



GOAT FARMERS' ADAPTATION STRATEGIES TO CLIMATE CHANGE IN ILORIN EAST LOCAL GOVERNMENT AREA OF KWARA STATE, NIGERIA

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ABSTRACT

This study examined the goat farmers' adaptation strategies to climate change in Ilorin East Local Government Area of Kwara State, Nigeria. About 105 goat farmers were selected for the study. Statistical tools such as frequency count, percentage, mean score and Pearson product moment correlation analysis were used to analyse data. The result revealed that about 61% of the respondents were males. The average age of the respondents was 57.7 years. About 48.6% of the respondents had primary education. The average years of experience in goat farming was 7 years and the average annual income of the respondents was ₦65,447.62. About 44.8% of the respondents indicated crop farming as the supportive occupation. The average number of Goats reared was 6 goats and about 58.1% of the respondents' system of goats rearing was semi-intensive system. The main motive for goat production were for financial purpose (43.8%). More than half (56.2%) of the respondents indicated that they had no access to extension services on goat production. About 50.5% of the respondents acknowledged that climate change is occurring. The result revealed that about 52.4% of the respondents had high level of usage of adaptation strategies to climate change. The highest ranked perception statement was that there is increase in temperature (mean=3.45). The result of Pearson Product Moment Correlation (PPMC) showed that income ($r=0.518$), educational status ($r=0.425$), main motive ($r=0.215$) and knowledge of climate change ($r=0.328$) were positively significant to the adaptation strategies to climate change at 5 % level of significance. The study therefore recommends that there should be creation of more awareness on climate change and provision of extension services to goat farmers on adaptation strategies to climate change.

Key words: Adaptation Strategies, Climate Change, Goat Farmers

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INTRODUCTION

Climate change and increased climate variability are emerging challenges limiting agricultural production all over the world (Allen *et al.*, 2014). Climate change is one of the greatest challenges to sustainable development in health and food security of many all over the world. Climate change is a global phenomenon. However,

developing countries are more exposed to the hazards of climate change and are less resilient to them (Morton, 2007). Its negative impacts are more severely felt by poor people in developing countries who depends on the ecosystem and the natural resource for survival. According to the World Bank, (2010) these group of people in developing countries like Nigeria will have to

bear an estimated 75–80% of the costs associated with the impacts of climate change themselves.

The climate change patterns play a fundamental role in shaping natural ecosystems and the human economies and cultures that depends on them (Adesiji *et al.*, 2013). According to Houghton *et al.*, (2001) who reported that the direct effects from air, temperature, humidity, wind speed and other climate factors influence animal performances in growth, milk production, wool production and reproduction. There are many ways climate change affects the livestock productions both directly and indirectly. Direct effects include increased temperatures, changes in the amount of rainfall, shifts in precipitation patterns and increased frequency of extreme weather events. Increased heat stress and reduced water availability can also have a direct negative effect on livestock production (FAO, 2021). According to FAO, (2021), the indirect impacts will be experienced through modifications in ecosystems, changes in availability, production costs, quality and type of feed and fodder crops, possible increases in animal diseases, higher energy prices and increased competition for resources. Climate change could lead to the increased emergence of goat diseases, as higher temperatures and changed rainfall patterns can alter the abundance, distribution and transmission of pathogens on goats.

Climate change Adaptation strategies are approach to adjust to climate change as it is already taking place (FAO, 2021). The Intergovernmental Panel on Climate Change (IPCC, 2001) defines climate change adaptation as the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (IPCC, 2001). The livestock sector which remains a major contributor to rural livelihoods and the national economies of most of the countries in West Africa. In Nigeria, the Livestock sector contributes around 1.7 percent to the national GDP and around 9 percent to the Agriculture value added (FAO, 2019).

Goat farming is vital to the wellbeing and livelihoods of many people in agrarian

communities in developing countries like Nigeria. Goats are kept by smallholder farmers for meat, hides, wool and rarely for milk production in Sub-Saharan Africa. Goat farming provides income and employment to several people. Goat has the ability to thrive even in the inadequate food supply and better performance (Abraham, 2015). Nigeria has the largest small ruminant herd in Africa followed by Sudan, Chad, Ethiopia and Kenya and there are about 76 million goats in Nigeria (FMARD, 2017). The predominant goat breeds in Nigeria are west-African dwarf goats, Red Sokoto goats and the Sahel goats. Goats are found more in the villages and rural areas than in the urban centres.

Even in the face of climate change challenges, it is expected that smallholder farmers will continue to play a significant role in agriculture, particularly in developing countries like Nigeria (Wiggins & Keats, 2015). Yet, not all smallholder farmers will remain in goat farming due to the negative effects of climate change. As goat farming can provide employment to several unemployed youths and there is dearth of information on the adaptation strategies of goat farmers to climate change in Ilorin East Local Government Area of Kwara State, Nigeria. Therefore, there is a need to determine the adaption strategies to climate change in Ilorin East Local Government Area of Kwara State, Nigeria.

The objectives of this study were to; ascertain the socio-economic characteristics of the respondents, determine the adaptation strategies to climate change among respondents, assess the perception of respondents on climate change in the study area and determine the factors affecting goat farming in the study area.

Hypotheses of the study were:

Hypothesis 1: There is no significant relationship between socio-economic characteristics of goat farmers and adaptation strategies to climate change.

Hypothesis 2: There is no significant relationship between respondents' perception on climate change and adaptation strategies to climate change on goat production.

MATERIALS AND METHODS

Study Area

The study was carried out in Ilorin east local Government area of Kwara state. Majority of the people in the local government area are farmers. The total respondents for the study consist of 105 goat farmers which were randomly selected from five rural communities in Ilorin east local government area of Kwara state. The communities are Oke-oyi =25, Oke-ose =20, Agbede=20, Iponrin=20 and Panada=20. To determine the adaptation strategies on climate change, the Yes and No scale were used where Yes = 1 and No = 0. In order to determine the respondents' level of use of adaptation Strategies on climate change, any respondents that used at least 6 of the adaptation Strategies on climate change (representing more than 50 %) of the practices is categorized as High Level/Status while any respondent that utilized less than 6 of the adaptation Strategies on climate change (representing less than 50 %) of the Adaption Strategies is categorized as Low Level/Status. In order to determine the perception on climate change, a five-point likert-type scale were assigned and scored as follows: Strongly Agreed (SA) =5, Agreed (A) =4, Undecided (U) = 3, Disagreed (D) = 2, and Strongly Disagreed (SD) = 1. To measure the factors affecting goat farming, a 3-point likert type scale where not a factor =1, less severe=2 and highly severe=3. Descriptive statistics such as frequency counts, percentage and means were used to analyse the finding of the study. Inferential statistics used to test the hypotheses was Pearson Product Moment Correlation (PPMC).

RESULTS

Socio-economic Characteristics of the Respondents

The socio-economic characteristics of the goat farmers are presented in Table 1. The table indicated that more than half (61%) of the respondents were males and 39% were females. The table also showed that that the average age of

the respondents was 57.7 years. This result indicates that the goat farmers were still agile and falls within the economically active age bracket. The table show that most of the respondents were married (71.4%) and about 12.4% were widowed. Regarding education of the respondents, 48.6% had primary education, 21.9% had secondary education, and 21% had no formal education. About 61.9% of the respondents was Islam worshippers. The average household size of respondents was 6 persons as most (59%) of the respondents had family size between 4 to 6 and 28.6% had between 7 to 9 persons.

Further results in Table 1 showed that the average years of experience in goat farming was 7 years. The average annual income of the respondents was ₦65,447.62. About 47.6% of the respondents were members of social group/cooperatives while most (52.4%) did not belong to any social group/cooperatives. About 44.8% of the respondents indicated crop farming as the supportive occupation in the study area. The result in table 1 also showed that the average number of Goats reared was 6 goats as the majority (95.2%) reared between 1 to 10 goats. The main motive for goat production were for financial purpose (43.8%). This indicates that financial purpose was the main motive for rearing goats in the study area. This result is similar with the findings of Ojango *et al.* (2015) who reported that about 40% of the respondents' motive for rearing goat was mainly financial purposive. About 60% of the respondents got credit for goat farming through personal savings. More than half (56.2%) of the respondents indicated that they had no access to extension services on goat production while less than half (43.8%) of the respondents indicated they had access to extension services on goat production. Regarding their knowledge of climate change, about 50.5% of the respondents acknowledged the existence of climate change while about 49.5% were of the opinion that climate is not changing.

Table 1: Socio-economic Characteristics of the Respondents

Variables	Frequency (n=105)	Percentage	Mean (SD)
Gender			
Male	64	61.0	
Female	41	39.0	
Age (years)			57.7(12.036)
30 and below	2	1.9	
31 – 40	7	6.7	
41 – 50	24	22.9	
51 – 60	33	31.4	
61 and above	39	37.1	
Marital Status			
Single	6	5.7	
Married	75	71.4	
Separated	9	8.6	
Widowed	13	12.4	
Divorced	2	1.9	
Educational Level			
No formal	22	21.0	
Primary	51	48.6	
Secondary	23	21.9	
Tertiary	9	8.6	
Religion affiliation			
Christianity	36	34.3	
Islam	65	61.9	
Traditional	4	3.8	
Annual Income from rearing of goat (Naira)			65,447.62 (59951.259)
10,000 and below	6	5.7	
10,001 - 50,000	57	54.3	
50,001 – 100,000	26	24.8	
100,001 and above	16	15.2	
Years of Experience in goat rearing			7 (4.877)
1 – 3	34	32.4	
4 – 6	36	34.3	
7 – 9	15	14.3	
10 and above	20	19.0	
Household Family Size			6(1.880)
1 – 3	8	7.6	
4 – 6	62	59.0	
7 – 9	30	28.6	
10 and above	5	4.8	
Membership of social group/cooperatives			
Yes	50	47.6	
No	55	52.4	
Other supportive occupation			
Crop farming	47	44.8	
Trading	44	41.9	
Civil servant	10	9.5	
Artisan	4	3.8	
Goat size			6(3.234)
1 – 10	100	95.2	
11 – 20	5	4.8	
21 and above			
Rearing system			

Intensive system	28	26.7
Semi-intensive system	61	58.1
Extensive system	16	15.2
Main motive for goat production		
Financial	46	43.8
Family consumption	21	20.0
Financial and family consumption	38	36.2
Sources of credits		
Personal Savings	63	60.0
Family/neighbor	13	12.4
Friends	16	15.2
Cooperative society	6	5.7
Bank	7	6.7
Access to extension services on goat production		
Yes	46	43.8
No	59	56.2
Knowledge that climate is changing		
Yes	53	50.5
No	52	49.5

Adaptation Strategies to Climate Change among Goat Farmers

The results of adaptation practices for goat production is presented in Table 2. The table showed that majority of the respondents applied the adaptive strategies to climate change. Some of the leading practices applied were planting of trees/erecting cover to serve as shades to reduce heat stress (79%), feeding animals with grains and concentrates (71.4%), silage production (67.6%), use of weather forecasting information (56.2%) and stocking species that are tolerant to

harsh weather conditions (47.6%), Storing grass for dry season (56.2%), cultivation of crop along with rearing of goat (58.1%) and rears more than one species (51.4%). Other notable adaptation practice to climate change were de-stocking during dry season (43.8%), diversify livelihoods/supportive occupations (45.7%), farm insurance (35.2%), and membership of association/social group/cooperative societies (35.2%) and diversify livelihoods/supportive occupations (45.7%).

Table 2: Adaptation Strategies to Climate Change among the Respondents

Adaptation Strategies to Climate Change	Yes, Used	
	Freq	%
1.Planting of trees/erecting cover to serve as shades to reduce heat stress	83	79.0
2.Use of weather forecasting information	59	56.2
3.De-stocking during dry season	59	43.8
4.Storing grass for dry season	64	56.2
5.Silage production	71	67.6
6.Feeding animals with grains and concentrates	75	71.4
7.Rears more than one species	54	51.4
8.Diversify livelihoods/supportive occupations	48	45.7
9.Stocking species that are tolerant to harsh weather conditions	50	47.6
10. Farm insurance	37	35.2
11. Cultivation of crop along with rearing of goat	61	58.1
12. Membership of association/social group/cooperative societies	37	35.2

Level of Use of Adaptation Strategies to Climate Change

The Level of use of adaptation strategies by goat farmers is presented in Table 3. The result

showed that slightly above half of the goat farmers (52.4%) had high level of usage of adaptation strategies while about 47.6% had low level.

Table 3: Status/Level of Usage of Adaptation Strategies for Goat Production

Status/Level of Use of Adaptation Strategies	Percentage score range of total usage	Frequency	Percentage
1. Low	0 – 50.0	50	47.6
2. High	51.0 – 100.0	55	52.4

Perception to Climate Change among Goat Farmers

The Perception of goat farmers on climate change is presented in Table 4. The Perception Statements were: There is increase in temperature (mean=3.45) was ranked first, There is increase in cost of food due to climate change and increased incidence of drought (mean=3.39) ranked second respectively, There is decrease in

rainfall (mean=3.36) ranked fourth, Climate change is responsible for the high mortality among goats (mean=3.28) ranked fifth, Climate change has led to increase in disease outbreaks (mean=3.11) ranked sixth, Climate change is responsible for scarcity of pasture and grass (mean=3.10) ranked seventh, and Climate change is responsible for the increase flooding (mean=3.05) ranked eight position respectively.

Table 4: Perception of Respondents on Climate Change

Perception statements	SD	D	U	A	SA	Mean	Rank
1. There is increase in cost of food due to climate change	6(5.7)	19(18.1)	21(20.0)	46(43.8)	13(12.4)	3.39(1.096)	2 nd
2. Climate change has led to increase in disease outbreaks	4(3.8)	40(38.1)	17(16.2)	28(26.7)	16(15.2)	3.11(1.187)	6 th
3. There is increased incidence of drought	2(1.9)	12(11.4)	45(42.9)	35(33.3)	11(10.5)	3.39(.893)	2 nd
4. There is increase in temperature	10(9.5)	12(11.4)	22(21.0)	43(41.0)	18(17.1)	3.45(1.185)	1 st
5. Climate change is responsible for the increase flooding	17(16.2)	19(18.1)	25(23.8)	30(28.6)	14(13.3)	3.05(1.289)	8 th
6. There is decrease in rainfall	11(10.5)	22(21.0)	16(15.2)	30(28.6)	26(24.8)	3.36(1.338)	4 th
7. Climate change is responsible for scarcity of pasture and grass	13(12.4)	25(23.8)	25(23.8)	23(21.9)	19(18.1)	3.10(1.287)	7 th
8. Climate change is responsible for the high mortality among goats	6(5.7)	30(28.6)	21(20.0)	25(23.8)	23(21.9)	3.28(1.252)	5 th

Factors affecting Goat Production

The results of factors affecting goat production among respondents as presented in Table 5. The factors affecting goat production were : incessant occurrence of drought during dry season (mean=2.28) ranked first, scarcity of grass during the dry season (mean=2.22) ranked second, inadequate technical know-how (mean=2.19) ranked third, theft (mean=2.13), lack of adequate information/extension services (mean=2.13) ranked fifth, unavailability of modern equipment

(mean=2.09) ranked sixth, high cost of production (mean=2.09) ranked seventh, marketing problems (mean=2.05) ranked eighth, low demand for the meat (mean=2.02) ranked ninth, non-availability of high quality breeds (mean=2.01) ranked tenth, high mortality rate (mean=1.99) ranked eleventh, disease outbreak (mean=1.94) ranked twelfth, and lack of start-up capital (mean=1.80) ranked thirteenth positions respectively.

Table 5: Factors affecting Goat Production among Respondents

Factors	Not a factor F(%)	Less severe F(%)	Highly severe F(%)	Mean (SD) Rank	
1.Lack of start-up capital	53(50.5)	20(19.0)	32(30.5)	1.80(.881)	13 th
2.Non-availability of high-quality breeds	23(21.9)	58(55.2)	24(22.9)	2.01(.672)	10 th
3.Unavailability of modern equipment	30(28.6)	36(34.3)	39(37.1)	2.09(.810)	6 th
4.Theft	24(22.9)	43(41.0)	38(36.2)	2.13(.760)	4 th
5.Inadequate technical know how	24(22.9)	37(35.2)	44(41.9)	2.19(.786)	3 rd
6. Low demand for the meat	34(32.4)	36(34.3)	35(33.3)	2.02(.832)	9 th
7. Scarcity of grass during the dry season	23(21.9)	36(34.3)	46(43.8)	2.22(.784)	2 nd
8. Lack of adequate information/extension services	29(27.6)	33(31.4)	43(41.0)	2.13(.821)	5 th
9. Incessant occurrence of drought during dry season	20(19.0)	36(34.3)	49(46.7)	2.28(.766)	1 st
10. High cost of production	25(23.8)	46(43.8)	34(32.4)	2.09(.748)	7 th
11. Marketing problems	33(31.4)	34(32.4)	38(36.2)	2.05(.825)	8 th
12. Disease outbreak	41(39.0)	29(27.6)	36(33.3)	1.94(.853)	12 th
13. High mortality rate	40(38.1)	26(24.8)	39(37.1)	1.99(.872)	11 th

The Result of Test of Hypotheses

Hypothesis 1: There is no significant relationship between socio-economic characteristics of goat farmers and adaptation strategies to climate change. The Pearson Product Moment Correlation (PPMC) correlation analysis showing the relationship between socio-economic characteristics of respondents and adaptation strategies to climate change for goat production is present in Table 6. The result showed that income ($r=0.518$), educational status ($r=0.425$), main motive ($r=0.215$), knowledge of climate change ($r=0.328$) were positively related at $p \leq 0.05$ level

of significance to adaptation strategies to climate change. This implies that the higher the income, educational status, main motive for going into goat farming and the knowledge of climate change, the higher the use of adaptation strategies to climate change by the goat farmers. Other socioeconomic characteristics such as gender ($r=-0.267$), age ($r=-0.420$), marital status ($r=-0.105$), religion ($r=-0.229$), and rearing system ($r=-0.219$) were inversely related to application of adaptation strategies of climate change for goat production in the study area.

Table 6: Correlation analysis showing the relationship between Socio-economic Characteristics of Goat Farmers and Adaptation Strategies to Climate Change

Socioeconomic Characteristics	R Value	P Value	Remark
Gender	-0.267**	0.006	Significant
Age	-0.420**	0.000	Significant
Marital status	-0.105	0.285	Not Significant
Educational status	0.425**	0.000	Significant
Religion	-0.229*	0.019	Significant
Income	0.518**	0.000	Significant
Years of experience	0.383**	0.000	Significant
Household size	-0.121	0.219	Not Significant
Membership of cooperative	-0.168	0.088	Not Significant
Supportive occupation	0.121	0.220	Not Significant
Number of goats	-0.063	0.522	Not Significant
Rearing system	-0.219*	0.025	Significant
Main motive	0.215*	0.027	Significant
Sources of credit	0.179	0.067	Not Significant
Access to extension services	0.035	0.726	Not Significant
Knowledge of climate change	0.328*	0.001	Significant

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

Hypothesis 2: There is no significant relationship between respondents' perception on climate change and adaptation strategies to climate change on goat production. The results PPMC correlation analysis revealing the relationship between respondents' perception on climate change and adaptation strategies to climate change for goat production is present in Table 7. The table showed that perception of goat farmers on climate change as responsible for increase in cost of food due to climate change ($r=0.246$), increase in disease outbreak ($r=0.391$), increase in drought ($r=0.309$), increase flooding ($r=0.259$), and scarcity of pasture and grass ($r=0.239$) were

positively related at $p \leq 0.05$ level of significance to adaptation strategies to climate change for goat production. This implies that goat farmers experienced of increased in cost of food due to climate change, increased in disease outbreak, increased in drought, increased flooding and scarcity of pasture and grass have influence on the respondent's decision to use the adaptation strategies to climate change in the study area. This result further indicates that farmers decision to utilize the adaptation strategies to climate change depends on their perceptions which are influenced by livelihood impacts the climate has on them.

Table 7: Correlation analysis showing the relationship between respondents' Perception on Climate Change and Adaptation Strategies to Climate Change.

Perception statement	R Value	P Value	Remark
1. There is increased in cost of food due to climate change	0.246*	0.011	Significant
2. Climate change has led to increase in disease outbreaks	0.391**	0.000	Significant
3. There is increased incidence of drought	0.309**	0.000	Significant
4. There is increased in temperature	0.035	0.722	Not Significant
5. Climate change is responsible for the increase flooding	0.259**	0.008	Significant
6. There is decrease in rainfall	0.162	0.099	Not Significant
7. Climate change is responsible for scarcity of pasture and grass	0.239*	0.014	Significant
8. Climate change is responsible for the high mortality among goats	0.188	0.054	Not Significant

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

DISCUSSION

The result indicates that there were more males than the females in goat farming in the study area. This result is in agreement with the findings of Dhakal, *et al.* (2021) in their study on features of small holder goat farming from Chitwan district of Bagmati province in Nepal reported that more than half (53.1%) of respondents were males. The result indicates that the respondents were smallholder. About 58.1% of the respondents' system of rearing was semi-intensive system. The result further showed that there is inadequate access to extension services in the study area. The result indicates that there is need to create awareness as almost half of the respondents does believe that climatic variables are changing.

Application of adaptation strategies will enhance goat farmers productivity as climate change is affecting agricultural practices. This result is in

agreement with the findings of Smith *et al.* (2012); IFAD, (2010) who stated that practices such as the diversification of livestock animals and crops, establishing trees alongside crops and pastures in a mix, integration of livestock systems with forestry and crop production, and changing the timing and locations of farm operations were important adaptation strategies to climate change.

This showed that the level of application of adaptation strategies for goat production is not high as almost half of the respondents has low level of usage. The goat farmers that highly used the adaptation strategies may be connected with their knowledge of climate change where similar percentage (50.5%) indicated agreement with the existence of climate change. This finding implies that the increase in temperature was the highest perception statement on climate change. This further implies that the farmers acknowledged that climate variables were changing as their perception on climate change will influence their

decision to utilize the adaptation strategies. This result is agreement with the findings of Barnes, (2013) who reported that the understanding of the farmers' perceptions and including them in rural policy development would enhance food security and environmental conservation objectives. This result showed that incessant occurrence of drought during dry season, scarcity of grass during the dry season and inadequate technical know-how were the main factors perceived to affect goat production in the study area.

CONCLUSION

Goat farming in study area were dominated by males and they are small scale producer of goat. Personal savings is the main sources of credit for goat production. There is inadequate access to extension services. Planting of trees/erecting cover to serve as shades to reduce heat stress, feeding animals with grains and concentrates, silage production, use of weather forecasting information, storing grass for dry season, cultivation of crop along with rearing of goat and rears more than one species were the highly used adaptation strategies for goat production in the study area. The three highest ranked perception

statements on goat were that there is increase in temperature, increase in cost of food due to climate change and increased incidence of drought. The highest ranked factor affecting goat production was incessant occurrence of drought during dry season.

Recommendations

The following recommendation were made based on the findings of this study.

1. There is need to create more awareness on climate change to the goat farmers.
2. There is need for extension information on adaptation strategies in the study to specially focus on encouraging the farmers to employ de-stocking of goat during dry season, farm insurance and join a cooperative group of livestock farmers. In this way, the use of the adaptation strategies will increase in the study area.
3. As incessant occurrence of drought during dry season highest ranked factor affecting goat production in the study area, there is need to train the farmers on supplementary feeds production such as silage and hay production.

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