

Awareness, Manifestation and Information Sources on Climate Change among Irrigation Farmers in Katsina State, Nigeria

Sulaiman Umar

Department of Agricultural Economics and Rural Sociology, Faculty of Agriculture/Institute for Agricultural Research, Ahmadu Bello University, PMB 1044, Samaru-Zaria, Nigeria

***Corresponding Authors**

Name: Sulaiman Umar

Email: sulaimanumar@hotmail.com

Abstract: Insufficient rainfall has been a major challenge to agricultural production in Katsina State, Northern Nigeria. The situation is being aggravated by climate change, a trending research development area. Farmers employ irrigation to supplement the water deficit in production. This research assessed the awareness of such farmers with regards to climate change and its manifestation, as well as the sources via which they obtained information on climate change. The study was carried out in Ajiwa and Dutsinma agricultural zones of Katsina State. A sample of 200 respondents was randomly selected and interviewed using structured questionnaire. The study found that there is high level of awareness of climate change among the respondents with only 1.5% claiming unawareness. The most important sources of information are: other farmers, identified by 96%; radio (88.5%); cooperative societies (71%); rural markets (63.5%); and extension agents (59.5%). Longer dry season has been identified by 83% of the respondents as manifestation of climate change in the study area. Other important indicators include: erratic rainfall pattern (79.5%); severe harmattan (72%); droughts (64.5%); and increased pest incidences (52%). These findings could serve as veritable information and basis in formulating effective people-centred climate change adaptation and mitigation programmes and policies.

Keywords: awareness, climate change, information, Katsina, manifestation

INTRODUCTION

In most parts of Nigeria, precipitation is concentrated in a particular period: the rainy season. The intensity, duration and quantity of rainfall depreciate northwards as one moves from the coastal South inwards to the hinterland north. There are several problems associated with total annual precipitation which include deficiency, distribution in time and space and the low dependability of rainfall especially in the parts of North where rainy season lasts about four months: mostly June to September [1]. Hence, the need to supplement rainfall with artificial application of water in agricultural production arises. Furthermore, Nigeria is listed by the United Nations Food and Agriculture Organization (FAO) among those nations that are technically unable to meet their food needs from rainfed production at a low level of inputs and appear likely to remain so even at intermediate levels of inputs at some points between 2000 and 2025[2]. This, coupled with climate change, makes irrigation imperative to sustainable food sufficiency among small-holder farmers of Northern Nigeria. Irrigation has been defined as the application of water to the soil for the purpose of supplying moisture essential for plant growth. It is also undertaken to provide an insurance against droughts, for cooling the soil and atmosphere. It equally provides a more favourable environment for plant growth. Irrigation washes out or dilutes salts in the soil and reduces the hazards of piping and softening

tillage pans[3]. It is found to be a wide-scale agricultural activity in the dry parts of Sub-Saharan Africa, especially in communities endowed with sources of water. According to Norman[4] some of the benefits of irrigation include: increasing the range of choice of crops and of livestock, thus providing flexibility in decision-making; focusing more complete and efficient resource use; lessening the danger of crop failure and the range of yield fluctuations, hence reducing uncertainties; increasing the capacity of the land for input of other factors; increasing the size of total farm business; and shifting the factor- product curves towards higher input and greater production.

Climate is the long term average weather conditions of a region while weather refers to the daily fluctuating state of the atmosphere[5]. The main elements of weather are temperature, rainfall, dew, humidity, mist, sunshine, clouds and haze. The International Panel on Climate Change (IPCC) defines climate change as statistically significant variations in climate condition that persists for an extended period, typically for decades or longer. It is any change in climate, rainfall or productivity caused by natural variability and direct or indirect human activities that alter the composition of the atmosphere [6, 7].

Climate change is as a result of global warming which is caused by green house effect

(increase in greenhouse gases – these are notably carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), Ozone (O₃), hydro fluorocarbons (HFCs), per fluorocarbons (PFCs), sulphur hexafluoride (SF₆) and water vapour (H₂O)); variations in earth's orbital characteristics (example: solar output, earth-sun geometry and interstellar dust); and volcanic eruptions - which invariably release large amounts of sulphur dioxide into the atmosphere [8]. Other contributory factors to global warming include some human activities like deforestation, desertification, pollution, degradation, erosion, emission of greenhouse gases, bush burning, oil spills, gas flaring, waste disposal and population growth [9].

Climate change assumes the centre stage in development research due to its numerous adverse effects on humankind and the environment which are more devastating on African agriculture and hence food security [10]. Its effects range from drought events to flooding events, sea level rise, drying of rivers and streams, decrease in water quality, melting of glaciers, loss of biodiversity, changes in rainfall pattern and amounts, increases in temperature, more frequent and severe pest and diseases incidences among others. These effects have negative impacts on the economy, food security, agricultural production, health, and social statuses (conflicts and migration) of many nations especially the developing countries.

Perception is the process by which information or stimuli are received from the environment and transformed into psychological awareness [11]. Farauta, *et al.*; [12] found that farmers' perceived manifestations of climate change include: unusual early rains that are followed by weeks of dryness, higher temperature, loss of soil fertility, reduction in farm yields, high rate of disease incidence, delay in onset of rain, less rainfall, erratic rainfall pattern, long period of dry season, no or reduced harmattan, long period of harmattan and heavy and long period of rainfall. The extreme weather events which support farmers' understanding of climate change are: desertification, heavy rainfall (which could lead to flooding), increase in atmospheric temperature and drought. These supported the findings of Hir [13].

However, a research by Ugwoke *et al*[14] claimed that although farmers are aware of climate change, they do not seem to know the cause(s). Their knowledge of climate change is mainly based on personal experience over time and information from social organizations. Elements of climate which they perceived to have changed significantly include rainfall pattern, sunlight and temperature. They seem to have perceived climate change to a fairly large extent. Perceived adverse effects of climate change include increased rainfall intensity, flooding, erosion, excessive heat and poor crop.

However, it has been found from the literature that local people are aware of the changing climate and they devise their own adaptation measures based on their cultural practice and past experiences in dealing with environmental changes and natural disasters. These local knowledge and experience are used as a basis of decision making for food security, human and animal health, and resource management[15]. Hence, this study aims to assess the awareness and perceived manifestations of climate change among irrigation farmers in Katsina State, Nigeria. The specific objectives of the study are to: describe the level of awareness of climate change in the study area; identify the sources of information on climate change in the study area; and assess the manifestations of climate change in the study area.

METHODOLOGY

This study was conducted in Katsina State, North-Western Nigeria. Katsina State has a total land area of 23,938 square kilometres located between longitudes 11⁰ and 13⁰ east; and latitudes 6⁰ and 9⁰ North. The projected population of the state was put at 7,452,629 in 2014 at a growth rate of 3.2 percent per annum[16]. The climate is semi-arid with average annual rainfall of about 689mm falling between May and September. The major crops grown are maize, cotton, groundnut, millet, sorghum, cowpea and vegetables among others. Katsina State Agricultural and Rural Development Authority (KTARDA), the state apparatus responsible for agricultural and rural development and extension, stratified the state into three agricultural zones. These are: Zone I (Ajiwa), Zone II (Funtua) and Zone III (Dutsinma).

Multi-stage sampling procedure was applied for the purpose of this research. Zones I and III (Ajiwa and Dutsinma) of KTARDA were purposively due to the prevalence of irrigation schemes and surface water bodies. This study targeted household heads who happen to be registered irrigation farmers in the study area as its respondents. After rigorous consultations with the staff of KTARDA and officials of community-based organizations, lists of farmers that fit the demand of this study were compiled. Fifteen percent of the sample frame was selected via simple random sampling method giving rise to two hundred (200) respondents. Table 1 shows the distribution of the respondents according to zones in the study area.

Primary data was used in this study. The data was obtained using a well-prepared and pre-tested questionnaire which was administered by well-trained enumerators. Descriptive statistics was used in analysing the data collected.

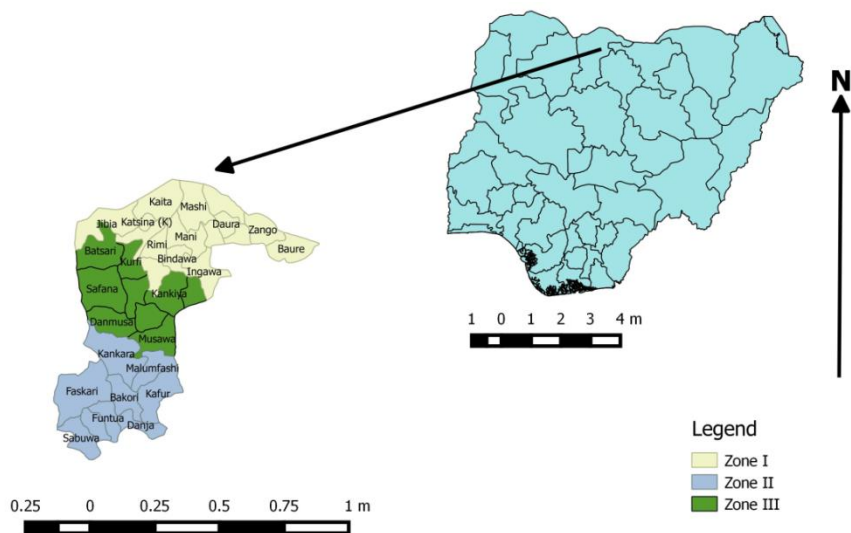


Fig-1: Map of Katsina State showing the different agricultural zones

Table 1: Distribution of sampled respondents according to zones

Zone	Population	Sample (15%)
Ajiwa (I)	702	105
Dutsinma (III)	630	95
Total	1332	200

RESULTS AND DISCUSSIONS

A. Irrigation farmers' awareness of climate change in the study area

Majority of the respondents (98.5%) indicated that they were aware of climate change and they know that it was affecting their agricultural activities and irrigation agriculture in particular. As shown in Table 2, in Ajiwa Zone, 98.1% were aware while 98.5% of the respondents from Dutsinma were aware of climate change in their area. Research showed that farmers in

northern Nigeria are found to be aware and knowledgeable of changing climatic conditions. A study in three states of the region found an overwhelming majority (84%) are aware of climate change, 79% also affirmed that they had knowledge of the changing climate, 81% of the respondents also noted that they had in various times experienced the incidence of climate change and 80.2% noted that they receive information on climate change[12].

Table 2: Distribution of respondents based on awareness of climate change

	Ajiwa	Dutsinma	Pooled Data
Aware	103 (98.1)	94 (99.0)	197 (98.5)
Unaware	2 (1.9)	1 (1.0)	3 (1.5)
Note: figures in parentheses are percentages.			

Sources of information

However, the respondents differ on their sources of information regarding issues of climate change and how it has manifested in their communities. In Table 3, most farmers (96%) identified other farmers – comprising of friends, relatives and neighbours – as important source of information on climate change. This implies that information on climate change is majorly disseminated informally in the study area. This was followed by radio (88.5%), cooperative group activities (71%), open market places (63.5%) and government extension agents (59.5%) in that order. Soothsayers (oracles and rainmakers that predict weather using supernatural powers) used to be very important source of information on climate issues.

However, the advent of Islam in the study area has diminished their relevance that less than a quarter of the respondents have ever patronised their (soothsayers') services. Internet has the lowest frequency (11.5%) followed by mobile phone (22.5%). This indicates that information and communication technologies (ICTs) for agricultural activities are still not widely adopted in the study area. In another study, Umar *et al.*; [17] found that majority (55.00%) of the respondents obtained information on from friends and relatives through conversation. This was followed by cooperative societies (35.00%) and radio jingles (25.00%), while extension agents (20.83%) ranked fourth as a source of information.

Table 3: Sources of information on climate change

Source of information	Ajiwa Zone (n=105)	Dutsinma Zone (n=95)	Pooled data (n=200)	Rank
Other farmers	99 (94.3)	93 (97.9)	192 (96.0)	1
Radio	95 (90.5)	82 (86.3)	177 (88.5)	2
Cooperatives	68 (64.8)	74 (77.9)	142 (71)	3
Rural market	69 (65.7)	58 (61.1)	127 (63.5)	4
Ext. agents	56 (53.3)	63 (66.3)	119 (59.5)	5
Print media	21 (20.0)	41 (43.2)	62 (31.0)	6
Television	32 (30.5)	24 (25.3)	56 (28.0)	7
Soothsayer	21 (20.0)	28 (29.5)	49 (24.5)	8
Phone	24 (22.9)	21 (22.1)	45 (22.5)	9
Internet	15 (14.3)	8 (8.4)	23 (11.5)	10

Note: multiple responses accepted. Figures in parentheses are percentages.

A. Manifestations of climate change in the study area

Table 4 shows what the respondents consider as indicators of climate change. Further investigations revealed that all of these indicators have been occurring in the study area; however, their intensity and the rate at which they occur in recent times indicate that the climate is changing. The most important manifestation of climate change in the area is relatively long dry seasons with 166 respondents (83%) identifying it. Conversely, this means shorter rainy season which have negative consequences on agricultural production and intensifies the need for irrigation. There is a Hausa saying which used to connote when rains were normally expected to start. It goes: watan bakwai makarar rani, KO ba ruwa da alamu. It could be loosely translated thus: the seventh (lunar) month is the end of dry season, even if it does not rain, there would at least be signs (that rainy season is about to start). The seventh lunar month corresponds to second-half of April to early May. Going by this saying, farmers believed that rains normally start within the seventh lunar month (each month having 28 to 30 days) after the last harvest, to the extent they used to practice what they termed bizne. Bizne is a practice whereby farmers sow their crops even though rains have not established, breaking the dry soil and putting their seeds, confident that rain is on the way. In recent years, to the dismay of the indigenous people, rains do not get established in this area until late June rendering their adage invalid and making bizne no longer feasible.

The respondents also identified erratic rain pattern as another indication of climate change. They cited examples with the recent rains that fell in some parts of the area in January of 2014. They said such are strange occurrences that signify that the climate is changing. Other indicators of climate change in the area include more intense and severe harmattan [144 (72%)], higher rates of drought [129 (64.5%)], increased rates and severity of pest incidences [104 (52%)], warmer temperature [79(39.5%)], increased cases of flooding [75 (37.5%)] and increased disease incidence [72 (36%)].

Different studies show farmers' perceived manifestations of climate change to include: unusual early rains that are followed by weeks of dryness, higher temperature, loss of soil fertility, reduction in farm yields, high rate of disease incidence, delay in onset of rain, less rainfall, erratic rainfall pattern, long period of dry season, no or reduced harmattan, long period of harmattan and heavy and long period of rainfall [12]. Another study in Southern Nigeria showed that farmers perceive deforestation, bush burning, gases released from industries, use of excessive chemicals in rice production, application of excess nitrogenous fertilizers, natural phenomena, violation of local custom and burning of firewood and farm residues (rice straws & husks) as causing adverse climate change to great extent [18].

Table 4: Manifestations of climate change as perceived by the respondents

Manifestations	Ajiwa Zone (n=105)	Dutsinma Zone (n=95)	Pooled data (n=200)	Rank
Longer dry season	89 (84.8)	77 (81.1)	166 (83.0)	1
Erratic rain pattern	90 (85.7)	69 (72.6)	159 (79.5)	2
Severe harmattan	71 (67.6)	73 (76.8)	144 (72.0)	3
Drought	70 (66.7)	59 (62.1)	129 (64.5)	4
Increased pest incidence	47 (44.8)	57 (60.0)	104 (52.0)	5
Warmer temperature	37 (35.2)	42 (44.2)	79 (39.5)	6
Flooding	38 (36.2)	37 (39.0)	75 (37.5)	7
Increased disease incidence	39 (37.1)	33 (34.7)	72 (36.0)	8

Note: multiple responses accepted. Figures in parentheses are percentages.

CONCLUSION

This study shows that irrigation farmers in rural areas of Northern Nigeria are aware and knowledgeable about the climate change phenomenon. They attain the level of awareness by accessing information on climate change via diverse sources with varying levels of importance. The respondents have identified various manifestations of climate change particularly as it negatively affects their irrigation agricultural production and agrarian livelihoods. These findings could serve as veritable information and basis in formulating effective people-centred climate change adaptation and mitigation programmes and policies.

ACKNOWLEDGEMENT: The author is grateful to J.H. Abdulkareem for designing the map of the study area that appears in Figure 1.

REFERENCES

1. Aquastat; Irrigation in Africa in figures – AQUASTAT Survey 2005. FAO, Rome.
2. Food and Agricultural Organisation; Nigeria: irrigation sub-sector study. Main text and annexes. Investment centre report No. 00/076 CP-NIR. 2000.
3. Yahaya MK; Development and challenges of Bakolori irrigation project in Sokoto state, Nigeria. *Nordic Journal of African Studies* 2002; 11(3): 411-430.
4. Norman WR; Indigenous community managed irrigation in Sahelian West Africa. Illinois, U.S, 1996.
5. Onwualu AP, Ogunwusi AA; Climate change and food security in Nigeria. *Agricultural extension strategies for climate change adaptation. Conference proceedings of the 17th annual national conference of the Agricultural Extension Society of Nigeria (AESON), 2012.*
6. Intergovernmental Panel on Climate Change (IPCC); Impact, adaptation and vulnerability. Contribution of working group II of the IPCC to the third assessment report of the IPCC. Cambridge University Press. London. 2001.
7. Intergovernmental Panel on Climate Change (IPCC); Tide gauge measurements and satellite imagery suggest that sea level has risen. Recent climate change – sea level changes, climate, science. The fourth assessment report of the IPCC. Cambridge university press. London. 2007.
8. Ibe NS; Nigerian agriculture, global challenges and rural development. In Nwachukwu, I. and Ekwe, K.C. (eds) *Globalization and rural development in Nigeria*. MEC, Umudike. 2011; 24-37.
9. Adejo PE, Ibrahim MK, Onuche U; The relationship between contributory factors to climate change and agriculture in Nigeria. *Proceedings of the Annual Conference of the Association of Nigerian Geographers. Held on the 7th–11th March, 2010 at Kogi State University, Anyigba, 2010; 469–473.*
10. Ozor N, Madukwe MC; Influencing curriculum development and knowledge of climate change issues in universities: the case of University of Nigeria Nsukka. *Journal of Agricultural Extension*. 2012; 16(1):103-118 ISSN 1119-944X
11. Van den Ban AW, Hawkins HS; *Agricultural extension*. 2nd ed. Blackwell Science. UK, 2000.
12. Farauta BK, Egbule CL, Agwu AE, Idrisa YL, Onyekuru NA; Farmers ‘Adaptation Initiatives to the Impact of Climate Change on Agriculture in Northern Nigeria. *Journal of Agricultural Extension*. 2012; 16 (1):132-144.
13. Hir J; Sand dunes threaten Northern Nigeria. Climate Change Group. Retrieved February 29, 2013 Available from: content&view=article&id=4517sand-dunes-threaten-northern-nigeria, 2010.
14. Ugwoke, F. O., Nnadi, F. N., Anaeto, C. F., Aja, O. O. and Nwakwasi, R. N; Crop Farmers’ Perception of an Adaptation to Climate Change in Orlu Agricultural Zone of Imo State, Nigeria. *Journal of Agricultural Extension* 2012; 16(2):212-223.
15. Twinomugisha B; *Tiempo: a bulletin on climate and development. Indigenous Adaptation 2005.*
16. National Population Commission; Report of national population census. Nigeria, 2006.
17. Umar SI, Olaleye RS, Ndanitsa MA, Ibrahim M, Tsado JH, Sadiq MS; Capacity Building Needs of Farmers for Safe Agro-chemical Use/Application in Niger State, Nigeria *Journal of Agricultural Extension*. 2013; 17(1)152-161.
18. Nwalieji HU, Uzuegbunam CO; Effect of Climate Change on Rice Production in Anambra State, Nigeria. *Journal of Agricultural Extension*. 2012; 16 (2):81-91.