

ASSESSMENT OF SHEEP FARMERS PERCEPTION OF CLIMATE CHANGE AND
ADAPTATION IN SOUTHEASTERN NIGERIA
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Abstract

The paper assessed sheep farmers' perception of climate change and adaptation in Southeast, Nigeria. Majorly, the paper examined the farmers awareness of the impact of climate change; the farmers sources of information on climate change; their perceived impact of climate change on sheep farming; as well as the adaptation measures used in addressing the impact of climate change on sheep farming. Cross-sectional survey design was used, while multi-stage sampling procedure was used to select the respondents for the study. Structured questionnaires were used to collect data from 80 sheep farmers within the study area. Accordingly, results show that the farmers perceived anthropogenic activities (3.6) and natural processes (3.5) as being responsible for climate change, but disagreed with spiritual forces (2.3) as a factor. The farmers were also able to recognize climate change related effects on their livestock production and productivity; hence, decrease in feed availability (3.5), fertility (3.7) and animal growth rate (3.7), as well as livestock disease susceptibility (3.6) were among the impacts identified. In respect to adaptation strategies, livestock species diversification (3.6), provision of sufficient water (3.6), as well as supplementary feeding (3.6), constituted the strategies adopted. Thus, from the findings, the study drew the conclusion that most sheep farmers in the Southeast know about climate change and its impact on their livestock, and also practices various adaptation strategies to address the negative effects on livestock productivity. The study therefore recommended among others, the need to ensure that sheep farmers have access to timely weather information, so as to enhance their perception and adaptation abilities to climate change.

Keywords: Climate change, Sheep farmers, Adaptation, Perception, Livestock

Introduction

Agriculture is negatively affected by climate

change. According to Apata, Samuel & Adeola (2009), Africa is generally acknowledged to be the continent that is most vulnerable to climate change because the weather is erratic and unreliable to livestock farmers. This implies that livestock farmers ought to be aware of the effects of weather patterns in the immediate and long terms. It also calls for adaptation measures that can be taken to curb the negative effects of climate change on livestock production. Hannah, Mozaharu, Rachael, Terry, Slaemu & Angela (2009), describes climate change as short, medium and long-term changes in weather patterns and temperature that are predicted to happen, or are already happening as a result of anthropogenic emission of greenhouse gases such as carbon dioxide. These changes include a higher frequency of extreme weather events such as drought and floods, as well as greater unpredictability and variability in the seasons and rainfall. The impact of climate change which manifests in the form of rising ambient temperature, rising sea levels, change in rainfall patterns, and emergence of new pests and diseases, among others, is felt all over the world and pose new risks to agriculture and food systems (Brida, Owiyo & Sokona, 2013).

Ruminants are adversely affected by the detrimental effects of extreme weather events. Climate change extremes and seasonal fluctuations in herbage quantity and quality affect the well-being of livestock leading to declines in production and reproduction efficiency (Sejian, 2013). For instance, temperature affects most of the critical factors for ruminant production, such as water and feed availability, production, reproduction and health of animals (Rojas-Downing, Pouyan, Harrigan & Woznicki, 2017). High temperatures predispose ruminants to physiological stress and diseases. Also, high temperatures trigger the incidence of transmittable chronic respiratory diseases: coryza, salmonellosis and infectious

laryngotracheitis (Biobaku & Amid, 2018). Thermal livestock stress decreases feed intake and efficiency of feed conversion, especially for livestock that are fed large amounts of high-quality feeds. Climate change affects feed availability and quality leading to nutrient deficiencies resulting in metabolic disease of varying nature. Mineral deficiencies result in anemia, retarded growth, and reproductive disorders in livestock. Also, the nutritional stress increases the case of pregnancy toxemia and neonatal death due to poor milk yield and resultant reduction in immunity with consequent proneness to many infectious diseases (Shinde & Sejian, 2013). Vector-borne diseases are also highly influenced by climatic factors. According to Ashraf, Mohammad, Basharat, Showkat, et al. (2017), climate change exerts both direct and indirect influences on the transmission of vector borne diseases, affecting timing of outbreak or the intensity of an outbreak, establishing a temporal linkage and affecting geographical distribution, establishing a spatial linkage of many infectious diseases in animals. Prolonging of the warm season due to climate change may increase the number of cycles of infection possible within 1 year for warm- or cold-associated diseases, respectively. As climate change disrupts rainfall patterns, there are high risks of a number of infectious diseases of ruminants including zoonotic illnesses. For instance, under high humidity, the incidence of helminthiasis increases in ruminants (Biobaku & Amid, 2018). Also, prolonged period of no rainfall leads to drought spells which affects pasture availability, quantity and quality. Feed scarcity due to limited pasture leads to stress, immune-suppression and finally predispose ruminant animals to different diseases and death.

Consequently, climate change perception by farmers is an important step for determining any climate risk management and mitigation measure (Tarfa, Ayuba, Onyeneke, Idris, et al, 2019). Response to climate change is usually a two-step process, which include perceiving climate change/event and based on the perceived event take appropriate measures to manage the risks associated with the event. Several studies conducted to examine perceptions of livestock farmers on climate change have shown that

farmers have different perceptions on climate change. Diggs (1991) cited in Mandleni & Anim (2011) found that approximately three-quarters of all livestock farmers surveyed in the Great Plains had different perceptions on change in climate. Another study conducted by Ishaya & Abaje (2008) in Nigeria, revealed that livestock farmers perceived climate change to have occurred over the years due to diverse human activities. A study by Mert, Mbow, Reenberg & Diouf (2009) in Sahel, Senegal indicated that livestock farmers were aware of the climate variability and identified wind and occasional excess rainfall as the most significant factors. In spite of low information about change however, farmers have unconsciously responded to the change in climate by developing adaptation or coping strategies that may not be sustainable in the long run. It has been reported that farmers in Nigeria have little adaptive capacity due to lack of scientific, technical, financial and institutional capacity to evaluate the impact of climate change (Kehinde & Adegunloye, 2011). Farmers therefore need help to ensure that adaptation strategies adopted by them against the impacts of climate change are further strengthened to efficiently cope with more unfriendly climatic conditions in the future.

Statement of the Problem

According to Onyedika & Okoronkwo (2009), several indicators or variables that increase greenhouse gases which are the major cause of climate change are very common and at a very high volume in Nigeria. In recent times, Nigeria has been experiencing severe and extreme flooding, increased environmental degradation, frequent drought, increased loss of biodiversity, changes in vegetational cover and declined forest resources. Efforts by the different tiers of government to control these natural and anthropogenic phenomena have not yielded the desired results. This is worrisome. While there are number of works on climate change adaptation and mitigation on agriculture, not much have focused on livestock farmers, particularly sheep farmers in Southeastern Nigeria. The problem is further complicated by the low level of awareness among sheep farmers. Sheep farmers stand the chance to lose their stock, experience a decline in birth rate, productivity, increased hunger, malnutrition and morbidity as a result of climate

change; hence, it is pertinent to ascertain the perception of sheep farmers on climate change and the adaptation strategies so far adopted within the southeastern zone of Nigeria.

Purpose of the Study

The general aim of this study is to assess the perception of sheep farmers on climate change on as well as the adaptation strategy being implemented. Specifically, the study sought to:

- i. examine the farmers awareness of the impact of climate change;
- ii. determine farmers sources of information on climate change;
- iii. find out farmers perceived impact of climate change on sheep farming;
- iv. identify the adaptation measures used in addressing the impact of climate change on sheep farming.

Research Questions

1. What is the degree of sheep farmers' awareness of the impact of climate change in Southeast, Nigeria?
2. What are the sources of information on climate change assessed by farmers on Southeast, Nigeria?
3. How do sheep farmers perceive climate change in Southeast, Nigeria
4. What are the adaptation measures used by sheep farmers in addressing the impact of climate change in Southeast, Nigeria?

Theoretical framework

This paper is anchored on TPB) which stems from the Theory of Reasoned Action (TRA). The TRA posits that attitude and subjective norms are the determinants of intention, and that intention directly affects behavior to some extent. In the TPB, individual intention mainly depends on three determinants: attitude, subjective norms, and perceived behavioral control. The theory posits that behavioral intentions are influenced by the attitude about the likelihood that the behavior will have the expected outcome and the subjective evaluation of the risks and benefits of that outcome. The two theories are based on the premise that individuals make logical, reasoned decisions to engage in specific behaviors by evaluating the information available to them. The performance of a behavior is determined by the individual's intention to engage in it, which is

influenced by the value the individual places on the behavior, the ease with which it can be done and the views of significant others and the perception that the behavior is within his/her control. This means that individuals will adopt a behavior which they think they can benefit from and which they have capacity to use within their own specific circumstances and which its adoption is supported by the members of their social system. Knowledge is a prerequisite for effective action. Li et al. (2019) noted that factors which influence pro-environmental behavior of individuals include environmental knowledge, demographic factors, institutional factors, economic factors, social and cultural factors, motivation, and so on. Farmers' knowledge about a technology is often influenced by their access to information which could come from extension, media and the farmers' social network. This knowledge influences farmers' evaluative capacity which in turn influences farmers' views about the practices (perceptions). Brokensha et al. (1980) noted that farmers' perception, knowledge and practice influence how farming decisions are made.

Methodology

The study used cross-sectional survey design to assess sheep farmers' perception of climate change and adaptation strategies in the study area. The study was conducted in Southeastern, Nigeria. The South East is one of the six geopolitical zones in Nigeria representing both a geographic and political region of the country. It comprises five states – Abia, Anambra, Ebonyi, Enugu, and Imo. The zone is bounded by the River Niger on the west, the riverine Niger Delta on the south, the flat North Central to the north, and the Cross River on the east. It is divided between the Cross–Niger transition forests eco-regions in the south and the Guinean forest–savanna mosaic in the drier north. Culturally, the vast majority of the zone falls within Igboland—the indigenous cultural homeland of the Igbo people, which makes up the largest ethnic percentage of the southeastern population at over 99.7%. Although the South East is the smallest geopolitical zone, it contributes greatly to the Nigerian economy due to oil and natural gas reserves along with a growing industrialized economy. Southeast is a cold region, with an average daily maximum

temperature of only 31 degrees. High humidity and hot temperatures make the weather pleasant at times, but also tropical humid. It is warm or hot all year long, and most precipitation falls from June to October.

A multi-stage sampling procedure was used to select the respondents for the study. In the first stage, two states comprising Enugu and Imo selected using simple random sampling technique. In each selected state, two agricultural zones were then randomly selected using simple random sampling. These were Owerri and Okigwe in Imo State and Enugu and Nsukka in Enugu state. In each Agricultural zone, two communities were randomly selected making a total of eight communities for the study. These were Ugwuene in Agwu and Amaechi in Nkanu, all in Enugu agricultural zone; Umualumo in Okigwe and Okwe in Onuimo, all in Okigwe agricultural zone; Ovoko and Akpa-Edem in Nsukka Agricultural zone; Amaigbo and Okpuala in Owerri agricultural zone. In each selected community, a list of farm households was compiled, from which ten farmers were randomly selected, bringing the total sampled respondents

for the study to eighty.

Structured questionnaires were used to collect data from 80 sheep farmers. The questionnaires were completed by the livestock farmers themselves. Information on socio-economic characteristics of the farmers such as age, level of education, farm size, household size, and years of farming experience were examined. To ascertain farmers' sources of information on climate change, a list of likely sources was presented to farmers to indicate their sources of information on climate change. In the same vein, to determine farmers' perceived impact of climate change on livestock, a list of variables on probable impact of climate change was provided on a 5-point Likert type scale. The values on the scale were added and divided by 5 to get the mean value of 3. Variables with mean score value ≥ 3 were regarded as possible impact of climate change, while variables with a mean score of ≤ 3 were not regarded as possible impact of climate change on sheep farming. Furthermore, data collected were analyzed and presented using descriptive statistics.

Results

Table 1: Socio-demographic Characteristics

Variable	n	%
Age (Years)		
≤30	17	21.3
31-40	24	30
41-50	19	23.7
51-60	11	13.8
60 and above	9	11.2
Sex		
Male	59	73.8
Female	21	26.2
Marital status		
Single	27	33.8
Married	51	63.7
Divorced	2	2.5
Acad. Qualification		
Primary	11	13.8
Secondary	29	36.2
OND/NCE/B.Sc.	32	40
No formal education	8	10

Variable	n	%
Household size		
1-5 persons	29	36.2
6-10	43	53.8
11 and above	8	10
Farming Experience		
1-5	21	26.3
6-10	17	21.2
11-15	10	12.5
16-20	21	26.3
21 and above	9	11.2
Membership of Association		
Yes	51	63.7
No	29	36.3

Table 1 presents the socio-economic characteristics of respondents. The majority (30%) of the farmers were between 31 to 40 years, with only about 11.2% above 60 years; just as the greater number of the participants were male (73.8%). Similarly, a considerable number (40%) of the respondents had attended tertiary level of education with only 10% without any formal education. Also, 63.7% were married, with household sizes ranging between less than 5

persons (36.2%) to 11 and above (10%). The majority (26.3%) had between 15 to 20 years of farming experiences; this means that the respondents had substantial knowledge on climate change. Lastly, 63.7% of the respondents were members of different social organizations, hence, farmers would be able to share their knowledge on climate change among each other and possibly discuss adaptation strategies.

Table 2: Sources of Information on climate change

Variables	n	%
1. Television	9	11.3
2. Radio	22	27.5
3. Newspaper	2	2.5
4. Personal observations	5	6.3
5. Fellow farmers	31	38.8
6. Family/Friends	4	5
7. Extension worker	7	8.8

Table 2 illustrates the sources of information accessible to sheep farmers on climate change. Accordingly, data shows that the mass media consisting of television (11.3%), radio (27.5%), as well newspaper (2.5%) were sources of information on climate change. Others were fellow farmers (38.8%), family and friends (5%) extension agents (8.8%) and personal observations (6.3%). Only 2.5% of the farmers got information on climate change through newspaper, however, radio (27.5%) seemed to

perform better considering its wide reach. Nevertheless, the data shows that sheep farmers relied more on each other considering that they were in the same venture and faced the same challenges, hence, the large percentage (38.8%) recorded. This finding aligns with Okoro et al. (2016) who reported that the major sources of information about climate change for rural farmers in the Enugu state were personal observation, friends, radio, and television.

Table 3:

	Farmers Perception of Climate Change	(X)	Remark
1.	Climate has changed	3.7	Accepted
2.	Increased variability in rainfall	3.8	Accepted
3.	Increased drought	3.1	Accepted
4.	Change in temperature	3.4	Accepted
5.	Anthropogenic actions are responsible	3.6	Accepted
6.	Climate change is a natural occurrence	3.5	Accepted
7.	Climate change is borne of spiritual forces	2.3	Rejected

Table 3 shows the findings on the perception of farmers on climate change. The mean responses indicate that sheep farmers in Southeast agreed that the climatic conditions has changed (3.7); there is increase variability in rainfall (3.8);

increase in drought occurrences (3.1), as well as change in temperature (3.4). This result aligns with the finding of Adeoti et al. (2016), who found that 84% of respondents perceived an increase in temperature. Owing to the trend in rainfall, most

Table 4: Climate change impacts on livestock

	Climate change impacts on livestock	(X)	Remark
1.	Increase price of grain/feed supplement	3.6	Accepted
2.	Reduced growth rate	3.7	Accepted
3.	Reduced feed availability	3.5	Accepted
4.	Reduced meat quality	3.2	Accepted
5.	Livestock disease susceptibility	3.6	Accepted
6.	Reduced fertility	3.7	Accepted
7.	Morbidity of livestock	3.6	Accepted
8.	Heat stress	3.6	Accepted
9.	Livestock mortality	3.4	Accepted
10.	Reduced water availability	3.2	Accepted
11.	Length of forage growing period	3.6	Accepted
12.	Outbreak of new/contagious disease	3.1	Accepted

Table 4 demonstrates the impact of climate change on sheep rearing such as increase in price of grain/feed supplement (3.6) and reduced feed availability (3.5). Thus, Abazinab, et al (2022) posits that, as the uncertainty in the onset and duration of rains increases due to climate change, the quantity and quality of pastures decline, while farmers resort to feed supplementation in order to cope. The competition for feed supplements no doubt, leads to high prices which mean more financial pressure on the ruminant farmers. Also, increased susceptibility of sheep to diseases (3.6), reduced meat quality (3.2), reduced fertility (3.7), length of forage growing period (3.6), and increased mortality of animals (3.4) were recorded as the impact of climate change. Respondents equally indicated reduced growth rate (3.7). Reduced growth rate according to Abazinab, et al (2022) is directly linked to low feed intake. When feed intake of animals is affected, major metabolic processes are retarded

leading to poor growth rate, reduced milk production, low resistance to diseases and possible death. In the same vein, heat stress on the animals recorded a mean score of (3.6), outbreak of new/contagious disease received (3.1) while reduced water availability recorded (3.2). Consequently, Tiruneh and Tegene (2018) affirmed that higher temperatures resulting from climate change may increase the rate of development of certain pathogens or parasites that have one or more life cycle stages outside their animal host. High temperatures lead to drought and heat stress on animals which results in physiological disorders in ruminants. As such, Malami and Tukur (2017) report that climate change has led to reduction on feed resources, loss in weight, increased mortality of young animals, increased heat load on the animals from cloudless skies for most part of the year, increased diseases and pest incidence in ruminant production. These effects will no doubt result to

low production thereby impacting negatively on the farmers' income. The finding of this study is also consistent with the result of Craine et al. (2010), who found that, increasing temperature and declining precipitation levels decrease forage crude protein, digestible organic matter and quality. Thus, Amole and Ayantunde (2016) opines that, options to better adapt feed resources to climate change effect may include cultivation

of resilient forage species, fodder conservation including silage and hay making, improvement of forage quality such as processing of locally available feed resources, particularly crop residues, integration of forage legumes into arable crops and grazing management. These feed interventions can improve livestock productivity, enhance adaptation, and reduce greenhouse gas emissions.

Table 5: Responses on Adaptation strategies adopted by Farmers

	Adaptation strategies	(X)	Remark
1.	Supplementary feeding	3.6	Accepted
2.	Forage production	3.2	Accepted
3.	Diversification of sheep breed	3.6	Accepted
4.	Vaccination/treatment of animals	3.5	Accepted
5.	Reducing stocking density	3.6	Accepted
6.	Adequate ventilation of pens	3.6	Accepted
7.	Use of local resistant breeds	3.6	Accepted
8.	Cross breeding with resistant breeds	3.1	Accepted
9.	Adequate provision of drinking water	3.6	Accepted
10.	Conservation of feeding	3.5	Accepted
11.	Mixed farming	3.1	Accepted
12.	Feeding with higher proportion of concentrates	3.0	Accepted

Table 5 sums up adaptation strategies to climate change; hence, sheep (ruminant) farmers are adapting to climate change by using various management practices. These practices ensure that farmers continue to increase production to enhance profitability of their livelihood activities while constituting minimal or no harm to the environment. In line with this, results show that respondents adopted mitigation options that ranged from supplementary feeding (3.6), forage production (3.2), diversification of breed (3.6), vaccination of animals (3.5), reducing stock density (3.6), adequate ventilation of sheep pens (3.6), etc. Others include use of resistant breeds (3.6), cross breeding of sheep with resistant breed (3.1) adequate provision of drinking water (3.6), conservation of feeding (3.5), adoption of mixed farming practice (3.1) as well as feeding of sheep with higher proportion of concentrates (3.0). In support of these findings, IFAD (2009) affirms that, deficiencies and metabolic diseases caused by feed scarcity and poor-quality feed can be cushioned through feed diversification and use of supplements, while removal of effluents can ameliorate the build-up of GHGs. Likewise, Haque (2018) maintains that feeding with higher proportion of concentrates reduces methane

release during enteric fermentation. Additionally, Lomiso (2020) found that, reducing herd size, diversifying animals species, supplementary feeding, improving animal health, income diversification, and temporary migration were the main adaptation strategies practiced by livestock farmers.

Conclusion

The study assessed sheep farmers' perceptions of climate change and adaptations strategies in Southeast, Nigeria. Accordingly, the participants perceived anthropogenic activities (3.6) and natural processes (3.5) as being responsible for climate change, but disagreed with spiritual forces (2.3) as a factor. The study also found that respondents were able to recognize climate change related effects on their livestock production and productivity; hence, decrease in feed availability (3.5) and quality, water availability (3.2), fertility (3.7) and animal growth rate (3.7), mortality (3.4) and livestock disease susceptibility (3.6) were among the impacts identified. In respect to adaptation strategies, livestock species diversification (3.6), reducing livestock density (3.6), provision of sufficient water (3.6), forage production (3.2),

feed conservation (3.5) as well as supplementary feeding (3.6), constituted the strategies adopted.

Recommendations

Based on these findings, this study recommends as follows:

- i. There is need to ensure that sheep farmers have access to timely weather information, livestock market and adequate extension services so as to enhance their perception and adaptation abilities to climate change.
- ii. It is imperative for policy makers and livestock development stakeholders to implement interventions that include improved forage production, appropriate and effective feed and water conservation technologies to enable farmers adapt to climate change.
- iii. To further enhance the adaptive capacities of sheep farmers in Southeast, farmers should be provided with weather-based livestock insurance schemes to enable them withstand climate change impact.

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