure 2, which shows an increasing temperature.

In terms of rainfall, 40% of the local farmers indicated increasing rainfall, 18% indicated decreasing rainfall, while 21% perceived no change in rainfall and 22% don't know. The local farmers' perception of increasing rainfall is in conformity with the statistical analysis in figure 1, this shows an increasing rainfall in the study area. While for onset dates, 6% of the local farmers indicated early onset, 65% mentioned delay onset, 11% noted no change in onset date and 18% don't know. However, the local farmers' perception on the onset dates disagreed with the statistical analysis in figure 4. This might be due to differences in geographical location of the various districts. While for cessation of rainfall, 47% of the local farmers indicated early cessation, 10% delayed cessation, 20% noted no change in cessation and 23% don't know. The local farmers' response on cessation is in conformity with the statistical analysis in figure 5, which indicates that cessation is earlier than before in the study area.

As indicated in table 2, 66% of the local farmers experience dry spell during growing season and 34% experience nothing; while 67% farmers experience water evaporation from the ground and 33% do not. The higher water evaporation as perceived by local farmers might be due to increasing temperature in the study area as indicated in figure 2.

The result of the local farmers response of the study area is in agreement with Lobell (2008) and Apata et al (2009), where respondent indicated high temperature, water evaporation from the ground and delay rainfall as determinant of climate change.

Table 2: Farmers Perception of Climatic Variables of the Study Area

1. Change in Temperature		Frequency	%
	Increasing Temp.	257	70
	Decreasing Temp.	27	7
	No Change	21	6
	Don't know	64	17
	Total	369	100
2. For how long did you start noticing change in temperature		Frequency	%
	2 - 5 Years	26	7
	6 - 9 Years	55	15
	10 - 14 Years	127	34
	15 Years above	161	44
	Total	369	100
3. Do you notice any change in rainfall		Frequency	%
	Increasing	148	40
	Decreasing	65	18
	No Change	76	21
	Don't know	80	22
	Total	369	100
4. what is the situation of onset of growing season now		Frequency	%
	Early	23	6
	Delayed	239	65
	No change	42	11
	Don't know	65	18
	Total	369	100
5. Do you normally experience dry spell during the growing season		Frequency	%
	Yes	243	66
	No	126	34
	Total	369	100
6. What is the cessation of rainfall		Frequency	%
	Early	174	47
	Delayed	36	10
	No change	75	20
	Don't know	84	23
	Total	369	100
7. Have you experience fast water evaporation from ground		Frequency	%
	Yes	247	67
	No	122	33
	Total	369	100

Source: field survey 2013

c. Farmers Adaptation Strategies

The table 3 below presents adaptation strategies by the respondents. These strategies are, planting of early maturing crops 26.2%, planting of resistant crops to pest and drought 22.7%, prayers to God and gods 6.5%, movement to new land 1.0%, mixed farming 23.3%, intensive use of fertilizer 17.8% and changing in planting dates 2.1%

Table 3 Farmers Adaptation Strategies

S/N	ADAPTATION	FREQUENCY	PERCENTAGE
1	Planting early maturing crops	97	26.2
2	Planting resistant crops to pest and drought	84	22.7
3	Prayers to God and gods	24	6.5
4	Movement to new land	4	1.0
5	Mixed farming	86	23.3
6	Intensive use of fertilizer	66	17.8
7	Changing in planting dates	8	21.1

Source: Field Survey 2013

Conclusion

The finding of the study revealed that climate change is real in study area, with an increasing rainfall from 1992-2012. Likewise the mean maximum temperature show an increasing trend. The trend of the onset date of rainfall is earlier but for cessation, the trend shows a decrease pattern i.e rainfall end earlier now than before. It is established from the study that farmers were aware of climate change, and where able to develop adaptation strategies in a way that enable them to constantly cope with an erratic impact of climate change on food production.

Finally, it is recommended that government policies and strategies that mobilize, facilitate and promote the realization of farmers needs based on understanding of the farmers perception on climate change and measures to mitigate them in the study area.

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