

USE OF INDIGENOUS KNOWLEDGED BY ALIERO METROLITAN FARMERS IN MITIGATING CLIMATE CHANGE

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ABSTRACT

This study assessed the perceptions of farmers on the use of indigenous knowledge to combat the effect of climate change in Aliero local Government of Kebbi State, Nigeria. A simple random sampling technique was used to arrive at the sample size of one hundred and fifty (150) farmers in the study area. The age groups involved farming activities in the study area range between 30-39 years had the greater percentage of 36%. Majority of the farmers were male and married with 92% and 08% respectively. The respondents of these questionnaires are 94% into commercial farming as their main grown crops are onion and pepper. Majority of the farmers' source of weather information is nonscientific, mostly relied on mere observations. This is followed by personal experience and pattern of first rain with 22% respectively. The major perception of the farmers on the use of indigenous knowledge to combat climate change is local knowledge in the weather forecasting obtained from mere observation with mean of (2.06). The least from farmers who were in the view that local knowledge is unrecognized with mean of (1.60). The farmers in the study area were highly aware of the indigenous knowledge on the use in determining weather conditions. It is recommended that farmers' indigenous knowledge should be respected by advocating and mobilizing their unique knowledge and practice in climate change adaptation.

Keywords: Indigenous, climate, knowledge farmers, questionnaires and crop

INTRODUCTION

There is increasing evidence that climate change strongly affects African Countries and could be one of the challenging issues for future developments particularly in the drier region of the world (Adger, 2007). The challenges of the climate change remain the subject of debate. The climate changes have aim on ecosystem services, agricultural production and livelihood worldwide. Bhories Rhomche (2010). Climate change is a long-term change in the statistical distribution of weather patterns over periods of time that range from decades to millions of years. It may be a change in the average weather conditions or a change in the distribution of weather events with respect to an average, for example, greater or fewer extreme weather events. Climate change may be limited to a specific region, or may occur across the globe. In recent usage, climate change usually refers to changes in modern climate. As culled from Wikipedia Climate change in Nigeria is evident from temperature increase, rainfall variability (increasing in coastal areas and decline in continental areas). It is also reflected in drought, desertification, rising sea levels, erosion, floods, thunderstorms, bush fires, landslides, land degradation, more frequent, extreme weather conditions and loss of biodiversity (Olaniyi, 2019)

Scientists recently reach a consensus that the climate change experienced currently is an outcome of human activities and this has been proven through the tests by atmospheric models and the measurable investigations of verifiable information records (Abdulmalik and Mudassir, 2019). Human activities induced by climate change had caused an increase in the frequency and intensity of extreme events as well as gradual change in the rainfall and temperature variability. This is expected to continue to a varying degree under different climatic scenarios for the future. The need to respond to these changes is urgent as climate change related effects have started to emerge more rapidly than before improving people's ability prepare for and also respond to extreme weather events and increasing climate variability.

The importance of the indigenous knowledge on climate change has been realized in the design and implementation of the Sustainable Development Project. However indigenous knowledge has been defined as an institutionalized local knowledge that have been built upon and passed on from one generation to another either by words or mouth (Suiven, et al., 2019). Indigenous Peoples and those living directly on the environment for sustenance, are already negatively impacted by the loss of ecosystem functions, they obtained unique information sources about past changes and potential solutions to climate contemporary issues (FAO).

Climate change on the other hand is a change in the statistical distribution of weather over a period of time that range from decades. It can be changes in the average weather events. Climate usually refers to the change in the climatic variables which is usually known as "Global Warming" (Anonymous, 2006). Low level of information technology among farmers in the state and particularly in Aliero Local Government will entail some serious consequences to a number of farmers and non-farming families whose livelihood are dependent on the climate understanding, the level of perceptions and patterns of behavior to changes in climatic factors. It is therefore important to examine an appropriate indigenous knowledge so as to reduce the effects of this climatic variability in the study area. The finding from this research shall be used in strengthening the existing indigenous knowledge by helping farmers to take necessary measures in combating the effects of climate change in the study area. The information will also be used to aid incorporated by the current sources of weather forecasting.

Concept of Climate Change

Climate includes pattern of temperature, precipitation, humidity, wind and seasons. The term climate change affects more than just a change in the weather. It refers to the seasonal changes over a long period of time (UNESCO). The United Nations Development Program (UNDP, 2009) define climate change as a scientifically proven phenomenon that includes any changes in the climate whether due to its variability or as a result of human activity. The United Nations Framework convention on Climate Change (IDCC, 1999) also sees climate change as a change which is attributed directly or indirectly to human activity that alter the composition of the global atmosphere and which are in addition to natural climate variability observed over comparable time periods. Climate change is a normal part of earth's natural variability which is related to interactions among the atmosphere, oceans, and land as well as changes in the amount of solar radiation reaching the earth (IPCC, 2007).

The growing population has put pressure on the carrying capacity of the natural resources over the last two decades per capital land holding size has reduced and pattern of land use has changed. In many cases leading to massive soil erosion and siltation up rivers system and reduce river flow. Demand for river based products have increase beyond imagination proportion leading to unsustainable use. Deforestation in traditional lands as well as encroachment in protected area has resulted in continue loss of plants and animal life at the same time it serves as a central player in contribution to the solution of climate change to the world changes. In other of this potential to be realized, agriculture must be including in any agreement on climate change. Agriculture is vulnerable to climate change, yet most of the world population is engage on the agricultural sector and this sector provide essential service needed for the life including food, feed fiber, energy and ecosystem services. Farmers especially women interact daily with the environment, they are thus well placed to implement sustainable agricultural practices that can help adaptation to the mitigation of climate change while benefiting rural and urban population (Bhole & Ramche, 2010)

Causes of Climate Change

Societies over the years have deleted natural resources and degraded their environment. Population has also modified their local climate by cutting down trees or building cities. It is now apparent that human activities are disturbing the climate systems at the global scale. Climate change is likely to have a wide ranging and potentially causes serious health consequences, others will result from disturbance to complex ecological process (IPCC, 2001). Natural and human activities are believed to be responsible in contributing to an increase in average temperature. The cause of climate change is believed to remain the unlimited burning of fossil fuels, coals oil and natural gas, releasing Co₂ in the atmosphere worldwide.

Natural causes of climate change

The natural processes incorporate the fundamental interaction between the oceans and the environment, volcanic activities and the changes in the earth's orbital forcing which alter and causes changes in the amount of sun's energy received by the earth (Crowly, 2000). In the natural causes of climate change, the earth climate is influenced and changed through natural causes like volcanic eruption, ocean current, earth's orbital changes and solar radiations.

Human causes of climate change

On earth, human activities are changing the natural greenhouse effects. Human activities contribute to the climate change by causing changes in the earth's atmosphere in the amount

of greenhouse and aerosols. The largest contribution came from burning of fossil fuels which released the carbon (iv) oxide gas to the atmosphere (Solomon, et al, 2007). Other human activities that contribute to the climate change includes bush burning, cutting down of trees, use of generator, gas flaring from oil companies, gas released from industries, excessive use of chemical and crude oil, and oil spillage (Egbule & Koroh, 2011).

Effects of Climate Change on Agriculture

Serious impacts are associated with the changing scenario. These include sea level rises, shift in growing season, increasing frequency and intensity of extreme weather events like storms, floods, and drought. Impact of climate change will vary regionally with the most significant impact expected in Sub-Saharan Africa (Garm et al, 2012). According to Chavex and Tauli (2008) the impact of climate change on people living in different ecosystem will include stormy hurricane, storms surge, which will lead to destruction of houses, infrastructures (bridges, roads, electrical line, dams, ponds etc). However, flood and massive landslides which will reduce the possibilities for people to market their crops, livestock, marine and coastal resources etc. the loss and destructions of ancestral lands, resources, and homes result in food insecurity and hunger.

Climate change continues to induce an impact on agriculture, fisheries and natural environment but agriculture itself also contributes to the climate change. Farming system whether mixed cropping - livestock system or crop and pastoral farming system are characterized by the way the resources are used, land, crops, and livestock management and their interaction with local and international economy.

Agriculture is highly sensitive to climate variability and weather extreme such as drought, floods, and severe storms while food production may benefit from a warmer climate. The increased potentials for drought, flood and heat waves will pose challenges for farmers thereby affecting their farming activities are already obvious and has been reported in some parts of the eastern Nigeria. According to Okoroh (2012), the impact of climate change on agriculture is observed as one of the causes of decrease in crop yield.

Climate Change and Indigenous Knowledge

Climate change impacts are already affecting the lives, livelihoods and human rights of over 370 million Indigenous Peoples globally. Indigenous Peoples have sustained themselves through their ability to work with nature and climate variance, relying primarily on precipitation patterns, temperature variances and local biodiversity to sustain themselves over long periods of time (UNESCO, 2023).

Climate variability affects the ability of the rural communities to satisfy those needs that inherent in the environment. Even though, changes have been occurring over generation, rural farmers have been adapting to these changes throughout their life using local environmental knowledge. The knowledge is relatively cheap, readily available to rural farmers, and climatically smart tool for sustainable development and management of climatic variability (Suiven et al. 2019). As environmental problems vary spatial, temporarily. but rural farmers through continuous experimentation trial-and-error and sustained interaction with their local environment, have developed a vast local knowledge about the nature their locale, that they use coping with and solving their problems among climate related problems has a well-established program on preserving traditional knowledge called local indigenous system knowledge (Odewo, 2011).

The Role of Indigenous Knowledge in the Development of Modern Science

Throughout the history, indigenous people have been responsible for the development of man's technologies and have substantially contributed to science. Indigenous science incorporates traditional knowledge and indigenous perspective while non-indigenous scientific approaches are commonly recognized as western science (Ajani, et.al, 2013). However, indigenous people also with their decades of potential experience combined with that of their ancestors harbor a vast knowledge about the environment and the ecological relationship within them. The tremendous opportunities exist where such knowledge can contribute to the development of modern science and natural resources management (the comvasation.com)

Adaptation of Indigenous Knowledge by Farmers

Adaptation is an adjustment made to a human ecological or physical systems in response to a perceived vulnerability. Specifically, IPCC describe adaptation to Climate change as adjustment to natural or human system in response to actual or expected climatic stimuli and their effects which moderate harm and exploiting beneficial opportunities. Adaptation is an important component of climatic changes impact. Adaptation to climatic changes is therefore critical and of concern in developing countries particularly in Africa where vulnerability is high because of ability to adapt is low. In agriculture, adaptation helps farmers achieved their food, income and livelihood security objectives (Brussel, 2009). According to Brussel, adaptation means to climatic changes in agriculture ranging from technological solutions to adjustment in farm management or structures and to political changes such as adaptation plan. Local and Indigenous knowledge systems contribute to the achievement of Sustainable Development Goal 13 on climate action by observing changing climates, adapting to impacts and contributing to global mitigation efforts (UNESCO 2023).

METHODOLOGY

Study Area

Description of The Study Area

The study was carried in Aliero local government area The study site lies on latitude 12°18' 22"N and Longitude 4°29' 35"E which covers an area of about 350km² (Olajuyigbe et al., 2012). Aliero is inhabited by an artisanal community with a special interest in onion and pepper farming. The area is dominated by two distinctive seasons: the wet season and the dry season with a mean annual rainfall of about 800mm and temperatures of about 26°C. Although, the temperature can go down to about 21°C during the harmattan and up to 40°C between April and June (Mukhtar, 2016). Suleiman (2016) highlighted that the area possessed two important cultivated lands namely: dryland (arid – prolonged dryness) and fadama (floodplains – significant alluvial clay particles). The vegetation of the area is characterized by a few annual grasses, shrubs, and scattered trees (Suleiman, 2016) which are threatened by the inhabitants as a result of over-exploitation without replacement (Bello and Gada 2015).



Sampling Techniques and Sample Size

The study was designed to assess the perception of farmers on the use of indigenous knowledge to mitigate the effects of climate change in Aliero Local Government area of Kebbi State, Nigeria. Five villages were randomly selected for the study. These villages include Danwarai, Jiga Birni, Kashin Zama, Rafin Bauna, and Sabiyal respectively. Ten farmers were also randomly selected to arrive at a sample size of fifty (50) farmers. These fifty (50) farmers constitute the sample size for the study.

Method of Data Collection

Primary and secondary data were used for the study. The primary data were collected using a structured questionnaire, interview, and observation. The structured questionnaire will be used to capture all the objectives of the research study. The secondary data were collected from textbooks, journals, and past projects.

Data Analysis

The analytical tools used for analyzing the data include descriptive statistics such as Frequency distribution, Percentage Table, Mean, and Five-point Likert scale.

Likert Specification

Key: SA= Strongly Agreed; A= Agreed; UD = Undecided; SD = Strongly Dis-agreed; D = Dis-agreed

RESULTS AND DISCUSSION

From table 1 below, the result shows that majority of the respondents are in the range of 30-39 years. This is followed by 20-29 years with 26% of the respondents with least above 50 years. It also reveals that majority of the farmers are male, which constitute 92%, while females' farmer was 8%. This indicates that there is fewer participation of female in agricultural production in the study area. The household size in the study were between 6-

10 persons which also constituted the majority of 46% with the least above 10 persons with just 26% of the respondents. The table revealed that most farmer are cultivating under a small farm size, less than a hectare of land with 72% and those from above 1 h are 28% of the respondents. This shows that farmers in the study area were fully operating in to cash crop but in a subsistence level due to land availability, urbanization and tenure system. 62% of the respondents have experience of more than 10 years into farming activities, that showed there brought up in farming community and constituted majority. While 12% have 1-5 years farming experience as the result shown. Also the result indicated, that farmers in the study area have been obtained one category of higher education to another, and constituted the majority with 34%. This is followed by secondary schools education 28%, with the least from non-formal education 16% of the respondents. These may be due presence of two prominent tertiary institutions in the study area named Kebbi State University of science and technology, Aliero and College of Health Science, Jega.

Table 1: Socio economic characteristics of Farmers in the study area (N=50)

Variables	Frequency	Percentages
Age		
< 19 years	06	12
20-29	13	26
30-39	18	36
40- 49	10	20
50& above	03	6
	50	100
Gender		
Male	46	92
Female	04	8
	50	100
Marital Status		
Married	34	68
Single	16	32
Others	0	00
	50	100
Household Size		
1-5	14	28
6-10	23	46
Above	13	26
	50	100
Farm size		
Lessthan 1ha	36	72
Above 1 ha	14	28
	50	100
Farming experience		
1-5 years	06	12
6- 10 years	13	25
Above 10 years	31	62
	50	100

Education level		
Non-formal	08	16
Primary	11	22
Secondary school	14	28
Tertiary education	17	34
	50	100

Source: Field survey, 2021

Table 2: Distribution of the Farmers based on the Types of Farming System practices in the study

Variables	Frequency	Percentage (%)
Subsistence farming	03	06
Commercial farming	47	94
	50	100

Source field survey 2021

Table 2 above indicated that 94% of farmers in the study area operate under commercial farming while only 6% of the respondent operate on subsistence farming practices. This also constituted that majority of the respondents in the study are commercial farmers, with only few are peasant in nature among the respondents.

Table 3: Distribution of Farmers based on the Sources of Indigenous Knowledge of Climatic Behavior in the Study Area

Sources	frequency	Percentages (%)
Personal experience	11	22
Through plants and animal behavior	04	8
Through elders	18	36
Through gathering of cloud	11	22
Through star constellation	06	12
Sow of birds and insects	0	0
Total	50	100

Source field survey 2021

Table 3 above indicated that farmers in the study area source their information on the indigenous knowledge of weather through elders with 36% of the respondents. This is followed by personal experience 22% with the least from plant and animal behavior with 8% of the respondents, this entails the role of elders in strengthening younger generation with the indigenous knowledge on weather situation, as it was supported by UNESCO 2023 as it observed Local and Indigenous knowledge systems contribute to the achievement of Sustainable Development Goal 13 on climate action by observing changing climates, adapting to impacts and contributing to global mitigation efforts..

Table 4.4 Distribution of the Farmers according to the level of Awareness on the use of Indigenous Knowledge in Combating the Effects of Climate change in the study area

Variables	Frequency	Percentage
Very high	07	14
High	21	42
Not certain	13	26
Very low	06	12
Low	03	06
Total	50	100

Source: field work 2023

The table 4 above revealed that farmers in the study were highly aware about the use of indigenous knowledge in predicting climatic conditions in a greater percentage of the majority that constitutes 42% of the respondents. This will enable the farmers in the study area to utilize the information in combating the effects of climate changes in the study area. This is also followed by those that are not certain the knowledge with 26% with the least from having low knowledge that constitutes just 6% of the respondents.

Table 5: Distribution of Farmers according to their Perceptions on these of Indigenous Knowledge to Combat the Effects of Climate Change in the Study Area

S/No	Perception	SA	A	UD	SD	D	TOTAL	MEAN	RANK
1	Local knowledge is simple to understand in weather prediction	5	15	28	21	12	81	1.62	4 th
2	Local knowledge in weather prediction does not require any sophisticated tool	9	12	31	27	09	88	1.76	2 nd
3	Local knowledge in weather forecasting are over the years obtained through observation	3	44	25	10	21	103	2.06	1 st
4	Local knowledge to weather prediction is always accurate	14	30	22	06	08	81	1.62	4 th
5	Local knowledge in weather prediction forecasting is a great measure spiritually	12	20	24	14	06	84	1.68	3 rd
	Local knowledge is unorganized	23	0	23	10	24	80	1.60	6 th

Source: Field work 2023

Key: SA- Strongly Agreed, A- Agreed, UD - Undecided, SD - Strongly Disagreed, D -Dis-agreed

Table 5 above indicated that the major perception of farmers on the use of indigenous knowledge is that local knowledge is used in weather forecasting over the years are obtained

from observation with a mean score of (2.06) of the respondents. Others are in the view that indigenous knowledge use in predicting weather does not require any sophisticated tools with a mean of (1.76) with the least from farmers who are in the view that indigenous knowledge unorganised with mean of (1.60) of the respondents

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

Summary

The data were collected from fifty (50) farmers through a simple random sampling on five villages. The data were collected using a structured questionnaire.

The major findings were summarized below.

The result of table 1 indicated that 92% of the farmers selected were male and 8% were female. 68% of the respondents were married and 32% were single. 72% operate under a small farm size of less than a hectare. 62% of the farmers have vast experience on more than 10 years in farming, the farmers in the study area possess higher education with 34%, which also constitute the majority of the respondents with least from non-formal schooling with 16% of the respondents.

Most of the farmers in the study area operate under subsistence farming with 94% of the respondents and 6% engaged in commercial farming. The study revealed that the major sources of indigenous knowledge are from elders with 36%, this is followed by personal experience and through gathering of clouds with 22% respectively. However, farmers in the study area were highly aware about the indigenous knowledge on weather condition with 42% and followed by those that were not certain with 26%, with the least from low awareness with 6% of the respondents.

The major perception of the farmers on the use of indigenous knowledge to mitigate the effects of climate change was that indigenous knowledge in weather forecasting are over the years obtained from the observation with mean of (2.06) of the respondents. This also constituted the majority with the least from farmers who were in the view that indigenous knowledge is unorganized and are haphazardly gathered.

Conclusion

Based on the findings of the research, the result revealed that there are fewer participations of female in farming in the study area. Likewise, farmers in the study area were usually operated under small farm holding, virtually produced under subsistence level of production. The findings showed that farmers in the study area source their indigenous knowledge mostly from elders in the community and some have vast experience on the use of indigenous knowledge in predicting weather condition in the area.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. There is need for the incorporation of indigenous with conventional knowledge in order to ensure local sustainable development in the study area.
- 2 Since indigenous knowledge cannot be used as substitute for conventional knowledge, it is therefore recommended that both knowledge systems can be use concurrently in solving environmental problems in the area.

3. Farmers' indigenous knowledge should be respected by advocating and mobilizing their unique knowledge and practice in climate change adaptation. This will contribute in the safeguarding traditional knowledge within the indigenous communities

REFERENCES

- Abdulmalik S. M. and Mudassir H. (2019) PEOPLE'S PERCEPTIONS OF THE CHANGING CLIMATE AND HUMAN INFLUENCE IN KATSINA STATE, NORTH-WESTERN NIGERIA. FUDMA Journal of Sciences (FJS) Vol. 3 No. 2, June, 2019, pp 245 - 249
- Adger, W., Hug, k., Brown, D. and Hulne, M. (2003). Adaptation to climate change in developing world, progress in development studies
- Ajani, E.N, Mgbenka, R.N and Okeke, M.N. (2013). Use of indigenous knowledge as a strategy for climate change adaptation among farmers in sub-Saharan Africa. Implication for policy. Asian journal of Agricultural Extension, Economic and sociology. Vol..2 (1)1
- Ajibefun, L. and Abdulkadir, O. (2004). Impact of size of farm: operation on resource use efficiency in small scale farming, evidence from south eastern Nigeria, Nigerian Journal of. Agriculture and Environment, vol. 2(1).
- Bello, A.G. and Gada Z.Y. (2015). Germination and early growth assessment of Tamarindus indica L in Sokoto State, Nigeria Hindawi Publishing CorporationInternational. Journal of Forestry Research. Article ID 634108, 5 pages.
- Bhole, M. and Ronche, L. (2010). Assessing climate change impact in resource district
- Brussels, SEC (2009). Adapting to climate change. Challenges to European Agriculture and rural areas, commission works staff working documents accompanying the white papers.
- Charves, D. and Tauli, C. (2008). Global warming and climate change.
- Crowley, T. J. (2000) Causes of climate change over the past 1000 years. Science, 289(5477), 270-277
- Ebule, E. and Okoro, B. (2012). Climate change information needs of the rural farmers in Enugu State.
- Garmet. T. (2012), Climate change and agriculture: can market, governance, food system family and efficiency, International institutes for Environmental Development London.
- Hulme, M. and Kelly, M.L., (1993). Exploring the link between desertification and climate change, Journal of Agriculture and Environment, Vol. 3(6).
- IPCC (2007). Agriculture and climate change mitigation., working group contributions to the, fourth assessment report of the intergovernmental panel on climate changes, Cambridge University press, Cambridge: U.K.

- Klan, P. and Anja, S. (2007). Indigenous people and climate change, tyndallcentre for climate change research,
- Mukhtar, R.B. (2016): Influence of light intensity on early growth of *Adansoniadigitata* (L.). *Research Journal of Recent Sciences*. 5(12): 5-9.
- O.A., Olaniyi; I.O., Olutimehin; O.A., Funmilayo (2019). "[*Review of Climate Change and Its effect on Nigeria Ecosystem*](#)". *International Journal of Rural Development, Environment and Health Research*. 3 (3): 92–100. [doi:10.22161/ijreh.3.3](#).
- Odewu, K. (2011). The role of indigenous knowledge in addressing the climate changes in proceeding AfricanAdapt.Climate change Symposia, Addis Ababa, Ethiopia
- Olajuyigbe, S.O., Jimoh, S.O., Adegeye, A.O. and Mukhtar, R.B. (2012). Drought stress on early growth of *Diospyros mespiliformis* (Hochst ex. A.) in Jega, Northern Nigeria. *Nigerian Journal of Ecology*, 12(1): 71-76.
- Oloro, J, Agwu, A.E, and Anugwa, I.Q (2012). Assessment of information need by rural farmers on climate change issues in Enugu. *Journal of agricultural extension*
- Solomon, S. (2007). The physical science basis. Contributions of working groups to the fourth assessment reports by intergovernmental panel on climate change.
- Suiven, J. Jude, N. and Zepharane, F. (2019). Indigenous knowledge and farmer's perception of climate change and ecological change.
- Suleiman, U. (2016). Surface soil factors and soil Characteristics in the geophysical milieu of Kebbi State. *Eurasian Journal of soil science*. 5(3):209-220
- UNDP (2009). The use of moderate climate change scenario
- Unesco 2023, Local and Indigenous Knowledge Systems and Climate Change <https://www.unesco.org/en/climate-change/links>