

Knowledge level of ruminant farmers on climate change in Enugu State, Nigeria

Nwobodo Cynthia Ebere✉, Nwokolo Blessing

To Cite:

Ebere NC, Blessing N. Knowledge level of ruminant farmers on climate change in Enugu State, Nigeria. *Climate Change*, 2021, 7(24), 52-58

Author Affiliation:

Department of Agricultural Extension, University of Nigeria, Nsukka, Nigeria

✉Corresponding author:

Email: cynthia.nwobodo@unn.edu.ng

Peer-Review History

Received: 21 August 2021

Reviewed & Revised: 22/August/2021 to 20/September/2021

Accepted: 22 September 2021

Published: September 2021

Peer-review

External peer-review was done through double-blind method.



© The Author(s) 2021. Open Access. This article is licensed under a [Creative Commons Attribution License 4.0 \(CC BY 4.0\)](https://creativecommons.org/licenses/by/4.0/), which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made. To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/>.

ABSTRACT

The study was designed to assess the knowledge level of ruminant farmers on climate change in Enugu State, Nigeria. The objectives of the study include; describe the socio-economic characteristics of ruminant farmers in the area, to assess the knowledge level of ruminant farmers on climate change, to ascertain the perceived effects of climate change on ruminant production and to determine the socio-economic factors influencing ruminant farmers' knowledge level on climate change. Multistage sampling procedure was used to select ninety six (96) respondents from two out of the six agricultural zones in the state. Semi-structured interview schedule was used in data collection. Data was analyzed using descriptive statistics. The results showed that ruminant farming is mostly done by the aged and that goats were the most common ruminants kept. Majority of the farmers had moderate knowledge on climate change. All the farmers perceived the effect of climate change in their production process. Educational level ($t = 3.238$; $p = 0.002$) was the factor that significantly influences the climate change knowledge level of ruminant farmers. The knowledge level of ruminant farmers should be improved through public extension services, dissemination of appropriate and relevant information on climate change.

Keywords: Climate change, ruminants, adaptation practices, farmers' knowledge.

1. INTRODUCTION

Ruminants play important roles in food and nutritional security of millions of rural people especially the landless, marginal and small holder farmers (Kumar and Roy, 2013). They're used for the production of many products including meat, milk, skin, wool and manure. Livestock classified as ruminants include cattle, sheep, and goats. They are characterized with a unique digestive system that allows them utilize energy from fibrous plant materials (University of Minnesota Extension, 2015) unlike other herbivores and monogastrics. Their digestive system can ferment feedstuffs to release for energy used by the animals. Instead of one compartment to the stomach they have four compartments namely rumen, reticulum, omasum and abomasum (University of Minnesota Extension, 2015).

Climate change has gained increasing attention in the natural sciences, social and political sciences researches and debates. It has formed major issue of discuss in the world political, economic, and environmental discuss in the past decades (Haunschild, Bornmann, Marx, 2016). Climate change is the variation of elements of climate such as rainfall, temperature, and wind among others that change significantly over decades affecting agricultural production (Tsojon, 2017). Agricultural systems are mostly affected by extreme climate conditions such as drought, flood and hailstorms including seasonal variation and change in rainfall patterns (Nwobodo, Odi, Ezeuzo, Iloegbu, 2018). Climate change is caused by greenhouse gases (GHGs). The GHGs are certain atmospheric gases which form a blanket around the earth, allowing solar radiation to penetrate, but preventing it from escaping. The more these greenhouse gases, the hotter the earth (Sejian, Indu and Naqvi 2013). The three most important greenhouse gases include carbon (iv) oxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) (Humane Society International (HSI), 2011). These gases are not harmful in their natural quantities as they contribute to the sustenance of life on earth by trapping excess heat near the surface of the Earth. However, human activities since the industrial revolution have injected significant amounts of these gases to the atmosphere which has resulted in increased greenhouse effect. This greenhouse effect traps excess heat to the surface of the earth causing global warming.

Climatic change has been found to occur due to natural variability or as a result of human activities (Tsojon, 2017). Climate change resulting from human activities include rapid deforestation for agricultural and industrial purposes, carbon (iv) oxide emission from fossil fuel burning during transportation, use of inorganic fertilizers in crop production and enteric fermentation in ruminant animals (Nwona, 2013). The natural cause of climate change is, as a result of variations in earth's orbits, variation in ocean circulation, variation in albedo of the continents, as well as variation in solar radiation (Adedeji, Okocha and Olufemi, 2014).

Decision-making for climate change adaptation requires knowledge on climate change issues. More meaningful decisions on adaptation and mitigation strategies would be taken if farmers have adequate knowledge on problems of adverse climate. Knowledge on the causes, effects and adaptation and mitigation strategies to climate change will influence farmers' use of good adaptation/mitigation strategies to enhance productivity while reducing the effect of ruminant production on climate change. According to Enete, Madu, Mojekwu et al., (2011), the awareness of climate change problems and the potential benefits of taking action can enhance the adoption of agricultural technologies and that farmers' awareness of change in climate attributes is important to adaptation decision making. Therefore, the following questions agitate the mind: What are the effects of climate change on ruminant production? What is the knowledge level of ruminant farmers on climate change? What factors affect the knowledge level of ruminant farmers on climate change?

Purpose of the study

The study was designed to determine ruminant farmers' climate change knowledge in Enugu State, Nigeria. The specific objectives were to:

1. Ascertain the knowledge level of ruminant farmers on climate change;
2. Ascertain the perceived effects of climate change on ruminant production;
3. Determine the socio-economic factors influencing ruminant farmers' knowledge level on climate change.

2. METHODOLOGY

The study area was Enugu State, Nigeria. Ninety six respondents were selected through multistage from two out of the six agricultural zones in the State. Semi-structured interview schedule was used in data collection. The knowledge of respondents was collected as a nominal value using (Yes =1 or No= 0) on a set of thirty (30) knowledge statements on causes (10), effects(10) and adaptation/mitigation measures (10) to climate change. Respondents were therefore scored based on correctness of their responses. Respondents were under low knowledge (1-10), moderate knowledge (11-20), and high knowledge (21-30). The perceived effects of climate change on ruminant production were collected by asking respondents to tick 'yes' or 'no' to the effects of climate change which they experienced in their ruminant animal production. The perceived effectiveness of sustainable production practices used was determined on a four-point Likert-type scale with a mean/cut-off point of 2.5. Constraints encountered using sustainable practices were collected on a four-point Likert-type scale with a mean/cut-off point of 2.5. Data were analyzed using percentage and mean scores, multiple regression.

3. RESULTS AND DISCUSSION

Knowledge level of ruminant farmers on climate change

Table 1 shows that all (100%) of the respondents experienced climate change out of which majority (88.5%) of the respondents have moderate knowledge on climate change while 9.4% have high knowledge. Only about 2.1% of the respondents have low knowledge on climate change. The result indicates that farmers are fairly aware of climate change and can easily adopt any innovative adaptation strategies introduced to them by extension agents. Enete et al., (2011) noted that farmers need to be aware of climate change and how they could take concrete actions to enhance adaptation. It can be deduced from the result that farmers' knowledge level on climate change should be improved as this would influence their decision in using good adaptation and mitigation strategies.

Table 1: Categorization of Ruminant farmers according to knowledge on climate change

Knowledge level	Frequency	Percentage
Experience climate change		
Yes	96	100
Low knowledge		
1-10	2	2.1
Moderate knowledge		
11-20	85	88.5
High knowledge		
21-30	9	9.4

Perceived effect of climate change on ruminant production

Table 2 show that (100%) of the respondents perceived the effect of climate change in their production process out of which majority (94.8%) of the respondents perceived increased price of grain/feed supplement while 89.6% perceived increased livestock disease occurrence. Also, 88.5% of the respondents experienced reduced feed/pasture availability and increased mortality of animals. Similarly, 84.4% of the respondents perceived reduced growth rate and 81.3% perceived lower feed intake. About 60.4% experienced heat stress on their animals and 54.2% experienced reduced water availability. This corroborates Malami and Tukur (2017) that climate change has led to reduction in the amount of milk, effect 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 in Semi-Arid Nigeria.

Table 2: Perceived effects of climate change on ruminant production

Effects	Frequency	Percentage
Climate change affects production process		
Yes	96	100
Heat stress on animals	58	60.4
Lower feed intake	78	81.3
Reduced growth rate	81	84.4
Reduced milk production	7	7.3
Reduced milk quality	4	4.2
Reduced feed/pasture availability	85	88.5
Reduced water availability	52	54.2
Reduced quality of pasture available	44	45.8
Increase livestock diseases occurrence	86	89.6
Increased mortality of animals	85	88.5
Reduced meat quality	4	4.2
Reduced fertility	27	28.1
Increase price of grain/feed supplement	91	94.8
Change in the distribution of pests	10	10.4
Others (cold stress)	9	9.4

Perceived effectiveness of adaptation and mitigation practices

Table 3 presents farmers' perceived effectiveness of sustainable production practices including: adequate ventilation of pens (M=3.90; SD=0.47), provision of sunshade (M=3.88; SD=0.55), and reducing the number of animals in a pen (M=3.36; SD=0.95). These practices are fundamentally employed in coping with high temperatures. This means that adequate ventilation, provision of sun shade and reduction in stocking density can be effectively used to manage heat stress during periods of high temperature resulting from climate change. Respondents also noted that reduction in number of animals in a pen is effective in slowing down the spread of pests and diseases. Other effective practices were: use of local breeds that are resistant to the effects of climate change (M=3.71; SD 0.60); diversification with crop farming (M=3.68; SD=0.79), diversification of animal feed (M=3.64; SD=0.70); diversification of livestock (M=3.52; SD=0.81); and diversification with non-farming business (M=3.45; SD=1.00). Diversification of production enterprises such as diversification into different livestock species, crop-livestock diversification, diversification to non-agricultural businesses are effective resilience options to possible economic shocks which farmers may face during climate disasters. Workneh et. al., (2014) noted that diversification of livestock, crop-livestock diversification and diversification with non-farming business helps farmers to sustain their livelihood and stabilize income. Use of feed supplements (M=3.61; SD=0.77), provision of plenty fresh drinking water (M=3.60; SD=0.72) were also rated as effective. Provision of extra feed and water are definitely the sure ways to overcoming the effects of feed and water shortages during drought periods. Frequent manure removal (M=3.54; SD=0.58) is effective in reducing the occurrence and spread of communicable diseases and in lowering high temperatures and consequent releases of N₂O and CH₄. Other sustainable production practices rated effective were: intensive rearing of animals/home feeding (M=3.34; SD=0.86) and medication/treatment of animals (M=2.91; SD=0.85). Proper veterinary services is paramount in ensuring herd health as climate change aggravates existing animal diseases and encourages the spread of new diseases of ruminants.

It is important to note that almost all (except for diversification with non-farm businesses) the standard deviations for the practices rated effective were less than zero. The implication of this result is that the responses were very close to the mean showing a convergence in the 'effectiveness' rating given by respondents for each of those practices. On the other hand, it is interesting to observe the bit of divergence in their views on diversification with non-farm businesses (SD =1.00). Farmers would prefer enhancing their resilience to climate change within the livelihood activities in which they already have some capacity than in other business for which they may not have sufficient knowledge and skills to run. Therefore, efforts to help farmers build resilience to climate change should concentrate on on-farm sustainable practices as they will be more likely to adopt those practices which are compatible with the economic activities they are conversant with.

Table 3 Effectiveness of adaptation and mitigation practices used

Adaptation practices	Mean	Std deviation
Reducing the number of animals	3.36	0.95
Provision of sun shade	3.88	0.55
Planting of trees around animal houses	2.26	1.09
Adequate ventilation of pens	3.90	0.47
Addition of oils to animal diet reduces ruminal protozoa and protozoa associated methanogens	1.50	0.65
Feeding with higher proportion of concentrates	1.55	0.81
Provision of plenty fresh drinking water	3.60	0.72
Use of local breeds resistant to the effects of climate change	3.71	0.60
Harvesting forage for ensiling at an early stage of maturity	1.15	0.41
Seasonal migration (movement) of animals	1.30	0.73
Reduce manure storage time	1.35	0.67
Providing bedding materials during cold	1.47	0.74
Cross breeding with resistant breeds	1.66	0.90
Use of feed supplement	3.61	0.77
Frequent manure removal	3.54	0.58
Using rotational grazing system	2.07	1.11
Medication/treatment of animals	2.91	0.85
Diversification with non-farming businesses	3.45	1.00

Intensive rearing of animals/home feeding	3.34	0.86
Provision of vegetative cover (grasses) around animal farm to reduce heat radiation from the soil.	1.51	0.95
Diversification of livestock	3.52	0.81
Reduce temperature in manure storage	1.30	0.60
Storing of animal feed (hay, straw, silage etc)	1.32	0.66
Diversification of animal feed	3.64	0.70
Diversification with crop farming	3.68	0.79
Immunization/vaccination of animals	1.40	0.78

Source: Field data, 2018-2019

Cut-off = 2.5

Constraints to use of adaptation and mitigation practices

The challenges (Table 4) farmers encounter in using of sustainable practice in ruminant production were: lack of funds (M=3.71; SD=0.78), high prevalence of animal diseases (M=2.77; SD=0.83), high cost of drugs (M=2.68; SD=1.11) and land scarcity (M=2.52; SD=1.24). Land scarcity and lack of funds hinders expansion of ruminant production enterprise. Farmers are limited in the number of animals they can keep because of insufficient fund and limited land area. Farmers in the area could only construct small pens within the available land which can only contain limited number of animals. Respondents narrated how livestock diseases such as trypanosomiasis, mastitis, brucellosis, foot and mouth disease, ecto- parasites and endo-parasites are reported had constrained their ruminant production enterprise. They stated that high cost of drugs and veterinary services to attend to sick animals is very high leaving many of the farmers without regular access veterinary services. Ofor et al., (2018) had noted that insufficient fund and disease incidence were the major constraints identified by small ruminant farmers. The increased incidences of diseases outbreak resulting from climate change without regular access to veterinary services leads to high mortality which translates to huge economic losses to ruminant farmers.

The standard deviations from almost all the results were less than zero (0), except for high cost of drugs. This suggests that respondents had convergent view on the constraints they faced in using sustainable production practices. However, respondents had little bit of divergent view on high cost of drug. This could mean that high cost of drug is relative to the income level of each of the respondents. Most of the ruminant farmers were poor and would find it costly to afford basic drugs for their animals. Having identified diseases outbreak as a major constraint, the farmers would not have complained about the cost of drugs if they were high income earners.

Table 4: Constraints to farmers' use of adaptation and mitigation practices

Constraints	Mean	Std deviation
Lack of funds	3.71	0.78
High cost of feeds	2.41	1.25
High prevalence of animal diseases	2.77	0.83
Poor educational level of farmers	2.00	1.01
Failed government policies	1.70	0.95
Urbanization	1.14	0.57
Inadequate storage facilities	1.51	0.81
Glut when marketing during shock	1.27	0.62
Inadequate extension services	2.37	1.08
Inadequate manpower	2.20	1.15
Poor awareness on sustainable production practices	2.22	1.16
Water scarcity	1.70	0.81
Pressure on grazing lands	1.45	0.80
Lack of access to improved breeds	1.56	0.90
Theft	1.47	0.94
Inadequate modern farm input	1.56	0.89
Lack of good management skills	1.99	1.05

High cost of drugs	2.68	1.11
Transportation issues	1.39	0.64
Inadequate basic infrastructure	1.50	0.82
Land scarcity	2.52	1.24
Poor attitude to animal production	1.71	1.10
Cultural influence	1.03	0.18

Source: Field data, 2018-2019

Cut-off = 2.5

Socio-economic factors influencing climate change knowledge level of respondents

The regression result in Table 5 show that among the factors studied, educational level ($t = 3.238$; $p = 0.002$) was the factor that significantly influences the climate change knowledge level of ruminant farmers. This means that farmers with formal education were more knowledgeable on climate change issues than those without formal education. This could be linked to literacy which is a factor in access to information. The null hypothesis is therefore rejected for educational level.

On the other hand, there was no significant relationship between farmers' knowledge level and other socio-economic factors such as: age ($t = 0.991$; $p = 0.326$), sex ($t = -0.955$; $p = 0.343$), marital status ($t = -1.525$; $p = 0.132$), years of experience in ruminant production ($t = -0.576$; $p = 0.567$), size of household ($t = -1.613$; $p = 0.112$), extension contact ($t = -0.198$; $p = 0.844$), access to veterinary services ($t = -0.068$; $p = 0.946$), belonging to social organizations ($t = 0.052$; $p = 0.959$), access to credits ($t = -1.013$; $p = 0.315$). Therefore, the null hypothesis is accepted for these factors.

Table 5 Socio-economic factors influencing climate change knowledge level of respondents

Model	Unstandardized coefficients		Standardized coefficients		
	B	Std Error	Beta	T	Sig
Constant	14.899	3.366		4.426	0.000
Age	0.037	0.037	0.143	0.991	0.326
Sex	-0.764	0.799	-0.129	-0.955	0.343
Marital status	-1.462	0.959	-0.177	-1.525	0.132
Educational level	2.992	0.924	0.439	3.238	0.002
Years of experience in ruminant production	-0.023	0.041	-0.083	-0.576	0.567
Size of household	-0.284	0.176	-0.182	-1.613	0.112
Extension contact	-0.580	2.933	-0.022	-0.198	0.844
Access to veterinary services	-0.052	0.764	-0.009	-0.068	0.946
Belonging to social organization	0.162	3.105	0.006	0.052	0.959
Access to credits facilities	-1.796	1.773	-0.116	-1.013	0.315
Estimated monthly income	3.442-5	0.000	0.171	1.242	0.219
Annual income from ruminant production	8.734-6	0.000	0.133	0.881	0.382

Dependent variable: knowledge level; $P=0.05$; $R=0.504$; $R^2=0.254$; Adjusted $R^2=0.119$

4. CONCLUSION

From the study, it can be deduced that ruminant farmers in Enugu State were aged, dominated by male and were married. The farmers had moderate knowledge on climate change. All of the farmers perceived the effects of climate change in their production process. Effects of climate change on ruminant production perceived by farmers include: increased price of grains/feed supplement, increased livestock diseases occurrences, reduced feed/pasture availability and increased mortality of animals. Educational level was the factor that significantly influences ruminant farmers' knowledge level on climate change. Therefore, the knowledge of ruminant farmers should be improved through public extension services, dissemination of appropriate and relevant information on climate change and sustainability through radio as ruminant production in Enugu State is done mostly by the aged. Literate people should be encouraged to engage in ruminant production as they are more knowledgeable on climate change issues.

Funding

This study was funded by the author only.

Conflict of Interest

The author declares that they have no conflict of interest.

Data and materials availability

All data associated with this study are present in the paper.

REFERENCES AND NOTES

- Adedeji, O., Okocha, R. and Olufemi, O. (2014). Global climate change. *Journal of Geoscience and Environment Protection*, 2: 114-122
- Chah, J.M. and Igbokwe, E.M. (2011). Plants used for Small Ruminants Nutrition in the Eastern Guinea Savannah Region of Nigeria. *Livestock Research for Rural Development*, 23(8). Retrieved Oct 24, 2019 from <http://www.lrrd.org/lrrd23/8/chah23173.htm>
- Enete, A.A., Madu, I.I., Mojekwu, J.C., Onyekuru, A.N., Onwubuya, E.A. and Eze Fidelis (2011). Indigenous agricultural adaptation to climate change: Study of Imo and Enugu States in Southeast Nigeria. African Technology Policy Studies Network. Working Paper Series/No. 53. ISBN: 978-9966-1552-2-1
- Enwelu, I.A., Ezeuko, E.I. and Machebe, N.S. (2015). Challenges of smallholder sheep and goat keeping in rural communities of Aguata Agricultural Zone of Anambra State, Nigeria. *Indian Journal of Animal Research*, 49(3): 373-377
- Eze, C.O., Chah, J.M., Uddin, I.O., Anugwa, I.J. and Igbokwe, E.M. (2017). Bio-security measures employed by farmers in Enugu State, Nigeria. *Journal of Agricultural Extension*, 12(3). Retrieved Oct 24, 2019 from <http://www.ajol.info/index.php/jae>
- Haunschild, R., Bornmann, L. and Marx, W. (2016). Climate change research in view of bibliometrics. *PLoS ONE*, 11(7).
- Humane Society International (HSI) 2011. An HSI Report: The Impact of Animal Agriculture on Global Warming and Climate Change. Retrieved 20 October 2018 from <http://www.humanesociety.org/assets/pdfs/farm/hsus-the-impact-of-animal-agriculture-on-global-warming-and-climate-change.pdf>
- Kumar, S. and Roy, M.M. (2013). Small Ruminant's Role in Sustaining Rural Livelihoods in Arid and Semi-arid Regions and their Potential for Commercialization. *New Paradigms in livestock production from traditional to commercial farming and beyond* (Eds) Shiv Prasad et al (2013), Agrotech publishing academy, Udaipur, pp. 57-80
- Malami, B.S. and Tukur, H.M. (2017). Effects of climate change on livestock production in semi-arid Nigeria: pastoralists' perception and coping strategies. *Usmanu Danfodiyo University, Sokoto-Nigeria*, 1(1-2): 16-23
- Nwobodo, C. E, Odii, J.N., Ezeuzo, O.P. and Iloegbu, A.C. (2018). Targeting vulnerable groups in climate change extension. *Climate Change*, 4(14): 156-165
- Nwona, Hyginus A. (2013). Climate change: causes, effects and the need for science education for sustainable development. *Mediterranean Journal of Social Sciences*, 4 (8)
- Sejian, V., Indu, S. and Naqvi, S.M.K. (2013) Impact of short term exposure to different environmental temperature on the blood biochemical and endocrine responses of Malpura ewes under semi-arid tropical environment. *Indian Journal of Animal Science*, 83(11): 1155-1160.
- Tsojon Jifin, D. (2017). Impact of climate change on agricultural production by farmers in Taraba State, Nigeria. *International Journal of Entrepreneurial Development, Education and Science Research*, 4(1)
- University of Minnesota Extension (2015). The Ruminant Digestive System. Retrieved 25 January, 2019 from <https://extension.umn.edu/diary-nutrition/ruminant-digestive-system>