



## IMPACT OF CLIMATE CHANGE ON RURAL GOAT FARMING IN EBONYI STATE, NIGERIA: IDENTIFYING EFFECTIVE ADAPTATION STRATEGIES

<sup>1</sup>Anugwo, S. C. and <sup>2</sup>Egwue, O. L.

<sup>1</sup>Department of Agricultural Economics and Farm Management.  
Federal University Oye-Ekiti, Ekiti State, Nigeria.

<sup>2</sup>Department of Agricultural Economics, University of Nigeria, Nsukka.

**Corresponding Author's E-mail:** anugstan4@gmail.com

<sup>1</sup><https://orcid.org/0009-0006-3139-8869> and <sup>2</sup><https://orcid.org/0000-0002-2390-9220>

### ABSTRACT

The study examined the Impact of Climate Change on Rural Goat Farming in Ebonyi State, Nigeria: Identifying Effective Adaptation Strategies. Based on the level of climate variability and large number of goat farmers, three local government areas namely, (Ohaozara, Ohaukwu and Ezza South LGAs) were randomly selected for this research. Multi-stage sampling technique was adopted for this research, with a total number of 84 respondents interviewed. Descriptive statistics and regression analysis were employed to analyze the objectives of the study. The results revealed that the mean age of the respondents was 27 years implying that the farmers were still young and active. Goat farming was dominated by males (63.0%) and a smaller proportion of females (37.0%). Majority of the respondents were married (53.6%). The results showed that many of the farmers with mean of (12 years) were relatively educated and (39.3%) had 6 to 10 years of experience mitigating the effects of climate change on goat production in the study area. Regression result revealed the  $R^2$  value was 0.832, implying that the regression analysis explained 83.2% of the total variation in the model. Regression variables of age, household size, marital status, access to extension agents, ownership of goats and land ownership were all positive and statistically significant. Goat farmers should form cooperative associations so as to receive aid from the government in providing high resistant breeds of goats, portable water and drugs which will help in mitigating the effects of climate change on goat production in the study area.

**Keywords:** Climate, change, mitigation, coping, strategies, information.

### INTRODUCTION

Climate change, characterized by fluctuations in temperature, precipitation patterns, and the increased frequency of extreme weather events, poses a significant threat to goat production systems worldwide. These variations disrupt the delicate balance between goats, their environment, and the resources they rely upon. One of the most immediate impacts of climate variability is a decrease in fodder availability. Prolonged droughts and erratic rainfall patterns lead to dry pastures, directly impacting the quantity and quality of feed accessible to goats (Muruganandam *et al.* 2023). This scarcity of essential nutrients results in slower growth rates, reduced milk production, and a decline in the overall nutritional health of goat herds. For instance, limited access to fresh forage can lead to deficiencies in essential vitamins and minerals, compromising their immune function and overall well-being (Sebata, 2018).

The rising temperatures associated with climate change pose another major challenge for goat production. Goats struggle to regulate their body temperature during extreme heat events, leading to heat stress (Kumalo and Manyani, 2023). This stress manifests in several ways, including reduced feed intake, decreased fertility, and increased health problems. Heat stress further compromises their nutritional intake as goats lose their appetite and disrupt hormonal cycles, leading to lower conception rates and reproductive problems (Kumalo and Manyani, 2023). Additionally, a weakened immune system due to heat stress increases the susceptibility of goats to various health issues. Recent studies by Sejian *et al.* (2021) have shown that prolonged exposure to high temperatures increases the risk of infectious diseases such as mastitis and respiratory infections in goats. Moreover, heat stress can exacerbate existing health conditions, leading to increased mortality rates and decreased productivity



among goat herds (Machado 2018). These detrimental effects highlight the urgent need for adaptive measures to mitigate the impacts of climate variability on goat production.

Water scarcity, often exacerbated by climate variability, poses another significant threat. Goats require consistent access to clean water for proper digestion, thermoregulation, and overall health (Kumalo and Manyani, 2023). When water becomes scarce, dehydration can lead to a range of health problems, including kidney failure, digestive issues, and reduced milk production in lactating does (Kumalo and Manyani, 2023). Climate change can also alter the dynamics of diseases that affect goats. Rising temperatures and erratic weather patterns can create favourable conditions for disease vectors, increasing the risk of outbreaks (Yadav *et al.* 2023). Additionally, erratic rainfall and temperature fluctuations can disrupt the breeding cycles of goats, leading to lower conception rates and greater infant mortality due to stress-induced weakening of offspring (Yadav *et al.* 2023).

## METHODOLOGY

### The Study Area

This research was carried out in Ebonyi State, Nigeria. The State covers a total of 6,488 square kilometers of land mass and it is bounded in the South-East by Cross River State, the South-West by Abia State and to the North and North-East by Benue State while to the East it is bounded by Enugu State. Ebonyi State is found on latitude 6.2649°N and longitude 8.0137°E of the Greenwich Meridian. The State is made up of thirteen (13) Local Governments Areas (LGAs). According to the (NBS 2022), Ebonyi State's population stood at 3,242,500 people thus making it rank the 29<sup>th</sup> most populous states in the country. The major occupations of the people living in the State are farming and trading while a few work as civil servants. Both cash crops and food crops including fruits and vegetables are produced in Ebonyi State. Cash crops like cashew, palm produce and food crops like yam, cassava, cocoyam, maize and rice are also produced in the state. Banana and other fruits and vegetables are also produced in Ebonyi State. There are two distinct seasons namely wet and dry seasons. The primary language of the state is Igbo, and its citizens are of Igbo descent.

### Sampling Technique and Sampling Size

The study employed the use of multi-stage sampling technique. In the first stage, three Local Government Areas (Ohaozara, Ohaukwu and Ezza South LGAs) were chosen at random from among the thirteen local governments in Ebonyi State due to the large number of goat farmers in the State. In the second stage, four communities were chosen at random from each of the selected L.G.As making a total of 12 communities. In the third stage, Seven (7) goat farmers were chosen from each community using a simple random sampling technique bringing the total number of respondents in the study area to eighty-four (84).

### Method of Data Collection

Primary data were used for this research; primary data was sourced using personal interviews and the administration of a well-structured questionnaire on goat farmers in the study area. The questionnaire was used to obtain primary data based on the objectives of the study.

### Methods of Data Analysis

Descriptive statistics, such as frequency distributions and percentages, were used to analyze the data collected for the study. Using frequency distribution and percentages, descriptive statistics were used to analyze objectives i, ii, and iv, which were to describe the socioeconomic characteristics of the respondents in the study area, identify sources of information on climate change, and identify the coping strategies of goat farmers in the study area in order to adapt to climate change. Regression analysis was used to analyze objective iii, which aimed to determine the factors influencing climate change adaptation techniques.

To determine the variables influencing climate change adaptation strategies in goat farming, the regression model was employed. A dependent dichotomous variable, which assumes just two values (zero or one), was used to estimate the likelihood of events using the probit model. The model that needs to be estimated is as follows;

$$P(Y_t = 1) = \frac{\exp(x_i\beta)}{1 + \exp(x_i\beta)} \quad (1)$$

$$x_i\beta \quad (2)$$



The explicit function was estimated as:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + U_i \quad (3)$$

Where:

Y is a binary response variable defined as; Y = 1 if the goat farmer participates in adaptation strategies to climate change and Y = 0 if otherwise.

X<sub>1</sub>= Age (years)

X<sub>2</sub> = Household size (number of persons)

X<sub>3</sub>= Marital Status (1 = Yes, 0 = No)

X<sub>4</sub>= Access to extension agents (1 = Yes, 0 = No)

X<sub>5</sub>= Climate change awareness (1 = Yes, 0 = No)

X<sub>6</sub>= Ownership of goats produced (1=Owned, 2=No)

X<sub>7</sub>= Land Ownership (1=Owned, 2=Leased)

b<sub>1</sub>...b<sub>7</sub>= parameter estimates

b<sub>0</sub>= Intercept

U<sub>i</sub> = error term

## RESULTS AND DISCUSSION

### Socio-economic Characteristics of the Respondents

According to results from Table 1, about 32.1% of the respondents were between the ages of 41 and 50 years, followed by those between the ages of 31 and 40 years (28.6%), those over 51 years were just (13%), and those under 30 years were (26.3%). These findings suggest that those in the 31–50 age range were likely to be more resilient to fatigue from the arduous work and effort required to raise goats and adapt to climate change in the study area. According to the study by Anugwo *et al.* (2024) titled High Feed Costs in Poultry Farming; An Analysis of Effective Coping Strategies in Enugu State, Nigeria, the majority of the poultry farmers were middle-aged and these findings are consistent with that study. Table 1 revealed that males (63.0%) were rearing more goats than females (37.0%) in the study area, indicating that the male goat farmers have the strength to engage all coping strategies on goat rearing in the study area, this finding conforms to the study by (Lantokpode *et al.*, 2022). Results from Table 1, also revealed that 41.7% of respondents had household size of 6–10 people, (27.3%) had household size of 1-5 people, (14.3%) had household size of 11–15 people, 16.7% had household size above 16 people in the study area. Implying that the respondents' goat farms have a sufficient amount of labor to address the causes of climate change. Additionally, the result further revealed that (17.8%) of the respondents were divorced, single, (28.6%) and married (53.6%). This suggests that the majority of respondents were married and would have enough family workers to complete some of the labor-intensive jobs associated with raising goats and adjusting to the changing climate in the study area and this finding is in line with the study by (Alemayehu, 2022). Table 1 revealed that, about 14.3% of respondents lacked formal education, 40.5% had completed primary school, 32.1% had completed secondary school, and only 13.1% had completed tertiary education. According to this, the majority of the respondents were educated, and a high level of literacy is anticipated to improve comprehension of concepts and innovations utilized to lessen the consequences of climate change on goat husbandry in the study area. Additionally, Table 1 indicates that the mean number of years of farming experience was 6.7 years, while (20.2%) of the respondents had between one and five years of experience with climate change mitigating strategies for goat rearing, 39.3% had between six and ten years, and significant proportion (23.8%) of respondents, had between eleven and fifteen years of experience with climate change mitigating strategies for goat rearing, and only 16.7% had more than sixteen years of experience with climate change coping strategies for goat rearing in the study area. This suggests that many of the study participants have a significant amount of expertise with coping mechanisms, which will assist to mitigate the impact of climate change on goat husbandry on their farms, this finding conforms to the study by (Lantokpode *et al.*, 2022).



**Table 1:** Distribution of the Respondents based on Socio-economic Characteristics (n=?)

Age	Frequency	Percentages	Mean
<20	10	12.0	
21-30	12	14.3	
31-40	24	28.6	
41-50	27	32.1	
>51	11	13.0	27 years
Sex			
Male	53	63.0	
Female	31	37.0	
Household Size			
1-5	23	27.3	
6-10	35	41.7	
11-15	12	14.3	
>16	14	16.7	7 persons
Marital status			
Single	24	28.6	
Married	45	53.6	
Divorced	15	17.8	
Educational level			
No formal education	12	14.3	
Primary school	34	40.5	
Secondary school	27	32.1	
Tertiary level	11	13.1	12 years
Farming experience			
1-5	17	20.2	
6-10	33	39.3	
11-15	20	23.8	
>16	14	16.7	6.7 years
Total	84	100	

**Source:** Field Survey, 2025.

### Sources of Information on Climate Change

According to results from Table 2, about 17.9% of respondents indicated that extension agents were the source of their information about climate change, 11.9% said that they learned about it from their family and friends, and television (19.0%) . The results also revealed that 11.9% of respondents derived their own information from radio in the study area, while only 10.7% of respondents obtained their information about climate change from newspapers and magazine, cooperative societies (13.1%),and social media (15.5%). Given that few of the goat farmers in the study area had constant access to electricity to power their radios, televisions, and phones, and that even the current high price of fuel is not helping, it is evident that the primary source of information about climate change for these farmers came from their extension agents. This outcome is consistent with the study by Dhakal *et al.* (2021), which found that farmers viewed the interpersonal and group methods as the most common ways to obtain climate change information.

**Table 2:** Distribution of Respondents based on the Sources of Information on Climate Change

Sources of Information	Frequency	Percentages
Extension Agents	19	22.6
Family and Friends	15	17.8
Television	17	20.2
Radio	13	15.4
Newspaper/Magazine	9	10.7
Cooperative Societies	18	21.4
Social Media	16	19.0

**Source:** Field Survey, 2025

\*Multiple responses allowed.

### Factors affecting Adaptation Strategies to Climate Change.

The regression model analysis of the link between climate change adaptation and the predictive variables in rural goat production in the study area is shown in the results of Table 3. According to the results, the regression model was able to explain about 83.2% of the link between climate change adaptation and the predictive factors, with the error term accounting for the remaining 16.8%. The  $R^2$  value was 0.832. From Table 3 results, it showed that household size and access to extension agents were all positive and significant at the 10% level. This suggests that increasing all of these factors will increase the adaptation strategies used to mitigate climate change and boost goat production in the study area. Age and marital status were positive and significant at the 5% level, and ownership of goat production and land ownership was positive at the 1% level as well. This suggests that as these variables rise, new ideas and innovations for climate change adaptation are adopted, making goat production in the study area profitable this finding conforms to the works by (Lantokpode *et al*, 2022), (Hristov, *et al*, 2022).

**Table 3:** Factors Affecting Adaptation Strategies on Climate Change.

Variables	Coefficients	Std errors	T-values
Constant	3.8028*	1.7782	2.1385
Age	1.621**	0.658	2.463
Household size	0.978***	0.349	2.802
Marital status	1.286**	0.516	2.492
Access to Extension Agent	0.882***	0.260	3.392
Climate Change awareness	0.526	0.376	1.398
Ownership of goats production	2.602*	1.269	2.050
Land ownership	2.476*	1.170	2.116
Model	$R^2=0.832$	Adjusted $R^2=0.643$	

**Source:** Field Survey, 2025      \*=1%, \*\*=5%, \*\*\*=10%

### Coping Strategies to Climate Change Employed by Goat Farmers.

According to the results in Table 4, the majority (65.5%) of goat farmers in the study area used high-resistant goat breeds to raise their livestock, while 34.5% did not. This suggests that the majority of these farmers used goat breeds that are resistant to the whims of climate change as a major coping strategy in the study area, meaning they won't lose many livestock. Additionally, Table 4 revealed that majority (71.4%) of respondents provided portable water for their goats in their farms, whereas 28.6% did not provide any kind of water. This suggests that goat farmers were conscious of the effects of water scarcity on their farms, and as a result, the majority of them provided water for their goats rather than depending on natural resources that may dry up due to climate change. Table 4 also revealed that more than half (52.4%) of respondents re-grassed their paddock, while 47.6% did not. This suggests that many farmers can continue to feed their livestock comfortably during harsh dry seasons brought on by climate change, without having to move around looking for grasses to graze. Additionally, 53.6% of goat farmers established rangelands for goat rearing in order to avoid the whims of climate change, while 46.4% did not have rangeland for goat rearing in the study area. From Table 4 results, majority (66.7%) of respondents in the study area gave their goats medication on a regular basis, while 33.3% did not. This suggests that most respondents made sure to vaccinate their goats to prevent disease and pest outbreaks on their farms. The result further revealed that majority (75%) of respondents in the study area sold some of their livestock to cover daily farm expenses, while 25% did not. This suggests that the majority of goat farmers used the money they raised from the sale of their goats to pay for some coping mechanisms they employed on the farm to lessen the effects of climate change. This outcome demonstrates that the goat farmers in the study area possess extensive knowledge of the coping mechanisms employed to lessen the impact of climate change on goat rearing, this finding conforms to the study by (Ifenychukwu *et al*, 2018), (Kabore *et al*, 2019), (Quedrago *et al*, 2021).





**Table 4: Coping Strategies to Climate Change Employed by Goat Farmers**

Coping Strategies	Frequency/ (%)	Total
Use of high resistant breeds	Yes 55(65.5) No 29(34.5)	84
Provision of portable water	Yes 60(71.4) No 24(28.6)	84
Re-grassing of paddock	Yes 44(52.4) No 40(47.6)	84
Rangeland establishment	Yes 45(53.6) No 39(46.4)	84
Fencing of camp	Yes 47(56.0) No 37(44.0)	84
Drug administration periodically	Yes 56(66.7) No 28(33.3)	84
Sale of livestock to meet needs	Yes 63(75.0) No 21(25.0)	84
Use of high quality grass	Yes 43(51.2) No 41(48.8)	84

**Source:** Field Survey, 2025

## CONCLUSION AND RECOMMENDATIONS

The study examined climate change and its mitigation strategies on goat production in the study area. The findings showed that majority of the respondents were within the economic active age and were married. Majority of the respondents have attended formal education at various levels and had reasonable years of climate change mitigating experience on goat production in the study area. The findings further revealed that extension agents were the major sources of climate change in the study area and most of them used high resistant goat breeds in their goat farms. Findings from the study further showed that household size and access to extension agents, were all positive and significant at 10% level. Age, marital status, ownership of goat production and land ownership were all positive and significant in influencing adaptation strategies among goat farmers in the study area. This study therefore recommends that goat farmers should form cooperative associations which will help procure high resistant goat breeds tolerant to the vagaries of climate change, also the cooperative associations should provide portable water during drought for the goat farmers to enable ease of proper digestion, thermoregulation and to avoid health problems for their goats. Government at all levels should employ more well trained agricultural extension agents to disseminate new ideas and innovations on climate change mitigation strategies on goat production in the study area so as to make the respondents be abreast of mitigating strategies on climate change. More so, policy makers, governments at all levels should take into consideration all these problems faced by goat farmers on climate change when enacting policies in the agricultural sector so as to help provide solutions that will enhance the respondents' adaptation strategies to climate change on goat farming in the study area.

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