British Journal of Applied Science & Technology
20(2): 1-10, 2017; Article no.BJAST.32611
ISSN: 2231-0843, NLM ID: 101664541

SCIENCEDOMAIN *international*
www.sciencedomain.org

Peasant Farmers' Adaptation Strategies to Coping with Climate Change in Jibia Northwest Katsina, Nigeria

Ibrahim Yusuf El-Ladan[1*]

[1]Department of Geography, Umaru Musa Yar'adua University, Katsina, Nigeria.

Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

Article Information

DOI: 10.9734/BJAST/2017/32611
Editor(s):
(1) Ahmed Fawzy Yousef, Geology Department, Desert Research Center, Egypt.
Reviewers:
(1) Cornelius Okello, University of Nairobi, Kenya.
(2) M. H. Shankara, University of Agricultural Sciences, Bengaluru, Karnataka, India.
Complete Peer review History: http://www.sciencedomain.org/review-history/18612

Original Research Article

Received 4th March 2017
Accepted 4th April 2017
Published 13th April 2017

ABSTRACT

The aim of this study is to identify the adaptation strategies developed by local peasant farmers to reduce negative impacts of climate change in Jibia, Northwest Katsina, Nigeria. Primary data were obtained from field survey through questionnaire administration using stratified random sampling technique where 102 respondents from 3 localities of the local government area. Data collected was then collated, summarized, analyzed and presented using simple descriptive statistics methods. Findings revealed that farmers observed elements of climate change in the area. Increased temperature, incessant rainfall and dry spells during rainy season were some indicators to climate change as perceived by the respondents. Various adaptation measures were being employed, among them, planting of drought tolerant crops, increased use of organic manure and planting varieties of crops. It is recommended that governments, in partnership with international development partners, should build the capacities of peasant farmers to strengthen their indigenous technology knowledge abilities in developing and implementing economically viable user-friendly adaptation plans and strategies that would reduce the impacts of climate change on agricultural activities. Successful adaptation techniques adopted elsewhere that have local relevance may also be replicated.

**Corresponding author: E-mail: yusuf.elladan@umyu.edu.ng;*

Keywords: Peasant farmers; adaptation strategies; clime change; Jibia.

1. INTRODUCTION

Africa's agriculture is negatively affected by climate change [1,2]. Adaptation is identified as one of the policy options to reduce the negative impacts of climate change [3,4]. Available evidences show that climate change is global, likewise its impacts, but the biting effects is being felt more by African developing countries due to their low level of coping capabilities [5,6,7]. Africa is one of the most vulnerable regions to climate change in the world. Previous assessments [8,9] concluded that Africa is particularly vulnerable to the impacts of climate change because of factors such as widespread poverty, recurrent droughts, inequitable land distribution and over dependence on rain-fed agriculture. Nigeria is one of such developing countries and researches have shown that Nigeria is already being plagued with diverse ecological problems which have been directly linked to the on-going climate change [10,11,12,13].

Adaptation to climate change refers to adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates, harm or exploits beneficial opportunities [9]. The adaptation methods most commonly cited in literature include, use of new crop varieties and livestock species that are more suited to drier condition, irrigation, crop diversification, mixed crop livestock farming systems, changing planting dates, diversifying from farm to non-farm activities, increased use of soil and water conservation techniques, modified use of capital and labour [14,4,15].

Adaptations usually take different forms, can occur at different scales, and can be undertaken by various community agents (farmers, middlemen, large scale organizations, and governments). There is thus, the need to continuously assess coping and adaptation ability of farmers, who are stakeholders in the climate change issues toward evolving avenues of mitigating undesirable impacts. This study is a contribution to that process using Jibia local government area of Katsina, Nigeria as the locale of investigation. A common disadvantage for local coping strategies is that they are often not documented but rather handed down through oral history and local expertise. As site specific issues require site specific knowledge, experience has shown that identified adaptation measures do not necessarily translate into changes because there are context specific social, financial, cultural barriers to adaptations.

Agriculture in the area is a major occupation accounting for about 85% of the population. The other 15% are engaged in other occupations of trading, carpentry and blacksmithing [16]. The study intends to guide government and agricultural policy planners in implementing mitigations and adaptation strategies to reduce vulnerability of farmers in the area to future impacts of climate change.

1.1 Aim and Objectives

The aim of this study is to identify the adaptation strategies developed by local farmers to reduce negative impacts of climate change in the study area. The objectives are to examine how local farmers in the area perceive climate change; determine how climate change affects farming activities and identify the adaptive strategies developed by farmers in response to the negative impacts of climate change on agriculture in the area.

2. STUDY AREA AND METHODOLOGY

2.1 Study Area

2.1.1 Location

According to [17] Jibia, the study area lies between Latitude 13° 57' 08" N to 13° 71' 27" N and Longitude 7° 15' 48" E to 7° 18'15" E. It shares land borders with Niger Republic to the North, Katsina and Kaita local governments to the east, Batagarawa and Batsari local governments to the south and Zamfara State to the west. See Figs. 1 and 2.

2.1.2 Climate

The climate is dominated by high temperatures in the summer and chilly during winter with little rainfall between June and October.

2.1.3 Vegetation

Vegetation falls into savannah type and further classification suggested that it is Sahel type. Typical characteristics of Sahel savannah have limited total rainfall (600 mm-1000 mm per year) and short grasses predominant with scanty

xerophytic trees. Original vegetation has undergone several modifications and destructions in efforts of land clearing for the cultivation of important economic crops like millet, maize, beans, groundnut, etc. Trees, among others, include *Azadirachta indica*, *Faidherbia albida*, *Tamarindus indica*, while shrubs range from *Cactus spp* to *Guiera senegalensis* and *Lawsonia inermis*.

2.1.4 Geology, relief and drainage

The area is underlined by basement complex. The basement complex rocks are Precambrian comprising of Gneiss, Magmatites, Phyllites, Schist and Pegmatites covering about 70% of the basement complex area. The area is composed of undulating plains which generally rise gently. The moderate relief is scattered with protruding geomorphic features such as laterite hills and small inselbergs. It also has some valley bottoms in very few places and is well served with streams that drain the area. One major river that drains the area is river Jibia on which Jibia dam was founded. The dam provides large potentials for irrigation [18].

2.1.5 Soils

[18] Stated that the area consist of a flat loamy soil with high fertility which seems to explain the predominance of large orchards and gardens. To the north, the land becomes more and more eroded and the soil shallow. Lateritic out-crops occur and the soil changes to waste land soil being partly covered by pebble stones. Adjacent to the bank of the River, (*Gulbi*) the soil becomes sandy and deep. In the north west of the area the land is partly undulated and the soil consists of sand and silt materials.

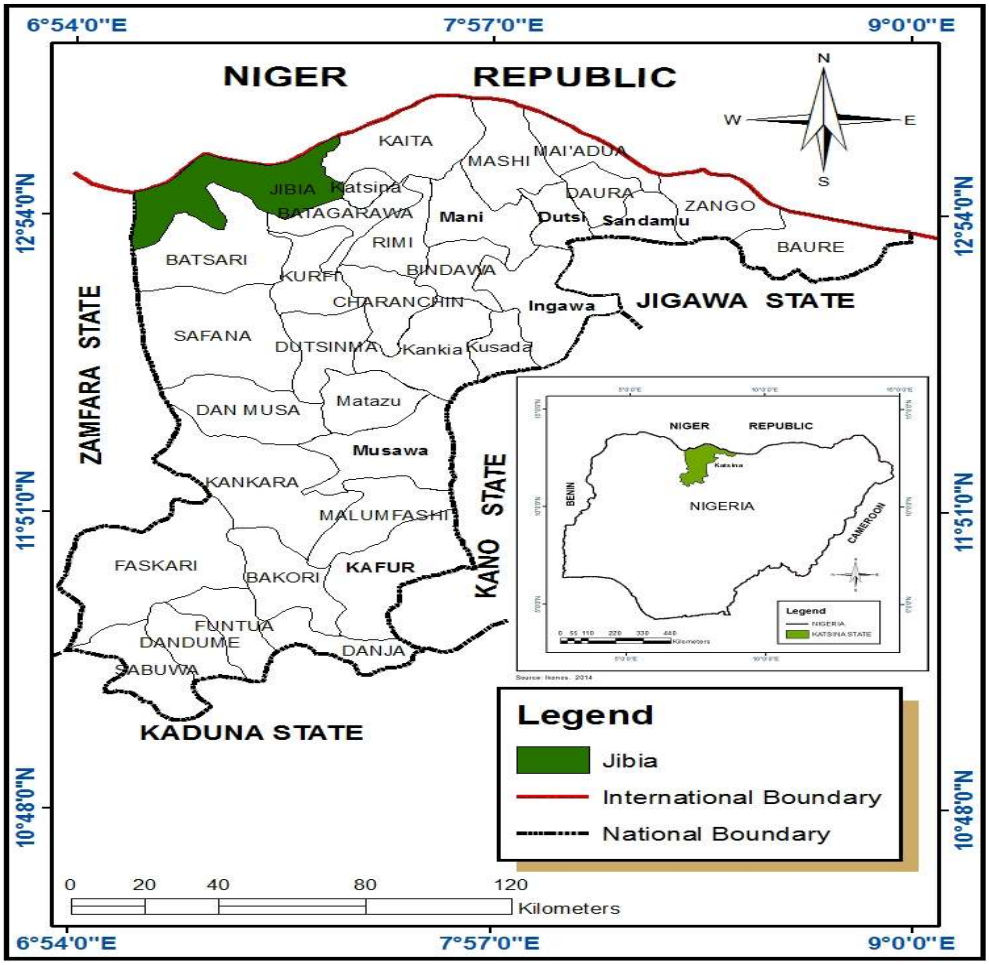

Fig. 1. Map of Katsina state showing Jibia LGA as study area
Source: Administrative map of Nigeria NPC. 2006

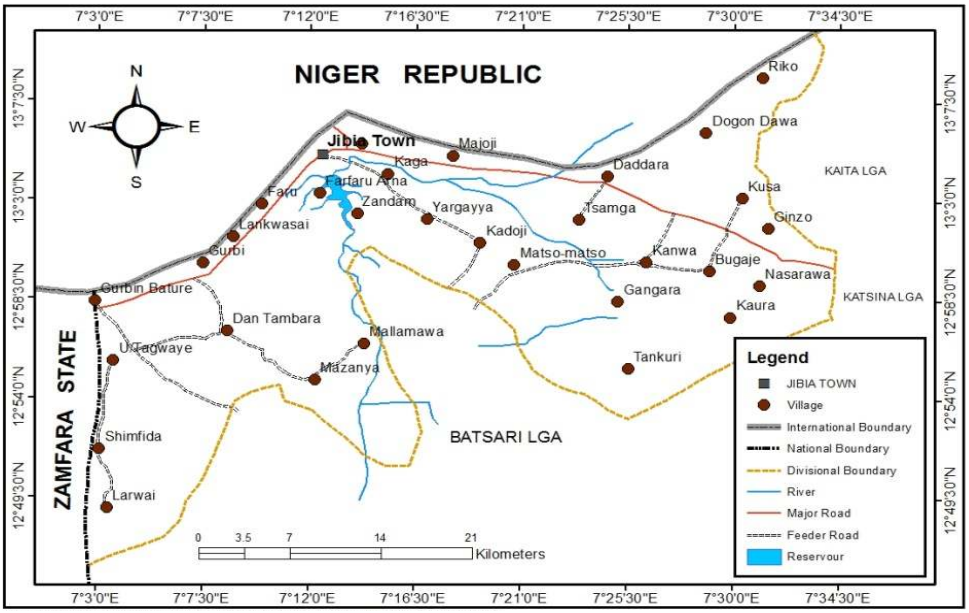

Fig. 2. Map of Jibia LGA showing some villages

Source: National aeronautical and space administration (NASA) 2016/Topo map series

2.1.6 Land use

Land use was above average since the construction of Jibia dam. However, since the use is ever growing at geometric ratio, it has now been turned to exploitation through overgrazing and all year round farming, especially close to the dam.

2.1.7 Population

According to the 2006 population census results by [19] the area is inhabited by 169,748 people. In terms of ethnicity, groups found are Hausa and Fulani. The ethnic differences between Hausa and Fulani are difficult to distinguish due to cultural similarities of inter marriage ties. The people are predominantly Muslims.

2.2 Methodology

2.2.1 Data collection

Primary data were obtained from field survey through questionnaire administration. The questionnaires were designed to capture respondents' demographic characteristics of sex, marital status educational attainment e.t.c. as well as their responses on perception of climate change, impact of climate change on agricultural activities, and adaptation techniques employed in counteracting such impacts.

2.2.2 Sampling techniques and data analyses

The study employed stratified random sampling technique where 102 respondents from 3 localities of *Daddara*, *Magama* and *Jibia* administrative wards (34 in each of the wards) of the local government area were administered with questionnaires. The choice of the three wards was based on population and levels of agricultural and economic activities within the local government (study) area. Data collected was then collated, summarized, analyzed and presented using simple descriptive statistics methods.

3. DATA PRESENTATION AND DISCUSSION

3.1 Farmers Awareness on Climate Change

Table 1 show that 96 of respondents (94%) were aware of climate change, while 6% were unaware.

Table 1. Awareness on climate change

Response	Frequency	Percentage (%)
Yes	96	94
No	6	6
Total	**102**	**100**

Source: field survey (2016)

Fig. 3 reveals that mass media were the major sources of awareness for more than 45% of the respondents as 30% got their awareness on climate change from Radio and 17% from the Television. About 19% of the respondents claimed that, their awareness of climate change were by personal experience; 12% got informed from Agricultural Extension Agents, while 16% from fellow farmers and 6% of the respondents did not respond about their sources.

Table 2 shows that 95% of the respondents observed changes in climate in the study area, while 5% stated that they do not observe any change in the climate of the area. This implies that most of the respondents in the area have observed noted some changes in climatic variables.

Table 2. Changes observed

Observation	Frequency	Percentage (%)
Yes	97	95
No	5	5
Total	**102**	**100**

Source: field survey (2016)

Table 3 shows that 37 respondents, (about 36%) opined that it was 10 years ago that they stated noticing changes in the climate settings; 32% said they noticed the changes in the last 5 years; about 20% comfirmed that they noticed the changes within the last15 years, while only 7% believed that the changes have been observable even before 15 years ago and the last 5% did not respond. This implied that climate changes began to occur in the area more than 15 years ago but wasn't noticed by most of the farmers.

Table 3. Extent of notice of changes

Duration of climate change (years)	Frequency	Percentage (%)
5 years	33	32
10 years	37	36
15 years	20	20
15 years above	7	7
Un answered	5	5
Total	**102**	**100**

Source: field survey (2016)

3.2 Perceptions of Climate Change

Table 4 shows that about 49% of the respondents agreed that the green environment in the study area is reducing, 37% strongly agreed. The result also revealed that 46% of the respondents agree that, the dryness in the environment is more than it used to be, and 38% of the respondents strongly agree with the statement.

As shown in Table 4, 36% of the total responses agreed that, the weather is becoming drier every year, 39 respondents representing 38% strongly agreed. Only 19% and 7% of the total respondents strongly disagreed and strongly disagreed respectively.

On the statement about annual increase in total amount of rainfall, 45% agreed that it is on the increase, only 38% strongly agreed while 6% strongly disagree with assertion.

The perception of the respondents on the issue of whether climate change has led to increased crop infestations and diseases, 40% agree with

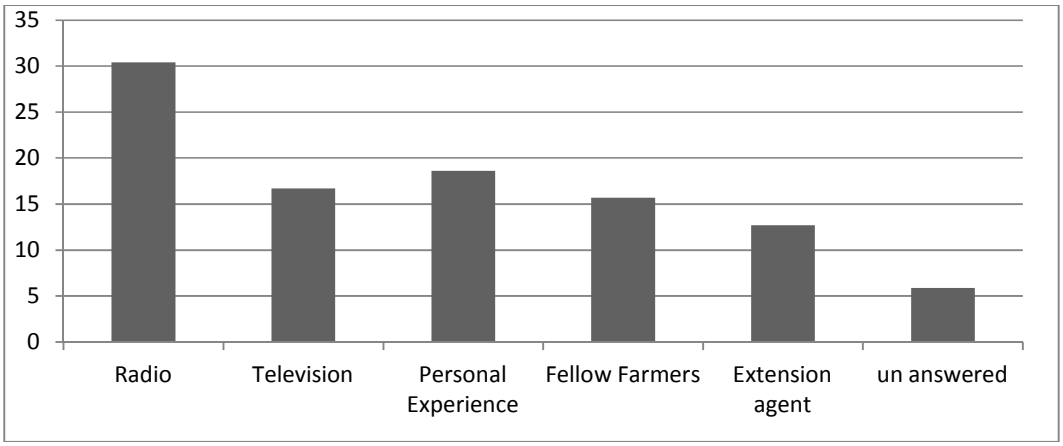

Fig. 3. Sources of Information on Climate Change (%)

the statement and 27% strongly agreed that increased crop infestations and diseases were caused by climate change factors.

It was also noted that 44% and 42% of the respondents agree and strongly agree respectively that there was gradual drying of water sources in the study area. Only 10% disagreed with the assertion and 4% strongly disagreed.

Results from the Table 4 further showed that 30% of the respondents agreed there was a decrease in crop yields, 21% strongly agreed that there was a decrease in crop yields as a result of climate change. [20] However found that soil quality in the area also determines crop yields. Similarly, from the data shown in Table 4, 35% of the respondents agreed that there were increased incidences of drought during rainy seasons and only 31% strongly agreed with the assertion. Twenty percent and 14% disagreed and strongly disagreed respectively.

3.3 Adaptation Strategies to Climate Change

Table 5 shows that 17% of the respondents agreed that cultivating varieties of crops was the main method they employed for adapting to climate change, 12% adapt by planting drought resistant crops, another 11% indicated planting of disease tolerant crops, while 12% adapted by plating different crops (mixed cropping), and 5% adapted by changing the extent of input into crop production, 3% adapt by engaging into irrigation (*Fadama)* farming.

Table 4. Perceptions of climate

Discernment indicator	Agree N/(%)	Disagree N/(%)	Strongly agree N/(%)	Strongly disagree N/(%)
The green environment in this village is reducing	49 (49)	10 (10)	38 (37)	4 (3)
The dryness in the environment is more than that of the past years	47 (46)	13 (13)	39 (38)	3 (3)
Yearly rainfall begins early	33 (32)	28 (27)	22 (22)	19 (19)
Yearly rainfall begins late	39 (38)	20 (20)	34 (33)	9 (9)
Yearly rainfall ends early	28 (28)	33 (32)	21 (20.)	20 (20)
Yearly rainfall ends late	44 (43)	22 (22)	28 (27)	8 (8)
Total rainfall is decreasing every year	47 (46)	9 (9)	41 (40)	5 (5)
The weather is becoming drier every year	37 (36)	19 (19)	39 (38)	7 (7)
Total rainfall is increasing every year	46 (45)	11 (11)	39 (38)	6 (6)
The weather is becoming wetter every year	37 (36)	12 (12)	48 (47)	5 (5)
Climate change has led to increased crop pest infestation and diseases	41 (40)	20 (20)	28 (27)	13 (13)
There is gradual drying of water resources	45 (44)	10 (10)	43 (42)	4 (4)
The cost of food crops are increasing because of climate change	49 (49)	9 (9)	38 (37)	5 (5)
Crop yield have decreased with climate change	31 (30)	24 (24)	26 (25)	21 (21)
Livestock numbers have decreased due to decreased pasture	51 (50)	11 (11)	35 (34)	5 (5)
Length of drought period during rainy season is longer	36 (35)	20 (20)	32 (31)	14 (14)

Source: field survey (2016)

Table 5. Adaptation strategies

Adaptation strategies	Frequency	Percentage (%)
Planting of different varieties of crops (multi-crop agriculture)	17	17
Planting of drought tolerant crops	12	12
Planting of disease resistant/tolerant crops	11	11
Changing the extent of input into crop production	5	5
Planting of different crops (mixed cropping)	13	12
Changing to irrigation (*Fadama*) farming	3	3
Decreased use of chemical fertilizer	6	5
Increased use of organic manure	19	19
Migration	9	9
No adaptation method	7	7
Total	**102**	**100**

Source: field survey (2016)

It can also be noted that, 6% of the respondents adapt by decreasing the use of chemical fertilizers while 19% follow increased use of organic manure. Furthermore, 9% of the respondents claim that migration is the best means to adapt to climate change while 7% said they do not adapt any method to adapting to climate change.

3.4 Perceived Hindrances to Adaptation Strategies

From Fig. 4, 24 respondents pointed-out that inadequate improved seeds was the hindrance for them to employ adaptation strategies, 22% confirmed that inadequate knowledge of adaptation methods was the hindrance, 3% claimed that lack of access to water for irrigation was a hindrance while, 21% held lack of information on weather as the hindrance to their adaptation, 19% argued that lack of capital to acquire new techniques was the hindrance to their adaptation strategies while 12% were of the opinion that there is no concrete adaptation strategy to climate change.

3.5 Alternative Crops Grown During Droughts

Table 6 shows the alternative crops grown by respondents in the advent of drought within the study area. Forty percent cultivate millet, 19% grow tomatoes, and 14% grow onions while 10% cultivate pepper. The results also show that about 12% cultivate sorghum while 3% alternate with spinach while 2% do not cultivate any crop. This implies that farmers in the area cultivate short duration crops in cases of droughts. Forty one of the 102 respondents choose to cultivate millet, a staple crop, probably for its drought resistance and being a crop that has economic and domestic values over sorghum. Onions and tomatoes were preferred too, possibly because they are cultivated for commercial purposes in dry weather especially during irrigation farming.

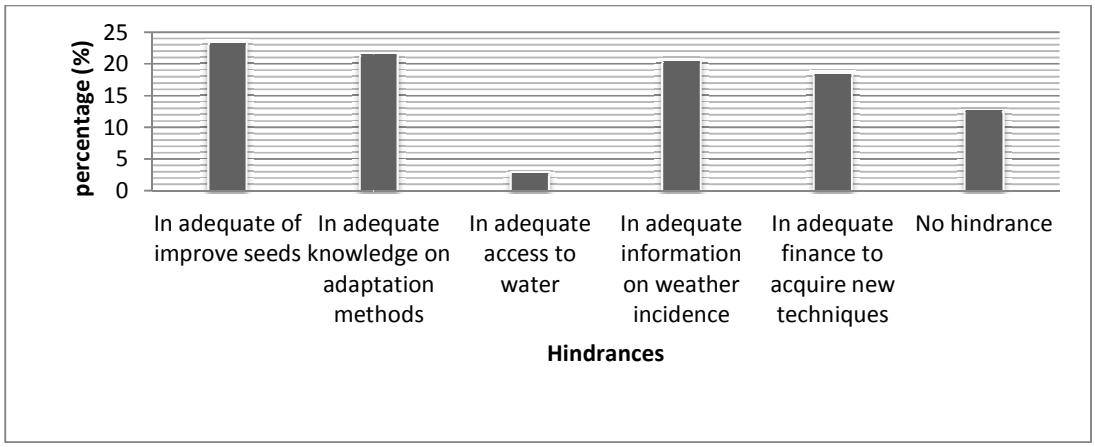

Fig. 4. Perceived hindrances

Table 6. Alternative crops

Alternative crops	Frequency	Percentage (%)
Millet (*Pennisetum glaucum*)	41	40
Tomatoes (*Lycopersicon esculentum*)	19	19
Onions (*Allium cepa*)	15	14
Pepper (*Capsicum annuum*)	10	10
Sorghum (*Sorghum bicolor*)	12	12
Spinach *(Hibiscus sabdariffa)*	3	3
None	2	2
Total	**102**	**100**

Source: field survey (2016)

3.6 Supports from Governments and/or International Development Partners

As indicated on Table 7, about 97% of the respondents appreciate that Katsina State Government subsidizes fertilizer and provides Afforestation support with tree species that are resistant to drought in the study area. Three percent of the respondents did not recognize the effort both Government and International Donor Agencies in providing adequate palliatives on counter-climate change strategies in the study area.

Table 7. External supports

Response	Frequency	Percentage (%)
Yes	99	97
No	3	3
Total	**102**	**100**

Source: field survey (2016)

4. SUMMARY, CONCLUSION AND RECOMMENDATIONS

4.1 Summary

This study examined the adaptation strategies developed by local farmers to cope with climate change indices in Jibia, northwest Katsina, Nigeria. It observed how peasant farmers perceived climate change; determined how climate change affects farming activities in the area and identified the adaptive strategies they developed in response to the negative impacts of climate change on agriculture. Findings revealed that 94% of the respondents are aware of climate change; 66% observed that there has been increased in the incidence of droughts during rainy seasons and 85% observed increased amount of total rainfall, while 55% were of the view that rainfall now commence earlier than in recent years. It was also found-out that inadequate access to information on weather incidences; lack of access to improved seeds; lack of water for irrigation and inadequate knowledge to adaptation methods were hindrances to farmers adapting to climate change. The results further showed that the main adaptation strategies to climate change by farmers in the area include increased use of organic manure; planting of varieties of crops and changing the extent of input in crop production. Other strategies are planting of disease resistant and drought tolerant crops, decreased use of chemical fertilizers, migration, aligning to irrigation farming as well as changing the crops cultivated.

4.2 Conclusion

Based on the findings, it was concluded that farmers observed elements of climate change in the area. Increased temperature, incessant rainfall and dry spells during rainy season were some indicators to climate change as perceived by the respondents. Various adaptation measures were being employed, among them, planting of drought tolerant crops, increased use of organic manure and planting varieties of crops.

4.3 Recommendations

The following recommendations are proffered:

Climate change issues and challenges should be publicized through mass media to enlighten farmers and citizens alike on adaptation strategies to reduce the aggravating factors. Successful adaptation techniques adopted elsewhere that have local relevance may also be replicated. Information on early warning signs and improved farmer education to create proper awareness on climate change and effective adaptation practices to be employed by farmers are also recommended. There is

also the need for governments, in partnership with International Development Partners, to build capacities of peasant farmers to strengthen their Indigenous Technology Knowledge abilities in developing and implementing economically viable user-friendly adaptation plans and strategies that would reduce the impacts of climate change on agricultural activities. Provision of financial resources that will increase farmers' abilities to adopt crop, soil and water management strategies in response to climate change should also be considered. This may be through formation of cooperative groups to support them from falling into the trap of being extremely vulnerable to climate change.

COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. Pearce D, Tietenberg V, Stewart S. The social costs of climate change: Green house damage and benefits of control. In: Bruce, J., H. Lee, and E. Hates, (Eds) Climate Change 1995: Economic and Social Dimensions of Climate Change. Cambridge University Press; 1996.
2. McCarthy JJ, Canziani OF, Leary NA, Dokken DJ, White KS. Climate change: Impacts vulnerability and adaptation. Contribution of working group II to the third assessment report of the inter-governmental panel on climate change. Cambridge University Press, Cambridge; 2001.
3. Adger WN, SH, Brown K, Conway D, Hulme M. Adaptation to climate change in the developing world. Progress in Development Studies. 2003;2(3):92–110.
4. Kurukulasuriya P, Mendelsohn R. A riparian analysis of impact of climate change on African cropland. CEEPA Discussion Paper No. 8. Centre for Environmental Economics and Policy in Africa. University of Pretoria, Pretoria, South Africa; 2006.
5. Mshelia AD. Adaptation strategies to climate change. Journ. Energy Env. 2005; 2(4):231–250.
6. Nwafor JC. Global climate change: The driver of multiple causes of flood intensity in Sub-Saharan Africa. Paper Presented at the International Conference on Climate Change and Economic Sustainability Nnamdi Azikwe University, Akwa, Nigeria; 2007.
7. Jagtap S. Managing vulnerability to extreme weather and climate events: implications for agriculture and food security in Africa. Paper Presented at the International Conference on Impacts of Extreme Weather and Climate on Socio-economic Development in Africa. Federal University of Technology, Akure, Nigeria; 2007.
8. Hulme M. Climate change in Southern Africa: An exploration of some potential impacts and implications in the SADC Region. Climatic Research.1996;5(2):78–94.
9. Inter-governmental Panel on Climate Change, IPCC. Climate Change: Impacts Vulnerability and Adaptation. Contribution of Working Group III to the Third Assessment Report of the Inter-governmental Panel on Climate Change. Cambridge University Press, Cambridge; 2001.
10. Adebayo WO. Heat Island and Oasis effects of vegetative canopies: A micro-meteorological Investigation. Int. Journ. Urban and Regional Affairs. 1997;7(9):23–34.
11. Chindo A, Nyelong PN. Lake chad: From Megalake to Minilake. Arid Wetland Bull. 2005;9(7):34–45.
12. Odjugo PAO. An analysis of rainfall patterns in Nigeria. Global Journ. Env. Sci. 2005;4(2):139-145.
13. Adefolalu DO. Climate change and economic sustainability in Nigeria. Paper Presented at the International Conference on Climate Change and Economic Sustainability Nnamdi Azikiwe University, Akwa, Nigeria. March; 2007.
14. Bradshow B, Dolan H, Smith B. Farm level adaptation to climatic variability and change: Crop diversification in the canadian prairies. OUP. Ontario, Canada; 2004.
15. Maddison D. Perception of and adaptation to climate change in Africa. CEEPA. Discussion Paper No. 10. Centre for Environmental Economics and Policy in Africa. University of Pretoria, Pretoria, South Africa; 2006.
16. Sokoto Rima River Basin Development Authority, SRRBDA. Energy Efficiency News. Bulletin 25; 2009.

17. Abdulkadir I, Musa FH, Babayo A. Analysis of land use/land cover changes in Jibia Local Government Area of Katsina State Nigeria. Journ. Geoinformatics & Surveying. Available:www.desertificationimpactsjibia/socio-economicdevelopment. (19/7/2012)
18. Abdulganiyu IA. Study of woody vegetation patches around Jibia Town, Katsina State. Unpublished MSc Dissertation. Department of Forestry, Usmanu Danfodio University, Sokoto – Nigeria; 2012
19. National Population Commission, NPC. Demographic and Population Census Results. Federal Republic of Nigeria; 2006.
20. Ibrahim YE, Nuraddeen AM. Soil fertility analysis of smallholder farms in Bugaje and Kusa Villages of Jibia Local Government Area, Nigeria. Journ. Agric.and Vet. Sci. 2014;5(II):2319-2372.

Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/18612