

Prioritizing Climate Change Adaptation Strategies among Farmers in Maijuju, Jos East LGA, Plateau State

Simi S. Goyol and Thomas M. Ibrahim

Department of Geography and Planning, Faculty of Environmental Sciences University of Jos

Corresponding author: mysim78@yahoo.com

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Abstract

Climate change poses a huge threat to farmers in the world today as on the average, individuals and groups within all societies have insufficient capacity to adapt to climate change. This study aims to investigate “climate change adaptation strategies among farmers in Maijuju, Jos East L.G.A. Plateau State” in order to prioritize actions for planning against climate change impacts. Quantitative data was obtained using a structured questionnaire administered to 150 farmers through the random sampling technique. Descriptive statistics from Likert scale measurement were used to analyze farmers’ perceptions of climate change, quantify impacts of climate change and identify adaptation strategies to climate change. Data obtained was subject to analysis using Statistical Package for Social Sciences (SPSS) and results presented in descriptive statistics of frequencies and percentages. Findings reveal that increase in temperature, late onset of rains, early cessation, and off-seasonal rainfall caused loss of crops, pests and diseases which resulted in food insecurity in Maijuju. Adaptation strategies taken by the farmers to mitigate the climatic effects on their farms are adjustments of planting dates, using different crop varieties, adoption of drought tolerant and early maturing crop varieties, application of agro-chemicals, fertilizer usage and application of animal manure among others. It is recommended that further effort towards complementing local adaptation strategies should be considered as this will positively influence priorities for adaptation actions.

Key words: Climate Change, Farmers perception, Adaptation Strategies, and Maijuju.

INTRODUCTION

Climate Change is the modification in average weather conditions of a place over a period of time. It refers to any change in climate over time, whether due to natural variability or as a result of human activities (IPCC, 2007). Through the statistical description of means and notable variations of relevant quantities of surface variables such as temperature, rainfall, and wind over a period of time ranging from months to thousands or millions of years, evidences of climate change have been established (IPCC, 2012). Over the years, climate change has had various levels of impacts on most sectors of the economy such as water resources, agriculture and food security, infrastructures among others (Goyol & Pathirage, 2018). Climate change has had adverse effects on the livelihoods of people in developing countries where a large proportion of the population is overwhelmingly dependent on agriculture for food and to cater for their immediate needs such as hospital bills, school fees, raiment, light bill, and water bills among others (Akponikpè *et al.*, 2010). Due to this overdependence, many people are living below the poverty line, face challenges of food insecurity and increased level of vulnerability to

uncertainties particularly in agrarian communities in Sub-Saharan Africa (Bryan *et al.*, 2009). Further to these, climate change is expected to and in parts of Africa has already begun to alter the dynamics of drought, rainfall and heat waves, and trigger secondary stresses such as the spread of pests, increased competition for resources, and biodiversity losses (Christensen *et al.*, 2007).

The mean global temperature has been increasing since the 1850s, mainly due to the accumulation of greenhouse gases (GHGs) in the atmosphere (Hansen *et al.*, 2000). The most common and most talked about greenhouse gas is carbon dioxide (CO₂), others considered more dangerous than carbon dioxide are Methane, Nitrous oxide, and Sulfur hexafluoride among others. But because CO₂ is the most common, scientists use it as the benchmark or measure of things that warm the atmosphere. The main causes of the concentration of GHG in the atmosphere are the burning of fossil fuels to meet increasing energy demand, and the expansion of intensive agriculture to meet increasing food demand, which is often accompanied by deforestation. This intensifies the release of CO₂ into the atmosphere as trees are no longer available. It is known that trees trap carbon dioxide and solar energy,

converts it through photosynthesis, then releases oxygen into the atmosphere. However, both natural and negative anthropogenic activities have continuously interrupted this process leading to global warming. Global warming is expected to bring about long-term changes in weather conditions: climate change and in turn an increased occurrence of extreme weather events (FAO, 2009). The speed of climate change is already inducing and modifying known variability patterns beyond the coping capacity of systems including agricultural systems (FAO, 2008).

It is generally acknowledged that Africa is the most vulnerable continent to climate change due to its weak adaptation capacity, high dependency on ecosystem goods or livelihood, and less developed agricultural production systems (IPCC, 2007). Over the last few decades, West Africa in particular has shown an increase in the impacts of climate change/ variability and an apparent increase in the scope of adaptation actions to cushion impacts. Recent food crises in countries such as Nigeria are promptings of the continuing vulnerability of the region to the changes of climatic conditions due to weak institutional capacity, limited engagement in environmental and adaptation issues, and a lack of validating on local knowledge (SPORE, 2008; BNRCC, 2008; Royal Society, 2005).

The capacity to adapt to climate change is unequal across and within societies. Generally, adaptation responses are underpinned by common enabling factors such as effective institutions and governance, innovation and investments in environmentally sound technologies and infrastructure, as well as sustainable livelihoods and behavioral/lifestyle choices (IPCC, 2014). Similarly, individuals and groups within societies may have different capacity levels to adapt to climate change due to differences in socioeconomic status. According to Füssel (2007), addressing adaptation practices to specific societies or communities may make it possible to offset the adverse impact of climate change. This helps to design appropriate policies and strategies in that local context. Targeting to invest in areas of greater shocks are clear adaptation actions that will not only reduce the vulnerability of communities but also provide avenues for better planning. The leading step in the process of climate change adaptation in agriculture is; perceiving climate change (Temesgen, *et al.*, 2011). Knowing farmers concerns and the manner in perceiving climate change is an essential virtue to offer effective policies for supporting

successful adaptation strategies of the agricultural sector. Further, it is also important to have precise knowledge about the type and extent of adaptation methods/strategies being taken up by farmers and the need for further advances in existing adaptation set ups. Hence, understanding how farmers see changes in climate and what factors shape their adaptive behavior is useful (Mertz *et al.*, 2009; Weber, 2010). In order to be willing to implement adaptation measures, farmers need to be aware of climate change (Silvestri *et al.*, 2012; Simelton *et al.*, 2013; Meldrum *et al.*, 2018).

The perception that farmers have about climate change not only informs their planting decisions, but also determines their choices of adaptation measures (Meldrum *et al.*, 2018; De Matos Carlos *et al.*, 2020). Therefore, understanding farmers' perceptions about climate change can be seen as a condition not only for the design and successful implementation of adaptation policies in agriculture but also for prioritizing what adaptation is most beneficial in terms of cost and importance (Hansen *et al.*, 2004; Silvestri *et al.*, 2012; De Matos Carlos *et al.*, 2020). Climate change perception is a complex process that encompasses a range of psychological constructs such as knowledge, beliefs, attitudes and concerns about if and how the climate is changing (Whitmarsh & Capstick, 2018). Perception is influenced and shaped, among other things, by the individuals' characteristics, their experience, the information that they receive, and the cultural and geographic context in which they live (vander Linden, 2015; Whitmarsh *et al.*, 2018). Therefore, measuring climate change perception and trying to find its determinants is not an easy task. The main features of communities or regions that seem to determine adaptive capacity are biophysical, economic, social, technological, information, skills, infrastructure, and institutional characteristics (Munasinghe *et al.* 2005). The aim of this paper is to examine climate change adaptation strategies among farmers in Maijuju, Plateau State in order to prioritize adaptation actions that can be taken against climate change impacts.

MATERIALS AND METHODS

Study Area

Maijuju is located in Farsum district of Jos East LGA, Plateau state. It shares boundaries with Daji Damshi at the North, Kadunu at the South, Bauchi state at the South-East and River Gongola, and Gora at the West. Maijuju is between lat 9° 45' 15" to 9° 46' 51" and long 9° 8' 45" to 9° 9' 54".

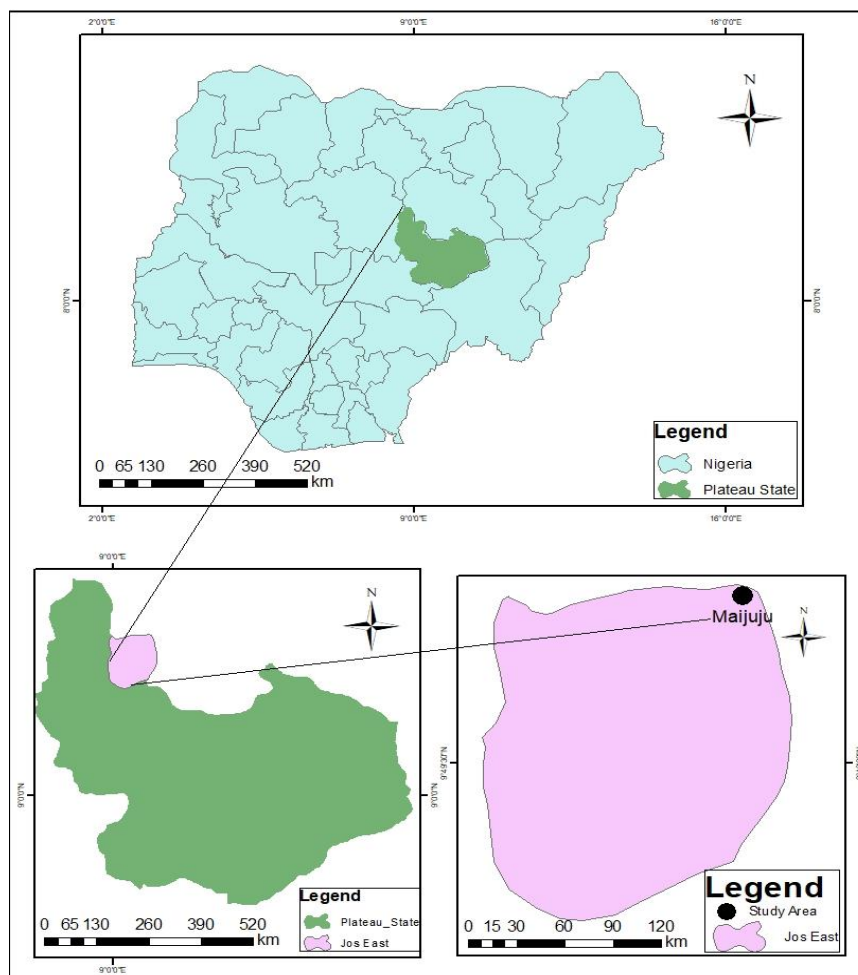


Figure 1: Maijuju, Jos East LGA, Plateau State

Jos East LGA of Plateau State Nigeria has a land area of about 907.2 km² and an estimated population of 82,260 people based on 2006 population census. About 80% of these populations are rural based and the remaining 20% live in the semi-urban centers (NPC, 2005). The weather of the area during the harmattan is characterized by the dry and dusty Northeasterly trade winds blowing from Sahara Desert (Nigerian meteorological agency ‘Nimet’ Jos, 2018). While in the raining season, the area enjoys over 6 months of rainfall. The rural settlers engage in farming as their main occupation while those in the semi- urban areas are either artisans or civil servants working in government establishments clustered around the area who mostly engage in farming as a secondary occupation. Crops such as Maize, Millet and Rice as well as Tomatoes, Pepper, Cucumber, Cabbage, Okra, Peas, and Green beans are cultivated in commercial quantities.

Data Collection and Analysis

Quantitative data obtained through a structured questionnaire was used to collect data for this study. One hundred and fifty (150) respondents were selected using random sampling technique to take part in the survey. A set of closed ended questions were used to elicit information about the socio-economic status of respondents, nature of the climate risk, the impact of climate change as well as the current climate change adaptation strategies of respondents. SPSS analysis package was used for data analysis and findings are presented in tables as frequencies and percentages as well as in graphs to make generalization from the data collected from the sampled population. The 5 point Likert scale was used for the ranking of level of agreement, frequency level and impact level, while all the 5 points are presented in the descriptive findings, the discussion of findings concentrates on only the positive side of the scale. Also, field notes taken from the researcher’s

observations while at field are used to corroborate discussions of research findings.

RESULTS AND DISCUSSION

Socio-Demographic Characteristics of the Respondents

Findings from analysis of quantitative data collected from sampled farmers through

questionnaire administration are presented accordingly. Information on respondents' gender, education level, marital status, main source of income, years of farming experience, other sources of farmer's income, family size, landholding are captured to assess the socioeconomic status of respondents (refer to Table 1).

Table 1: Farmers characteristics

Gender	Frequency	Percentage (%)
Male	118	79
Female	32	21
Educational status	Frequency	Percentage (%)
Primary	27	18
Secondary	76	51
Tertiary	29	19
No formal education	18	12
Marital status	Frequency	Percentage (%)
Single	39	26
Married	106	71
Widowed	5	3
Main source of income	Frequency	Percentage (%)
Crop production	148	99
Livestock Production	0	0
Mixed farming	2	1
Years of farming experience	Frequency	Percentage (%)
1-10years	36	24
11-20years	66	44
21-30years	39	26
31>years	9	6
Farming as main occupation	Frequency	Percentage (%)
Yes	122	81
No	28	19
Alternative source of income	Frequency	Percentage (%)
Civil servant	9	6
Hand work	18	12
Business	6	4
Others (Pension)	1	1
Total	34	23
Household Size	Frequency	Percentage (%)
<10	116	76
11-15	25	15
16-20	9	9
Land ownership	Frequency	Percentage (%)
Yes	139	93
No	11	7
Farm size	Frequency	Percentage (%)
<1 hectare	130	87
2-5 hectares	18	12
6-10 hectares	2	1
11> hectares	0	0
Total	150	100%

Source: Fieldwork 2021/2022

Findings reveals that from the total sample, 79% are male and 21% are female. Findings on respondents education level reveals that 18% attended primary school, 51% attended secondary, and 19% attended tertiary institution, while 12% of the respondents had no formal education. In terms of marital status, 26%, 71%, and 3%, are single, married, and widowed respectively. Even though 81% of the respondents have farming as their main occupation and 19% had farming as a secondary occupation, 98.7% of respondents depend on farming as their main source of income. 1% of respondents were observed to have an alternative source of income out of which are civil servants currently under government payroll or retirees receiving their pension. This implies that though farming might not be considered a major occupation for some, yet it can be a lucrative venture that provides above an alternative occupation. Findings reveal that 26% of the farmers had less than 10 years farming experience

and over 70% more than 10years of experience. As such, most respondents were found suitable enough to identify local climate changes and changes in farm practices due to their years of experience. Regarding landholding size, majority of the respondents own small and fragmented plots as portions allotted to them from family lands. There are a few farmers (7%) who do not own their personal land but utilize the communal land or collect from others on lease.

Farmers Experiences of Climate Change

Ten (10) statements indicating common experiences of changes in temperature patterns, rainfall patterns, pest and diseases infestation as well as deforestation were presented to respondents on a 5-point agreement scale to rank what situation best describes their opinions of experiences of local climate change in Maijuju. The results are presented in Table 2.

Table 2: Statement Points on Climate Change Experiences

Statement Point	SA	A	N	D	SD	Total (%)
There is an increase in temperature	60	13	19	8	0	100
There is an increase in the number of hot days	24	76	0	0	0	100
There is a late onset of rainy season	87	6	7	0	0	100
There is an early cessation of rainfall	100	0	0	0	0	100
There is a decrease in rainfall amount	77	23	0	0	0	100
There is an increased regularity of rainfall	0	1	5	58	36	100
Rainfall couldn't support full crop growth period	97	3	0	0	0	100
More cases of crop disease and pest infestation	100	0	0	0	0	100
More Water bodies and streams drying out	91	9	0	0	0	100
Deforestation is becoming more severe than before	99	0	0	1	0	100

Note: 5 = Strongly agree (SA), 4 = Agree (A), 3 = Neither (N), 2 =Disagree (D), 1=Strongly Disagree (SD)
Source: Fieldwork result 2021/2022

Changes in Temperature: In terms of changes in temperature patterns, 73% of respondents are of the opinion that there is an increase in temperature over the years. All 100% respondents are of the opinion that there is an increase in the number of hot days, which farmers perceived was more than what was formerly experienced in the area.

Changes in Rainfall: With regards to changes in rainfall patterns, most farmers agreed that the rainy season started later (93%) and stopped earlier (100%). All 100% respondents noted a decrease in rainfall amount. 94% agreed to have observed an increased irregularity in rainfall patterns and 97% further agreed that due to irregularities, rainfall could not support full crop growth period.

Incidences of Diseases and Pests: Similarly, all (100%) of the farmers agreed that they experienced more cases of crop diseases and pest infestation due to warmer temperatures and insufficient rainfall.

Drying of water bodies: All (100%) of respondents agreed that they observed more cases of water bodies and streams drying out in the area. This they attributed to increase rates of evaporation due to warmer temperatures and less recharge of water bodies due to less rainfall.

Loss of Vegetation: 99% of respondents also agreed that deforestation was becoming more severe in the area. Even though not necessarily as a result of climate change but other factors such as

clearing forests to expand agricultural land and cutting down trees for fuel wood and other domestic purposes.

Climate Change Impacts In Maijuju

The Farmers in Maijuju agreed to have perceived changes in their local climate over the recent years as they observed different changes in rainfall

patterns, increase in temperature and other changes which have direct impacts on farmers and their activities. Five (5) variables earlier identified from literature as possible impacts of climate change on crop production were posted to the farmers to rate on a 5-scale ranging from Very high Impact (5) to No impact (1). The results are presented in Table 3.

Table 3: Climate Change Impacts

Climate change impacts	VH	HI	MO	MI	NI	Total (%)
Decline in crop yield	100	0	0	0	0	100
Food shortage	0	0	0	82	18	100
Increase in weeds, pests and diseases	87	12	1	0	0	100
Decrease of water quality and quantity	100	0	0	0	0	100
High risk of crop damage	100	0	0	0	0	100

Note: 5= Very high impact (VH), 4= High impact (HI), 3= Moderate impact (MO), 2= Mild impact (MI), 1= No impact (NI)

Source: Fieldwork 2021/2022

Findings reveals a decline in crop yield, decrease in water quality and quantity, high risk of crop damage from drought, and increase weed and pest pressure; were Four (4) variables with Very high Impacts of Climate change. Even though respondents agreed to a decline in crop yield, they however said that food shortage was a mild impact. This can be as a result of previous findings on farmers' socio-demographic characteristics where 20% of farmers have a main occupation and farming as a secondary occupation and another 23% had alternative/ off farm income sources.

Decline in Crop Yield

A major impact of Climate change to farmers in Maijuju is a decline in crop yield. All farmers (100%) indicated to experience declined in crop yield due to the rainfall and temperature changes they experience in the area. Similar to many parts of Nigeria, crop production in Maijuju is dependent on favourable rainfall and temperature. With changing climate, crops sensitivity to weather stresses will lead to further decline in crop yield except if tolerant plant species are introduced.

Decrease in Water Quality and Quantity

Another impact of climate change identified from findings is decrease in the quality and quantity of water which 100% of respondents affirmed to. In Maijuju, farmers indicated that the decrease in water quantity is evident with recent drying up of rivers and streams in the area. This often led to cases of occasional and seasonal drought. With

prolonged decrease in water quantity, water quality subsequently decreases as the colour and even the odour of the water changes. The respondents believe that Climate change is the main driver of the current changes in availability of water in the area which also influences water demand for agriculture. As the yearly amount of rain decreases, the quantity of water to support the growth of plants is insufficient. This in turn causes the drying and crop death even before the yielding period of the plants.

High Risk of Crop Damage from Water shortage

The third impact of climate change is high risk of crop damage due to water shortages. All (100%) of respondents indicated a high risk of crop damage from water shortages. Drought is a situation in which the amount of available water through rainfall is insufficient to meet the evapotranspiration needs of the crop. Drought also results in abnormal metabolism that may reduce plant growth, and/or cause the death of entire plants. The growth of crops is greatly affected due to insufficient rainfall to support the full growing period in the area, which also affected the yield of the crops.

Increase in the emergence of Weeds, Pests and Disease Pressure

99% of the farmers indicated to have experienced an increasing trend in the emergence of weeds as well as increased pressure of pests and diseases on their farms. Farmers indicated that the occurrence

of farm weeds was on the increase, which when left causes stunted growth and poor yield of crops and farmers have to control weed multiple times now within the farming season. Similarly, farmers indicated an increase in the incidences of pests and diseases in recent years, particularly between 2020 and 2021. Common insect pests in the area are worms that eat up the leaf and stems of crops and moths or leaf miners that cause the tomato ebola disease in tomatoes. Farmers further indicated that when pesticides and agro-chemicals were applied, they had different effect on both the pests and the weeds on their farms which brought more damage to their farm produce.

CLIMATE CHANGE ADAPTATION

Access to Climate Change Adaptation Information

Access to information about climate change and its adaptation strategies determines the kind of mitigation or adaptation actions taken against the effect of climate change. Sources of information on climate change adaptation range from external sources such as government agencies and NGOs or internal sources such as farmer to farmer and neighbours. Research findings indicated that farmers in Maijuju mostly access information on climate change adaptation from internal sources. Findings on these sources are presented in table 4.

Table 4: Sources of information on climate change adaptation

Sources of information on climate change & adaptation strategies	A	O	S	R	N	Total (%)
Extension workers (Malaman Gona)	0	0	11	0	89	100
Farmer to farmer	57	16	27	0	0	100
Neighbors	56	28	16	0	0	100
Television (TV)	0	0	10	2	88	100
Radio	0	6	67	15	12	100
Newspapers	0	0	3	3	94	100
School	0	0	66	10	24	100
Government agencies	0	0	0	11	89	100
NGOs	0	0	0	2	98	100

Note: 5= A=Always, 4= O =Often, 3= S= Sometimes, 2= R= Rarely, 1= N=Never

Source: Fieldwork 2021/2022

Results shows that there are only two major areas where by the farmers get information about climate change and possible strategies to adopt to cushion the impact of climate change: from farmer to farmer 73% and 84% from neighbors. Most farmers do not use television or newspaper in their homes because of their distance from the town and lack of electricity in the place. This is also a key factor of why information about climate change is very scarce in the area. Most of these farmers have never heard about the possibility of accessing climate change information from NGOs. 11% of farmers indicated that some years back Local Government extension workers popularly known as Malaman gona did come from neighbouring Bauchi state to inform them about climate change and its adverse effects. After which farmers were advised on what measures to take for effective crop yield and mitigation against the adverse effect of the climate change on their farms. Other benefits from the visit of the Malaman gona included fertilizer, new crop varieties and some irrigation farming accessories for the very few who engage in irrigation farming along the stream bank.

Findings further revealed that accessing information about climate change and possible adaptation strategies had positive impacts on farmers and the overall farming output. 100% of the farmers agreed that access to information was a major determinant to their adaptation choices. This is in line with earlier identified findings from literature that access to information enlarges perception for example on adjustment on planting date, change on crops, chemical usages, among others.

Farmers Adaptation Strategies against climate change

In this study, adaptations are adjustments or interventions, which take place in order to manage or take advantage of the opportunities presented by a changing climate. It is the process of improving society's ability to cope with changes in climatic conditions across time scales, from short-term to the long-term. The goal of an adaptation measure should then be to increase the capacity of a system to survive external changes. A number of adaptation options earlier identified from literature were explored with the

questionnaire with famers. These are identified by considering the number of frequencies of these adaptation strategies among farmers as compared

to all other options surveyed. Findings are presented in Table 5.

Table 5: Climate change adaptation strategies

Adaptation strategies	A	O	S	R	N	Total (%)
Drought tolerant & early maturing crops	100	0	0	0	0	100
Change planting date	88	12	0	0	0	100
Application of agro-chemicals	87	12	0	1	0	100
Change crop variety	48	13	36	3	0	100
Fertilizer usage/ animal manure	44	56	0	0	0	100
Crop diversification	7	48	45	0	0	100
Change fertilizer application	1	48	51	0	0	100
Agro-forestry/planting tress	0	0	30	13	57	100
Home-garden agriculture	0	0	0	0	100	100
Water conservation techniques	0	0	0	0	100	100
Water harvesting techniques/ irrigation	0	0	0	0	100	100
Mixed farming	0	0	0	0	100	100

Note: 5= A=Always, 4= O =Often, 3= S= Sometimes, 2= R= Rarely, 1= N=Never

Source: Fieldwork 2021/2022

Adaptation strategies identified as prominently used by farmers in Maijuju range from using adjustment of planting dates, using different crop varieties, adoption of drought tolerant and early maturing crop varieties, application of agro-chemicals, fertilizer usage and application of animal manure among others, which accounts the response of 100%, 61%, 100%, 99%, 100% respectively to reduce the negative impact of climate change (see table 5 above). Among the strategies, Adoption of drought tolerant and early

maturing crop varieties and changing planting date are the strategies that are used most among all the strategies while Water conservation techniques, Water harvesting techniques and increased use of irrigation, and Home-garden agriculture are the least to be used or applied by the farmers in Maijuju. In prioritizing adaptation strategies based on farmers responses from the most adopted to the least adopted, this research arrived at three (3) categories. These are presented in Table 6.

Table 6: Prioritizing climate change adaptation strategies based on farmers responses

First Priority	Second Priority	Third Priority
Drought tolerant & early maturing crops	Change of crop varieties	Water harvesting techniques/ irrigation
Changing planting date	Fertilizer usage/ animal manure	Water conservation techniques
Application of agro-chemical	Change fertilizer application	Mixed farming
	Crop diversification	Home-garden agriculture
		Agro-forestry/planting tress

Source: Fieldwork 2021/2022

Farmers in Maijuju adopt more often certain adaptation actions as first priority adaptation strategies (Use of drought tolerant and early maturing crops, Changing planting date, and Application of agro-chemical) in their farms against the negative effects of climate change. Findings indicates that although there are adaptation strategies that should have naturally been adopted by the farmers considering the nature of climate risk and exposure to impact, however these were not adopted by farmers in the

area. Due of the peculiarity of the problems that farmers in the area are confronted with (decline in crop yield, decrease in water quality and quantity, high risk of crop damage from drought, and increase weed and pest pressure), one of the major climate risk is inadequate rainfall to support the full growth of crops, yet findings reveals that farmers did not adopt measures such as water harvesting techniques/ irrigation and water conservation techniques, that will help in mitigating against the negative effect water

shortages due to inadequate rainfall. This, the farmers did not see as a priority strategy against climate change impacts. If water harvesting techniques/irrigation and water conservation techniques can be included as priority actions to selected adaptation strategies, it will greatly boost crops yields and reduce crops wilting caused by insufficient rainfall. This can be possible if the government and relevant agencies take action plans to the locals to create awareness about water conservation techniques as one of the most important adaptation strategies to take against the adverse effect of climate change in the area.

Farmers in Maijuju have but little information about climate change adaptation strategies and most of which are from Neighbor-neighbor, farmer-farmer and agro-chemicals and crops variety sellers in the market. Findings on the sources of information, advice received and adaptation strategies adopted, the researcher found out that most of the farmers received not much information about climate change adaptation strategies, but their level of adaptation strategies is based on their past experiences which they rely on weather patterns of each year to decide what strategy to adapt. Findings further revealed that farmers' sources of information on climate change are basically internal (farmer to farmer, and neighbors), and other external sources such as extension workers, government agencies and NGOs were almost totally absent. Hence, the importance of community support systems and social networks in building climate change adaptation are highlighted in the findings of this research.

The key factor affecting the farmers' choice of adaptation strategies in the area is lack of information from external bodies about climate change effects and its adaptation strategies. When there are more contacts from the external bodies or agencies it will enhance choices in adopting strategies that will bring great mitigation against the changes in the climate.

CONCLUSION

Climate change has adverse effects both on the farms and the people in Maijuju where a large proportion of the population is heavily dependent on agriculture. Most of the respondents indicate that there have been noticeable and repeated rise in temperature and rainfall failures resulting in higher levels of food insecurity, including serious shortage of food in Maijuju due to significant loss of crops in the year 2021. Farmers should thus be able to adapt in order to reduce the negative impact

of climate change. This paper provided an understanding on prioritizing climate change adaptation strategies among farmers in Maijuju, Jos East L.G.A., which data was collected from 150 respondents. It answered the questions of what is the level of perception of farmers and the major adaptation strategies to climate change and attempted a priority classification of adaptation strategies. Descriptive statistics of Likert scale measurements of level of agreement, impact and, frequency scale were used to analyze farmers' perception to climate change, its impacts and adaptation strategies. The results revealed that farmers are well aware of the increase in temperature and decrease in rainfall and resultant inadequacy of water for sufficient crop growth. Thus, all of the farmers perceived the existing climate change in the study area in one form or the other. The study also found out that there are five major adaptation strategies: adjusting planting date, using different variety, using of drought tolerant variety, application of agro-chemical, fertilizer among others. Above all, it discovered the key factors to consider during intervention in order to exploit the available adaptation strategies so to promote the adaptive capacity of farmers.

Based on the findings of this study, the following recommendations have been made for local policy makers and stakeholders in the district. The level of perception of farmers to climate change has a significant effect on the level of using adaptation strategies, therefore, emphasizing on awareness creation about the changing climate is very important.

Policy interventions aimed at mitigating the adverse effect of climate change need to focus on supporting farmers to intensively use and capitalize the existing adaptation strategies: use of drought tolerant varieties, adjusting planting dates, and irrigation.

It is necessary to encourage informal social networks and discussions at farmers' level so that will enable them to share information and experiences which are important for choice of appropriate adaptation strategies.

Making opportunities for a diversified farm and non-farm income sources for the farmers' is important. Higher income increases the purchasing power of farmers and enables them to easily meet the cost of farm inputs like drought tolerant variety, inputs for irrigation use like water pump, seeds, seedlings and fertilizer. Hence, adequate farm inputs need to be available to improve farm income and creation of alternative off-farm income source is very important.

REFERENCES

- Akponikpè, P. I., Johnston, P., and Agbossou, E. K. (2010). Farmers' perception of climate change and adaptation strategies in Sub-Saharan West-Africa. In *ICID+ 18 second international conference: Climate, sustainability and development in semi-arid regions*, Fortaleza - Ceará, Brazil.
- Bryan, E., Deressa, T. T., Gbetibouo, G. A., and Ringler, C. (2009). Adaptation to climate change in Ethiopia and South Africa: Options and constraints. *Environmental science and policy*, 12(4), 413-426.
- Building Nigeria's Response to Climate Change (BNRCC) (2008): 2008 Annual Workshop of Nigerian Environmental Study Team (NEST): The Recent Global and Local Action on Climate Change, held at Hotel Millennium, Abuja, Nigeria; 8-9th October, 2008.
- Christensen, J. H., Hewitson, B., Busuioc, A., Chen, A., Gao, X., Held, R., and MagañaRueda, V. (2007). Regional climate projections. In *Climate Change, 2007: The Physical Science Basis. Contribution of Working group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, University Press, Cambridge.
- FAO (Food and Agriculture Organization). (2007). Climate change adaptation and mitigation in the food and Agriculture Sector. Food and Agriculture Organization of the United Nations, Rome, Italy. 58.
- FAO (Food and Agriculture Organization). (2009). Climate Change in Africa: The Threat to Agriculture. <ftp://ftp.fao.org/docrep/fao/012/ak915e/ak915e00.pdf>.
- FAO (Food and Agriculture Organization) (2016). Ethiopia situation report. May.
- Füssel, H. M. (2007). Adaptation planning for climate change: Concepts, assessment approaches, and key lessons. *Sustainability science*, 2(2): 265-275.
- Goyol, S., & Pathirage, C. (2018). Farmers perceptions of climate change related events in Shendam and Riyom, Nigeria. *Economies*, 6(4), 70.
- Hansen, J., Sato, M., Kharecha, P., Russell, G., Lea, D. W., and Siddall, M. (2007). Climate Change and trace gases. *Phil. Trans. Roy. Soc. A*, 365, 1925-1954, doi:10.1098/rsta.2007.2052.
- Hansen, J., Sato, T. Bond, B. Cairns, H. Gaeggler, B. Liepert, T. Novakov, and B. Schichtel, 2004: Carbonaceous aerosols in the industrial era. *Eos Trans. Amer. Geophys. Union*, 85, no. 25, 241, 245.
- Kandlinkar, M. and Risbey, J. (2000) Agricultural Impacts of Climate Change. If Adaptation Is the Answer, What Is the Question? *Climate Change*, 45, 529-539.
- IPCC (Intergovernmental Panel on Climate Change). (2007). *Climate change 2007: Synthesis report*. Contribution of working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.
- IPCC, Geneva, Switzerland. IPCC (Intergovernmental Panel on Climate Change). (2012). Glossary of terms in managing the risks of extreme events and disasters to advance climate change adaptation. *A special report of working Groups I and II*, Cambridge University Press, Cambridge, UK, and New York, NY, USA. 555-564.
- IPCC (Intergovernmental Panel on Climate Change). 2014. *Climate Change 2014: Impacts, Adaptation and Vulnerability: Regional Aspects*. Cambridge University Press.
- Matos Carlos, S., da Cunha, D. A., Pires, M. V., and Do Couto-Santos, F. R. (2020). Understanding farmers' perceptions and adaptation to climate change: the case of Rio das Contas basin, Brazil. *GeoJournal* 85, 805–821.
- Meldrum, G., Mijatović, D., Rojas, W., Flores, J., Pinto, M., Mamani, G., et al. (2018). Climate Change and Crop Diversity: Farmers' Perceptions and Adaptation on the Bolivian Altiplano. *Environ. Dev. Sustain.* 20, 703–730.
- Mertz, O., Mbow, C., Reenberg, A., and Diouf, A. 2009. Farmers' perceptions of climate change and agricultural adaptation strategies in rural Sahel. *Environmental Management*, 43(5), 804-816.
- Munasinghe M. and Swart R. 2005. *Primer on climate change and sustainable development: Facts, policy analysis, and applications*. Cambridge University Press.

- National Population Commissions (NPC): Provisional of 2006 Nigeria Census Results.
- Nigerian Meteorological Agency (Nimet) Jos, (2018).
- Royal Society (2005) Impact of climate change on crops worse than previously thought <http://royalsociety.org/news.asp?>
- Silvestri, S., Bryan, E., Ringler, C., Herrero, M., and Okoba, B. (2012). Climate Change Perception and Adaptation of Agro-Pastoral Communities in Kenya. *Reg. Environ. Change* 12 (4), 791–802.
- Simelton, E., Quinn, C. H., Batisani, N., Dougill, A. J., Dyer, J. C., Fraser, E. D. G., et al. (2013). Is Rainfall Really Changing? Farmers' Perceptions, Meteorological Data, and Policy Implications. *Clim. Development* 5, 123–138.
- SPORE, 2008; Climate Change, Spore Special Issue-August, 2008
- TemesgenTadesse, Hassan, R. M., and Ringler, C. 2011. Perception of and adaptation to climate change by farmers in the Nile basin of Ethiopia. *The Journal of Agricultural Science*, 149(1): 23-31.
- Van der Linden, S. (2015). The Social-Psychological Determinants of Climate Change Risk Perceptions: Towards a Comprehensive Model. *J. Environ. Psychol.* 41, 112–124.
- Whitmarsh, L., and Capstick, S. (2018). “Perception of Climate Change.” In *Psychology and climate change: Human perceptions, impacts, and responses*. Editors S. Clayton, and C.Manning (Academic Press), 13-33.