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Farmers' Perception of Climate Change and Coping Strategies across Gender in Two Agro-Ecological Zones of Nigeria

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Abstract

This study examined farmers' perception of climate change and coping strategies across gender in two agro-ecological zones of Nigeria. Two agro-ecological zones namely north-central and north-west were purposively selected and one State Agricultural Development Project each namely Niger and Kaduna were selected repectively. Structured questionnaire was used to elicit information from 140 respondents. Data were analysed using both descriptive and inferential statistics. Personal experience was the most prominent means through which females (35.7%) and males (38.6%) became aware of climate change. Majority of the females (85.7%) and males (74.3%) in the north-central zone , started to notice the effect of climate change only about 1-5years ago. About 89% of males and 82% of females opined that yearly rainfull begins late. About 97% of the female and 99% of the males were of the opinion that there had been gradual reduction of vegetation cover. General perception by both females (mean=3.2) and males (mean=3.2) was that climate change reduces the yield of crops, increase the cost of crop production and reduces the productivity of livestock and also time spent by the females to look for water for domestic use had increased. Chi-square analysis indicated positive and significant relationship between perception of climate change and farm size (X^2 = 4.1; $p<0.05$) in north- central and farming experience (X^2 = 7.3; $p<0.05$) in north west zone. The results of t-test analysis showed significant difference between how the females and males perceived the effect of climate change with regards to rainfall ending early ($t(138)=2.5$; $p<0.05$) and time spent to look for water for cooking food has increased($t(138)=2.2$;$p<0.05$). A multi-media enlightenment campagn of the effects and posssible coping strategies of climate change should be adopted by all tiers of government and NGOs to reach the farmers using available extension structure on ground. Also, farming communities can run local disaster risk committees to encourage local adaptation measures as survival tactics for the purpose of ensuring food security.

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Key Words: Gender, Farmers Perception, Coping strategies, Climate Change, Agro-ecological Zone

Introduction

Agriculture is a very climate-sensitive sector. Climate change is a major challenge to agricultural development in Africa and the world at large as reported by Technical Centre for Agricultural and Rural Co-operation (2009). It is not only a challenge to agricultural development but to food security and the general livelihoods conditions of any population. Agriculture, being one of the most weather-dependent of all human activities is highly vulnerable to climate change. African countries are particularly vulnerable to climate change because of their dependence on rain fed agriculture, high levels of poverty, low levels of human and physical capital, inequitable land distribution and poor infrastructure (Watson *et al*., 1997). Africa, like the rest of the world, is experiencing increasing risk from climate change including rising temperatures and heat waves, shortfalls in water supply/increasing floods arising from shortage/excessive rainfalls, sea level rise, increasing likelihood of conflict and induced environmental and vector borne diseases . These conditions emanating from climate change are bound to compromise agricultural production (crop, livestock, forest and fishery resources), nutritional and health statuses, trading in agricultural commodities, human settlements (especially of agricultural communities), tourism and recreation among others.

Generally climate change is expected to have a mixed effect on agriculture with some areas benefiting from moderate temperature increases and others being negatively affected. Positive effects of climate change could arise from changes in seasons and production cycles. For example, Ethiopia and Southern Africa are expected to have extended growing seasons as a consequence of increased temperature and rainfall. In the same vein, livestock production could be boosted by temperature increases (FAO, 2009). Conversely, Deressa and Hassan (2009) found increasing temperatures to be particularly damaging to Ethiopian agriculture; a situation that is not uniformly distributed across agro-ecological zones. Kurukulsuriya and Mendelson (2007) equally indicated that African agriculture is sensitive to climate change in the sense that farmers will experience net revenue losses from warming especially with reduction in precipitation. Also, climate change is thought to be responsible for conflict in Darfur where a combination of decades of drought, desertification and overpopulation are among the causes of conflict in that the Baggara Arab nomads search of water have to take their livestock further south, to lands mainly occupied by farming peoples (IFPRI, 2009).

The above effects of climate change can be said to hold true for Nigeria in the sense that the same ecological conditions applies especially in the savanna and sahelian regions of the north. In which this study was conducted.

Agriculture which is the main source of food in Nigeria, contributes about 40% to the Gross Domestic product (GDP) and employs 70- 80 % of the population. Agricultural production in

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most of its sectors is reported to be dependent on weather and climate (Ozor, 2009). It is believed that mitigating strategies to combat the effects of climate change and also ensuring improve and sustainable livelihood for the farm family depends on the knowledge, attitudes, practices and belief systems of farmers.This study was conducted to assess the perception of impact of climate change from a gender perspective and control strategies; provides empirical data on much needed gender dimension of effect of climate change in Nigeria; and captures the perception of rural men and women farmers in Northwest and North-central agro-ecological zones of Nigeria. Most of the studies on gender and climate change have focused on scientific and technological aspects of the problem while the socioeconomic aspect have not been looked into with special reference to Nigeria. Gender is a very critical aspect of all development initiatives such as agriculture. Gender analysis of perception of climate change effect and coping strategies is expected to promote an understanding of the ways that men and women are differently impacted by climate-related hazards. Due to little available information on the perception of effect of climate change from gender perspective of rural farmers the need for this study is underscored in order to build an information source with specific reference to Nigeria.

Gender is regarded as a cornerstone in dealing with climate change adaptation strategies (FAO, 2009). climate change effect on human in general and ability to mitigate and also adapt are dependent on social factors including gender (WHO…) It was further stated that women and men differ in their roles, behaviours and the attitudes that are expected to assist in climate change mitigation. Goh, 2012 reported that women and men may experience impacts of climate change differently. Women express more willingness to adopt pro-environmental behaviours than men (O'Connor et al., 1999; Kollmuss and Agyeman, 2002; Sundblad *et al.* 2007). This is attributed to the fact that a feminine identity stresses attachment, empathy, and care (Keller, 1985). Additionally, majority of women are not economically empowered and are likely to be vulnerable to the effects of climate change (Davidson and Freudenburg, 1996; Broady *et al*.2008; Hemmati and Rohr, 2009). High dependence on local resources for their livelihood and socioeconomic norms which tend to limit women from acquiring the information and skills necessary to escape or avoid hazards (Hebtezion, (2013).

In order not to undermine the effectiveness of climate change the inclusion of women in decision-making processes in climate change mitigation and adaptation cannot be over-emphasized. Thus, this study was therefore aimed at analyzing the gender perception and adaptive strategies used by rural farmers to alleviate the effect of climate change on crops, livestock and domestic chores. The specific objectives were to:

i. describe the socio-economic characteristics of the respondents;
ii. ascertain farmers understanding of climate change and sources of awareness;
iii. examine respondents' perception of climate change;
iv. describe the climate change parameters observed by farmers;
v. ascertain the coping strategies used by farmers; and

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vi. determine the perceived effectiveness of these strategies on gender basis.
vii. determine the relationship between perception of climate change and other variables.

Methodology

Two agro-ecological zones namely north-west and north-central were purposively selected from which Kaduna and Niger States respectively were selected. The basis for the selection was the location of National Agricultural Extension and Research Liaison Services zonal office and the Coordinating Research Institute of the National Agricultural Research System. One Agricultural Development Project (ADP) zone was purposively selected from each selected State. Furthermore, one extension Block was selected out of which 7 extension cells/communities were randomly selected from which 10 farmers, consisting of 5 males and 5 females were randomly selected. In all, a total 140 respondents were interviewed through structured questionnaires were used to elicit information from respondents

The data collected were analyzed using frequency counts, means and percentages. A 4-point Linkert type scale of strongly agree, agree , dis-agree and strongly disagree with assigned weight of 4,3,2,1 respectively was used to measure effect of climate change and climate change coping strategies. In calculating perception of effect of climate change (PCC) and climate change coping strategies (CCCS), the mid-point values of the scale were summed up and further divided by 4 to obtain mean of 2.5. The mean for each of the PCC and CCCS was obtained by multiplying the point scale by the number of respondents in each point scale. Any PCC or CCCS with a mean score of equal or above the cut-off mean of 2.5 was regarded as agreed with the statement indicated and any mean score of lower than 2.5 was regarded as not agreed with the statement.. Furthermore, PCC score and CCCS score was obtained by adding the scores of each respondent for each of the PCC and CCCP . The score obtained for each respondent was further dichotomised into low and high perception based on the mean score in each case. These were used to determine the relationship between the dependent variable, PCC and gender and other independent variables.

Results and Discussion

Socio-economic characteristics of respondents

Results in Table 1 indicate that majority of the respondents were middle aged (62.9%); married (87.1%); and had a household size of above 5 (67.9%). Majority of the respondents had high educational level (52.2%), farm size (63.3%) of not more than 2ha; and (65.7%) membership farmers' cooperative society (65.7%). The analysis of respondents' socio-economic characteristics tend to suggest that respondents have the qualities to understand the various effects of climate change in their localities.

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Farmers' understanding, observation , awareness sources and climate change parameters observed and time effect was noticed

Majority (96.4%) of the respondents understood the term "climate change" as shown in Table 2. About 97% of the respondents observed climate change in one form or the other. Personal experience (37.1%) and radio (32.9%) were the most important sources of awareness of climate change by the respondents..This finding is in agreement with Tologbonse *et al* 2011 and 2010. The most critical climate change parameters observed respondents were gradual drying of water sources by both female(100%) and male (100%) in north-west agro-ecological zone, and gradual reduction of vegetation cover (female, 97.1%; male=98.6%) in both zones ; This result probably implies that food production might have been decreasing.

Table 2 also reveals that 51.0% of female respondents had noticed the effects of climate change between 1 to 5 years ago as against 48.6% in males. This finding is also in agreement with Tologbonse *et al* (2011 and 2010) which reported that majority of the respondents noticed effect of change between 1-5 years ago.

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Table 1: Socio-economic characteristics of respondents

Variables	State/Agro-ecological zone/Gender						
	Kaduna-North-west		Niger-North-central		Sub-Total		Combined
	Female (n=35)	Male (n=35)	Female(n=35)	Male(n=35)	Female(n=70)	Male(n=70)	(female+male)(n=140)
Age (years)							
Young (30 & below)	14.3	2.9	28.6	37.1	21.4	20.0	20.7
Middle(31-50)	80.0	48.6	65.7	57.1	72.9	52.9	62.9
Old (51-above)	5.7	48.6	5.7	5.7	5.7	27.1	16.4
Marital Status							
Single	5.7	0.0	14.3	14.3	10	7.1	8.6
Married	82.9	100	82.9	82.9	82.9	91.4	87.1
Divorced	2.9	0.0	0.0	2.9	1.4	1.4	1.4
Widowed	8.6	0.0	2.9	0.0	5.7	0.0	2.9
House hold size							
5 & below	22.9	14.3	48.6	42.9	35.7	28.6	32.1
6-10	37.1	22.9	42.9	37.1	40	30.0	35.0
11 & above	40.0	62.9	8.6	20.0	24.3	41.4	32.9
Educational level							
Low(no formal/quaranic)	27.3	47.1	35.3	34.3	31.3	40.6	36.0
Medium(adult/primary)	21.2	11.8	23.5	8.6	22.4	10.1	16.2
High (sec/teriary)	51.5	41.2	41.2	57.1	46.3	49.3	47.8
Farm size (Ha)							
Small(1.0 & below)	52.9	11.4	62.9	29.0	58.0	18.6	38.1
Medium(1.1-2.0)	32.4	28.6	17.1	22.9	24.6	25.7	25.2
Large(2.1 & above)	14.7	60.0	20.0	51.4	17.4	55.7	36.7
Farming experience(yrs)							
Low(10 & below)	50	20.0	68.6	47.1	59.4	33.3	46.4
Medium (11-30)	47.1	48.6	31.4	50.0	39.1	49.3	44.2
High (31 & above)	2.9	91.7	0.0	2.90	1.4	17.4	9.4
Primary occupation							
Farming	37.1	71.4	20.0	65.7	28.6	68.6	48.6
Civil servant	14.3	20.0	25.7	17.1	20.0	18.6	19.3
Others	48.6	8.6	54.3	17.1	51.4	12.9	32.1
Cooperative membership							
Member	48.6	54.3	68.6	91.4	58.6	72.9	65.7
Non member	51.4	45.7	31.4	8.6	41.4	27.1	43.3

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Table 2 : Farmers' understanding, awareness sources and observed parameters of climate change

Variables	State/Agro-ecological zones/Gender Kaduna North West		Niger North Central		Sub total		Total
	Female (n=35)	Male (n=35)	Female (n=35)	Male (n=35)	Female (n=70)	Male (n=70)	Female & male (n=140)
Understand term "climate change"							
Yes	94.3	97.1	94.3	100	94.3	98.6	96.4
No	5.7	2.9	5.7	0.0	5.7	1.4	3.6
Observed any form of change in climate							
Yes	100	100	88.6	100	94.3	100	97.1
No.	0.0	0.0	11.4	0.0	5.7	0.0	3.9
Sources of awareness *							
Extension agent	2.9	2.9	11.4	14.3	7.1	8.6	7.9
Radio	51.4	48.6	14.3	17.1	32.9	32.9	32.9
Television	2.9	0.0	37.1	31.4	20.0	15.7	17.9
Personal experience	48.6	42.9	22.9	34.3	35.7	38.6	37.1
Fellow farmers	5.7	5.7	14.3	2.9	7.0	4.3	7.1
Parameter Observed*							
yearly rainfall begins early	22.9	11.4	22.9	20.0	22.9	15.7	19.3
Yearly rainfall begins late	77.1	88.6	85.7	88.6	81.4	88.6	85.0
Yearly rainfall ends early	97.1	80.0	100	49.3	98.6	88.6	93.6
Yearly rainfall end late	62.9	62.9	71.4	60.0	67.1	61.4	64.3
Gradual reduction of vegetation cover	97.1	97.1	97.1	100	97.1	98.6	97.8
Gradual drying of water sources	100	100	97.1	100	98.6	100	99.3
Time effect of climate change noticed							
Less than a year	0.0	0.0	2.9	0.0	1.4	0.0	0.7
1-5 years ago	17.1	22.9	85.7	74.3	51.0	48.6	50.0

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6-10years ago	20.0	14.3	11.4	25.7	15.7	20.0	17.5
11-15 years ago	34.3	20.0	0.0	0.0	17.1	10.0	13.6
Above 15 years	28.6	42.9	0.7	0.0	14.3	21.4	17.9

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Perception of effects of climate change

As indicated in Table 3, increase in temperature was perceived to have the highest effect of climate change by both the females (mean=3.5) and males (mean=3.7) respondents.. Furthermore, both female (mean=3.4) and male (mean=3.3) respondents perceived that some crops were more prone to climate change than others. Both female and male respondents opined that there had been . drastic change in weather; increased frequency of flooding; increased effect of heat stress on livestock; reduction in vegetation cover; and reduction in family income with a high combined perception mean of 3.3 each. The findings in reduction in vegetation cover and animal species might be due to what Agwu and Akhimamhe (2012) reported to be due to harvesting of tree and fuel wood which had led to the disappearance of many plant and animal species and not necessarily due to Climate change.

Table 3 also tend to suggest that both female and male respondents usually experienced reduction in yield of crops (mean=3.1) and that income of family had not increased (mean=2.1) They also both disagreed with the statements that time spent generally to get water has not changed (mean=2.2) neither did the quality of water used for domestic chores changed (mean=2.2)

Strategy to reduce the effect of climate change

Many strategies were used by farmers to reduce the effects of climate change on their enterprise as indicated in Table 4. The adoption of multiple cropping practice by both female and male respondents (mean=3.5) was the most important strategy used to alleviate the effects of climate change. This finding is in agreement with Apata *et al*. (2009), Rudolf and Hermann (2009) and Molua (2008) that reported that multiple cropping was one of the most effective strategies employed by farmers to diversify production and livelihood. Other strategies perceived to be effective include agricultural insurance (mean=3.4), rearing of heat-tolerant livestock (mean=3.4). and use of organic manure ((mean=3.3). The stoppage of the use of inorganic fertilizer was perceived as an ineffective strategy to alleviate the effect of climate change by both female (mean=2.0) and male (mean=1.8). This finding is in agreement with Tologbonse *et al*.(2011 and 2010).

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Table 3: Perception of Effects of climate change

S/№	Variables	Mean perception score (4 point scale) Agro-ecological zone/State/Gender						
		Kaduna-NWZ		Niger-NCZ		Sub-Total		Combined
		Female (n=35)	Male (n=35)	Female (n=35)	Male (n=35)	Female (n=70)	Male (n=70)	Female + male n=140)
	Increase in temperature	3.3	3.6	3.7	3.7	3.5	3.7	3.6
	Drastic change in weather generally	3.2	3.3	3.1	3.7	3.3	3.5	3.3
	Reduces yield of crops generally	3.1	3.1	3.3	3.3	3.2	3.2	3.1
	Increases yield of crops generally	2.3*	2.4*	1.8*	2.0*	2.0*	2.2*	2.1*
	Some crops more prone to climate change than others	3.2	3.2	3.6	3.5	3.4	3.3	3.4
	Increases productivity of livestock generally	2.4*	3.5	2.4*	2.8	2.4*	2.6	2.4*
	Reduces productivity of livestock generally	3.0	2.9	3.0	2.9	3.0	2.9	3.0
	Some livestock more prone to climate change than others	3.1	3.0	2.5	2.7	2.8	2.9	2.8
	planting time of crops now unpredictable generally	3.1	3.1	2.6	2.7	2.9	2.9	2.9
	Fertilizer use increases the negative effect of climate change	2.7	2.7	2.4*	2.6	2.6	2.6	2.6
	Increases frequency of drought	3.1	3.1	2.4*	2.3*	2.8	2.7	2.7
	Increases frequency of flooding	3.3	3.1	3.4	3.3	3.3	3.2	3.3
	Increases effect of heat stress on livestock	3.1	3.1	3.4	3.4	3.3	3.2	3.3
	Increases effect of heat stress on crops	3.2	3.2	2.7	2.8	3.0	3.0	3.0
	Increases effect of heat stress on farmers	3.2	3.1	3.0	3.1	3.1	3.1	3.1
	Increases poverty rate of farmers generally	3.2	3.2	3.0	3.0	3.1	3.1	3.1
	Increases pest and disease incidence in crops	3.2	3.1	3.0	3.0	3.1	3.0	3.0
	Increases pest and disease incidence in livestock	3.0	3.1	2.9	3.0	2.9	3.1	3.0
	Inceases cost of crop production	3.1	3.1	3.3	3.3	3.2	3.2	3.2
	Increase in loss of agricultural land due to erosion	3.1	3.2	2.9	2.9	3.0	3.1	3.0
	Reduction of soil fertility	3.0	3.2	2.7	2.7	3.0	2.9	2.9
	Increase in poverty level of farmers	2.9	3.2	2.9	3.0	3.1	2.9	3.0
	Increase in weed infestation of crops	2.9	3.1	2.7	2.9	2.8	3.0	2.9
	Reduction in vegetational cover	3.1	3.2	3.6	3.6	3.3	3.4	3.3
	Reduction in family income generally	3.1	3.2	3.3	3.4	3.1	3.7	3.3
	Increase in family income generally	2.3*	2.4*	1.9*	2.0*	2.1*	2.2*	2.1*
	Increase in rate of sickness/infection of children	3.5	3.1	2.5*	2.4*	3.9	3.2	2.9
	Increase in rate of sickness/infection of adults	3.4	3.2	2.7	3.6	3.0	3.4	3.2
	Decease in rate of sickness/ infection of children	2.9	2.9	2.9	2.9	2.4*	2.4*	2.6
	Decease in rate of sickness/ infection of adults	3.0	2.8	3.0	2.8	2.4*	2.3*	3.1
	Time spent generally to get water has increased	3.2	3.2	3.2	3.1	3.1	3.0	2.5
	Time spent generally to get water has decreased	2.7	2.3	2.6	2.6	2.4*	2.4*	2.5
	Time spent generally to get water has not changed	2.6	2.6	2.6	2.6	2.5	2.5	2.2*
	Quality of water used for domestic chores has been bad (low quality)	3.2	3.2	3.2	3.2	3.0	3.0	3.0
	Quality of water used for domestic chores has been better (high quality)	2.7	2.2*	2.7	2.0*	2.0*	2.1*	2.1*
	Quality of water used for domestic chores has not changed	2.7	2.7	2.7	2.2*	2.3*	2.1*	2.2*

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Table 4 : Strategy to reduce/alleviate the effect of climate change

Strategy to reduce effects of climate change	Score: Agro-ecological zone/State/Gender						
	Kaduna (NWZ)		Niger (NCZ)		Sub-Total		
	Female (n=35)	Male (n=35)	Female (n=35)	Male (n=35)	Female (n=70)	Male (n=70)	Combined (n=140)
Agricultural insurance of enterprise	3.4	3.4	3.3	3.3	3.4	3.4	3.4
Planting different types of crops (multiple-cropping)	3.4	3.4	3.5	3.5	3.5	3.5	3.5
Planting of drought resistant/tolerant variety	3.0	3.1	3.1	3.1	3.0	3.1	3.1
Planting of flood resistant/tolerant variety	2.9	3.1	3.2	3.2	3.0	3.1	3.1
Planting of pests and disease resistant/tolerant crop or variety	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Rearing of heat tolerant livestock	3.4	3.2	3.5	3.5	3.4	3.3	3.4
Mulching of crops to reduce water loss	3.4	3.4	2.8	2.8	3.1	3.0	3.1
Increase in Use of organic manure	3.4	3.4	3.2	3.2	3.3	3.3	3.3
Stop the use of fertilizer	2.0*	1.5*	2.1*	2.1*	2.0*	1.8*	1.9*
Provision of bore hole to supply water	3.5	3.5	3.2	3.2	3.4	3.3	3.3
Provision of modern health facilities	3.5	3.5	3.2	3.2	3.4	3.4	3.4

Figures are weighted mean of 4-point scale of strongly agree, agree, disagree , strongly disagree. *= disagreed with statement

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Relationships between perception of climate change and other variables

Table 5 shows Chi-square analysis which indicated a positive and significant relationship between perception of climate change and the following variables namely farm size ($X^2 = 4.1$; $p<0.05$) in north-central, farming experience ($X^2 = 7.3$; $p<0.05$) in north-west zone; Membership of farmers organization ($X^2 = 2.1$; $p<0.05$) in north west zone and House hold size($X^2 = 3.6$; $p<0.05$)in North-west. The significant positive relationship between perception of climate change and house hold size and farm size are in agreement with the findings of Gutu *et al*. (2012)

The results of t-test analysis showed significant difference between how females and males perceived the effect of climate change with regards to rainfall ending early ($t(138)=2.5$; $p<0.05$) and increase in time spent to look for water for cooking ($t(138)=2.2$;$p<0.05$). The significant difference in perception of effect of climate change between females and males tend to give credence that climate change affect females and males differently. This is in agreement with the findings of Goh, (2012) reported that women and men may experience impacts of climate change differently.

Table 5: Relationship of perception of climate change and other independent variables

Variables	Agro-ecological zone/State X^2 @ 1 degree of freedom		
	Kaduna (NWZ)	Niger (NCZ)	Total
Agro-ecological zone	-	-	2.32
Age	1.47	0.01	0.12
Number of children	1.04	0.03	1.91
House hold size	3.6*	1.2	2.1
Educational level	2.3	2.4	0.001
Farm size	2.37	4.1*	0.41
Farming experience	7.3*	2.8	0.95
Coping strategy	0.28	0.32	0.001
Major occupation	2.5	1.2	0.02
Membership of farmers association	5.7*	2.1	4.62*

*Significant at 5% level of significance

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Conclusion and Recommendations

This study have shown majority of both female and male respondents are aware of what climate change is all about and they have also observed changes in climage through personal experience. Majority of both the female and male respondents also observed and seems to also attributed changes to effect of climate change on gradual reduction of vegetation cover and reduction in yield of crops Both females and males also opined that copping strategies for climate change could include planting of drought resistant crop varieties, multi-cropping and the adoption of agricultural insurance.

This study has shown that effect of climate change perception is affected by gender. This is because of significant difference between how the females and males perceived rainfall ending early and increase in time spent to look for water for cooking. It is recommended that efforts should be geared towards developing and making available high yielding improved crop varieties and improved livestock breeds that are tolerant to adverse conditions associated to climate change such as diseases, flood, drought and temperature. Efforts should also be made to make available potable water in the environment by NGOs and other organizations to sink bore hold to assist in the provision of clean water for domestic chores. A multi-media aggressive enlightenment campaign especially the use of radio on the awareness of the effects and possible coping strategies of climate change should be adopted by all tiers of government and NGOs to reach the farmers using available extension structure on ground. Also, farming communities can run local disaster risk committees to encourage local adaptation measures as survival tactics for the purpose of ensuring food security by building the capacity of all stakeholders on current and possible copping strategies to be employed.

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