SURVEY OF DROUGHT ADAPTATION STRATEGIES AMONG HOUSEHOLDS IN RURAL AREAS OF KUMBOTSO LOCAL GOVERNMENT KANO STATE

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A DISSERTATION SUBMITTED TO THE DEPARTME

NT OF GEOGRAPHY BAYERO UNIVERSITY KANO IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF A MASTER OF SCIENCE NATURAL RESOURCES MANAGEMENT AND CLIMATE CHANGE

DECEMBER 2016

Declaration

I hereby declare that this work is the product of my research effort; under the supervision of Dr. Ibrahim Baba Yakubu and has not been presented and will not be presented elsewhere for the award of a degree or certificate, all sources have been duly acknowledged.

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Certification

This is to certify that research for this dissertation with the subsequent preparation of this dissertation by has been undertaken by IshamSani SPS/12/MDL/00020 in the Department of Geography Bayero University Kano, for the degree of Master of Science in Natural Resources Management and Climate Change.

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This dissertation entitled survey of drought adaptation strategies among households in rural areas of Kumbotso Local Government area Kano State has satisfied all the requirements for the award of the Master of Science Natural Resources Management and Climate Change.

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Acknowledgement

Praise be to God the most gracious the most merciful, who made it possible for me to conduct this research. I am very grateful to my course lecturers in the Master of Science Natural Resources Management and Climate Change program.

I really acknowledge the unforgettable concern of my supervisor Dr. Ibrahim Baba Yakubu. Sir, you always have time to read my work, make corrections and guidance which entirely changed my academic orientation positively. May God make it possible for you to succeed in all that you wishes.

I would like express my gratitude and pray to my late mother HajiyaHusainaShehu and late father AlhajiMuhammaduSaniIlliyasu may your gentle soul rest in perfect peace. I will always remember my wife Rabi LawanYakasai, my brothers and sisters, including; Alh. Garzali, HajiyaTarasuluDahiru late MariyaSani and other relatives for their support and courage My colleagues, including Mukhtar Ismail Abdulkadir, Mahmud Zubair Imam, SalisuGwadabe, AbdullahiHussain, and Marwan HabibYakasai who have really contributed through advise, corrections, and provision of related literatures.

Finally I am grateful to district heads of the respective study units, who assisted me on meeting the respondents for the research interviews, and also the respondents for their corporation.

Dedication

I dedicated this work to beloved parents, AlhajiMuhammaduSaniIliyasu, and HajiyaHussainaShehu

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ABSTRACT

The aim of this research is to assess the level of preference of drought adaptation strategies among farmers in rural areas of Kumbotso local government Kano state. The study locations were Rigafada, Batakaye and Zara communities. The respondents were selected using systematic and purposive sampling. Survey interviews containing structured questionnaires, and checklist for focus group discussion were conducted for data collection. Descriptive statistics such as frequency distribution, mean, and standard deviation were used for data analysis. In addition Z-score statistic was used to measure relative standing of both on-farm and off-farm adaptation strategies. It was found that majority of the respondents have adequate historical experience on droughts that occurred in 1980s (83.6% in Batakaye; 89.5% in Rigafada; and 85.7 in Zara). For the off-farm adaptation strategies, trade was the most preferred in Rigafada and Batakaye (Z-score =1.17 and 2.02 respectively). In Zara food consumption changes was the most preferred (Z-score =1.52). Among the on-farm adaptation strategies, cultivation of drought resistant seed variety was the most practiced in Rigafada, Batakaye and Zara (Z-score =1.15, 1.17 and 1.69 respectively) The study recommends that The farmers should be encourage to engage in to the disaster risk management activities, such asagricultural insurance, and stock market investment. This would enable the farmers to enter in to the international market of agricultural products in order to promote their resilience to severe drought events

CHAPTER ONE

1.1 INTRODUCTION

Drought is prolonged absence or marked deficiency of precipitation (Mehdi, 2007). Also it is an extended period, a season, a year, or several years of deficient rainfall, relative to the long term average for the region (Abubakar, and Yamusa, 2013). Generally rainfall is related to the amount of water vapor in the atmosphere, combined with the upward forcing of the air mass containing that water vapor. If either of these is reduced, the result is a drought (Mariere, 2012).

Conceptually, drought and desertification are very difficult to define due to controversy involve among scholars and or subject emphasis. For logical understanding and academic pedagogy however, three main kinds of drought are considered, these are meteorological, hydrological, and agricultural (Ibrahim, 2014).

According to National Weather Service, (2008) meteorological drought is defined usually based on the degree of dryness in comparison to some normal or average amount of rainfall. The agricultural drought link various characteristics of meteorological drought to agricultural impacts, focusing on precipitation shortages, differences between actual and potential evapotranspiration, soil water deficit, reduced groundwater levels. The hydrological drought usually occurs following period of extended precipitation shortfall that impacts water supply (stream flow, reservoir, lake level, and groundwater) potentially resulting in significant societal impacts.

The socio economic drought is associated with human activates. It occurs when various human activities are impaired due to reduced precipitation or water availability (Ebenezer, 2015). On the other hand, Benson, and Clay, (1998) said that, an economic definition of drought by contrast

involves low rainfall that is outside the normal expected parameters with which an economy is equipped to cope. Such an event typically results in sharp reductions in agricultural output, related productive activity and employment in turn, this is likely to reduce consumption and investment and destocking. Socio economic drought occurs when the demand for the economic good exceeds supply as a result of a weather-related shortfall in water supply (Mehdi, 2007).

Among the types of drought defined, the meteorological drought was recorded in Kano and other parts of northern Nigeria. For example the study of the analysis of rainfall dynamics in Kano, study showed that the rainfall amount was high in the 1930s and low around 1970s and then increase in 1990s to date. It was believed that droughts and near droughts conditions were experienced between 1970s and 1980s Mohammed, et al(2015). Findings from the 10-year non-overlapping and 30-year overlapping sub period analysis (crammer's test) and the plotted standard deviation for the monthly and annual rainfall revealed that Kano has been experiencing decreasing number of dry conditions and consequently increasing wetness over the recent years. This also coincides with the periods of great droughts of the 1970s and 1980s in the regionAbaje, et al(2014). However the standard precipitation index (SPI) calculated for the distinct savannah ecological zones within northern Nigeria reflects how severe to extreme drought characterized the 1980s, while the 1990s experienced mild droughts like the years before 1980s (Adeaga, 2011).

The trend of rainfall in Kano state (as described above) indicated that 1970s and 1980s was periods of droughts. Among the impacts of these droughts was,it results in increased indebtedness' culminating in the loss of productivity and the income sources (Mortimore, 1989). And from 1990s to date, the rainfall has been increasing, which also indicated that no serious

drought hits the region. Therefore the people especially rural farmers are recovering from impacts suffered. In other words they have different ways of coping and adapting to the drought

To study drought adaptation strategies the Drought Cycle Management Model (DCM model) and the Droughts, Agricultural Production, Adaptation and Adaptation Motivation Theory provides a relevant framework.DCM model is a refinement of the general disaster risk reduction models (Schilderinck, 2009). The model considered drought as a cyclical phenomenon, therefore it has been useful in assessing how the rural communities coped, and at the same time considered how they recovered when the drought terminated. The model recognized four stages through which community can cope with the drought. The first is called normal stage. The second stage is alert-alarm when drought was envisaged. And when the drought hits the community or society, it is known as emergency stage. And finally the recovery stage when the drought terminates, before another cycle. On the other hand the adaptation motivation theory distinguishes between several socioeconomic and psychological factor to explain a farmers drought risk adaptation. Furthermore, it helps to gain insight in the factorsthat determine the adaptation stage of a farmer (Duinen, 2014).

1.2 RESEARCH PROBLEM

Many literature such as Mortimore, (1989); Nyong, (2001); Dai, (2004); Ekpo, and Nsa, (2011); Adeaga, (2011); Kayode, and Francis, (2012); Francis, and Kayode, (2013);Joshua, and Ekwe, (2013);Abubakar, and Yamusa, (2013); Ifabiyi, and Ojoye, (2013); Ibrahim, (2014); Abaje, and Ndabula, and Garba, (2014); Mohammed, et al (2015); have made different assertions with regard to drought occurrence, impacts and adaptation strategies in the region.

According to the findings the frequent occurrence of drought in Kano and other parts of northern Nigeria was in the 70s and 80s, and from 90s to date, rainfall has been increasing without serious drought. This indicated that there were two consecutive decades of droughts and subsequent decades of recovery. Being a cyclical event the drought may frequently occur in the region. Despite the social and economic losses, the people cope and adapt with the droughts.

A research on adaptation strategies in Kano revealed that to survive the impacts of drought farmers engage in transfer of financial resources such as money and farm implements from poorer to richer farmers (Mortimore, 1989). Butadaptation needs vary across geographical scales (local, national, regional, global), temporal scales (coping with current impacts versus preparing for long-term change), and must be addressed within complex and uncertain conditions (Predo, 2010). Therefore drought adaptation strategies are well known in different geographical areas, these include; income diversification, and geographical shifts of agricultural systems.

However as indicated above the strategies adapted in different geographical areas cannot be the same, and the most adapted strategy in a given area can be the poorly adapted in another area. Consequently a research to determine or categorize the drought adaptation strategies in to level of preference is essential.In other words investigate the most adapted strategies and poorly adapted strategies. Hence the following questions need to be answered;

1.3 RESEARCH QUESTIONS

What are the drought adaptation strategies in Kumbotso local government area?

What are the adaptation strategies preferred and those not preferred by farmers in Kumbotso local government area?

1.4 AIM

The aim of the research is to assess the level of preference of the drought adaptation strategies among farmers in rural areas of Kumbotso Local Government, Kano state.

1.5 OBJECTIVES

i. To examine the drought adaptation strategies in rural areas ofKumbotso local government areas.

ii. To conduct a survey on adaptation strategies that are most preferred and those not preferred by farmers inKumbotso local government area.

1.6 JUSTIFICATION OF THE STUDY

The research provided a framework for explanation of household resilience to long term impacts of drought. In Kano and other parts of northern Nigeria severe to extreme droughts occurred in the 70s and 80s. The research facilitates the understanding of how the people in the study units, were able to survive the droughts and how they engaged in activities for capacity building.

In addition the research can help in the identification of adaptation strategies that were relevant and those not practice in the research communities. Involving the community in the disaster risk reduction is important, because they were the victims of the droughts, such as loss of productivity that increase level of hunger and subsequently has effect especially the stimulation of short term and permanent migration and hence farm labor shortage (Motimore, 1989). Therefore the communities must, at the very least, be active in production of information as well as being recipients of information (Joy and Muller, 2014).

Assessment of preferred drought coping and adaptation strategies can help in the identification of category of households that were vulnerable to the drought impacts. Therefore policy makers can decide how, when, where to direct resources, during and after the droughts in the region.

1.7 SCOPE OF THE STUDY

In the literature drought adaptation strategies were divided in to two (on farm and off farm). The study covered both on-farm and off-farm drought adaptation strategies, including socio economic aspects such as employment diversification,food consumption changes, productivity changes, agricultural support, livestock keeping system, formal and informal trading, migration, and assets changes. The on farm strategies include irrigation, practicing intercropping, crop diversification, cultivating short duration crops, agro forestry, soil conservation techniques, use of drought tolerant varieties and practicing crop rotation.

Among these strategies some might be highly practiced while others poorly practiced or not even practiced. This research seeks to establish this relationship.

1.8DEFINITION OF MAJOR CONCEPTS

1.8.1 Drought

Drought is a period of abnormally dry weather which persist long enough to produce a serious hydrological in balance (National Weather Service, 2008). Also it is defined as deficiency or abnormal deficit of water in an area during a specific period (Olatunde, 2013). According to Wolcover, (2014) in the 1980^{th,} two researches uncovered more than 150 published definitions of drought. In an effort to measuring drought, the scientist grouped the definitions in to four basic approaches: meteorological, hydrological, agricultural and socioeconomic.

Different definitions might lead to different conclusions regarding the drought phenomenon. For instance it is possible that rainfall statistics summarized over a calendar year indicate no drought whereas the moisture in the growing season does (Hisdal and Tallaksen, 2000). Therefore drought has many attributes, some of them apart from those mentioned earlier are: on-set, duration, persistency, intensity, return period, severity and termination, (Francis, and Kayode, 2013) also reported that out of this attributes the important one is intensity, this is because it shows the severity, degree of the drought.

1.8.2 Coping Strategy

Different households are spatially and temporally vulnerable to impacts of drought, and over time develop coping mechanism. Coping mechanism can also be described as survival skills. They are strategies that people use in order to deal with stresses, pain, natural changes that we experience in life, Intergovernmental Panel on Climate Change, (2001).

1.8.3 Adaptation Strategies

The term adaptation refers to, adjustments in ecological, social or economic systems in response to actual or expected stimuli and their effects or impacts. This term refers to changes in processes, practices and structures to moderate potential damages or to benefit from opportunities associated with climate change, Intergovernmental Panel on Climate Change,(2001). Adaptation is a strategy to better resist and cope with droughts that induce losses to farmers (Duinen, et al 2015). To adapt with drought household employ a wide variety of strategies to mitigate the effects of drought on their real incomes and hence their food security and survivability, these are income diversification, asset disposal, loans and transfer, reduce and diverse consumption, (Webb and Reardon, 1992).

1.9STUDY AREA

1.9.1 Location

Kumbotso is a local government area in Kano state Nigeria, Its headquarters is in the town of Kumbotso. The coordinates are; 11^0 53' 17N to $12^0$0' 0N and 8^0 25' 10E to 8^0 37' 30E. It is the only local government area that share border with eleven local government areas in Kano state. To the north it shares border with Ungogo, Gwale, Kano-Municipal, Tarauni, Nassarawa, local government areas. To the south is Dawakin Kudu, and Madobi local government areas. And to east there is Gezawa and Warawa local government areas. To the west there is Rimingadoand Tofa local government areas (Figure 2)

1.9.2 Climate and Drought Condition in the Area

Generally the Kano region has a semi arid climate with a mean daily temperature of 30^0c. The months of December to February are colder with the lowest temperature recordedaround 20^0c. The rainfall regime is characterized by two seasons, namely the rainy season from May to October and the dry season from November to April. The average annual rainfall is about 884mm increasing from north to south. In the extreme south it reaches 1200mm per annum around Riruwai and Doguwa (Liman, et al 2014).

Four distinct seasons are experienced, which are the dry and cool, dry and hot, wet and warm, and dry and warm seasons (Olofin, 1987).

1.9.3 Relief Soil and Vegetation

In Kano region Kumbotso is part of the high plains. The high plains occupy more than 50% of the surface area. And lie on elevations ranging between 450m and 650m (Olofin, 2014).

The soils of Kano region are derived from the two main geologic formations; the base complex and the chad formation. The basement complex rocks are quite variable in size and composition, and include schist, shale, and granite among others. The soils formed on the basement complex rocks are relatively well structured and possess sufficient depth to permit the cultivation of most staple crops (Essiet, 2014).

According to the National Drought Preparedness Plan, (2006) the region has low level of biological productivity, organic matter and aggregate stability. Their vegetation and plant cover are relatively sparse and are savanna grassland type; soils are relatively more susceptible to accelerated erosion by water and wind. People at risk and at loss in the Sudano-Sahelian region are more than 40 million living within about 25% of the total landmass of Nigeria, constantly under drought and soil erosion threats.

1.9.4 People and Population

The people in the area are Hausa sedentary Fulani pastoralist. The socio cultural activities are based on Islamic law, since they are predominantly Muslims. Traditionally each village has ward head known as *Maiunguwa*in Hausa language. The ward head coordinates administrative matters between government and the people.

The population ofkumbotso local government was 295,979 (National Population Census, 2006)

1.9.5 Settlement

The villages have the same characteristics, such as low homogenous population, most of the households were built with locally mud bricks. Batakaye and Rigafada were located along western bye pass, and not very far from ring road, therefore there is road that joins both villages

to the ring road. Zara was located along eastern bye pass and not far from ring road also. Each village was surrounded by farms used for crop cultivation.

Rural area refer to the geographical areas that lie outside the densely built up environment of towns, cities, and the sub urban villages and whose inhabitants are engaged primarily in agriculture as well as the most basic rudimentary form of secondary and tertiary activities (Ezeah, 2005). Also according to the National Population Commission, (2004) it is defined as an area having population of less than 20 000 persons.

1.9.6 Economic Activities

Major economic in the rural villages was agriculture. It includes crop cultivation and animal husbandry. The crop production was limited to the wet season, and according to the farmers; cereals, cowpea, and groundnut were commonly produced.

The major trading and commercial activities in the area was the sale of agricultural goods. The sales depend on what was currently harvested, especially fruits and vegetables.

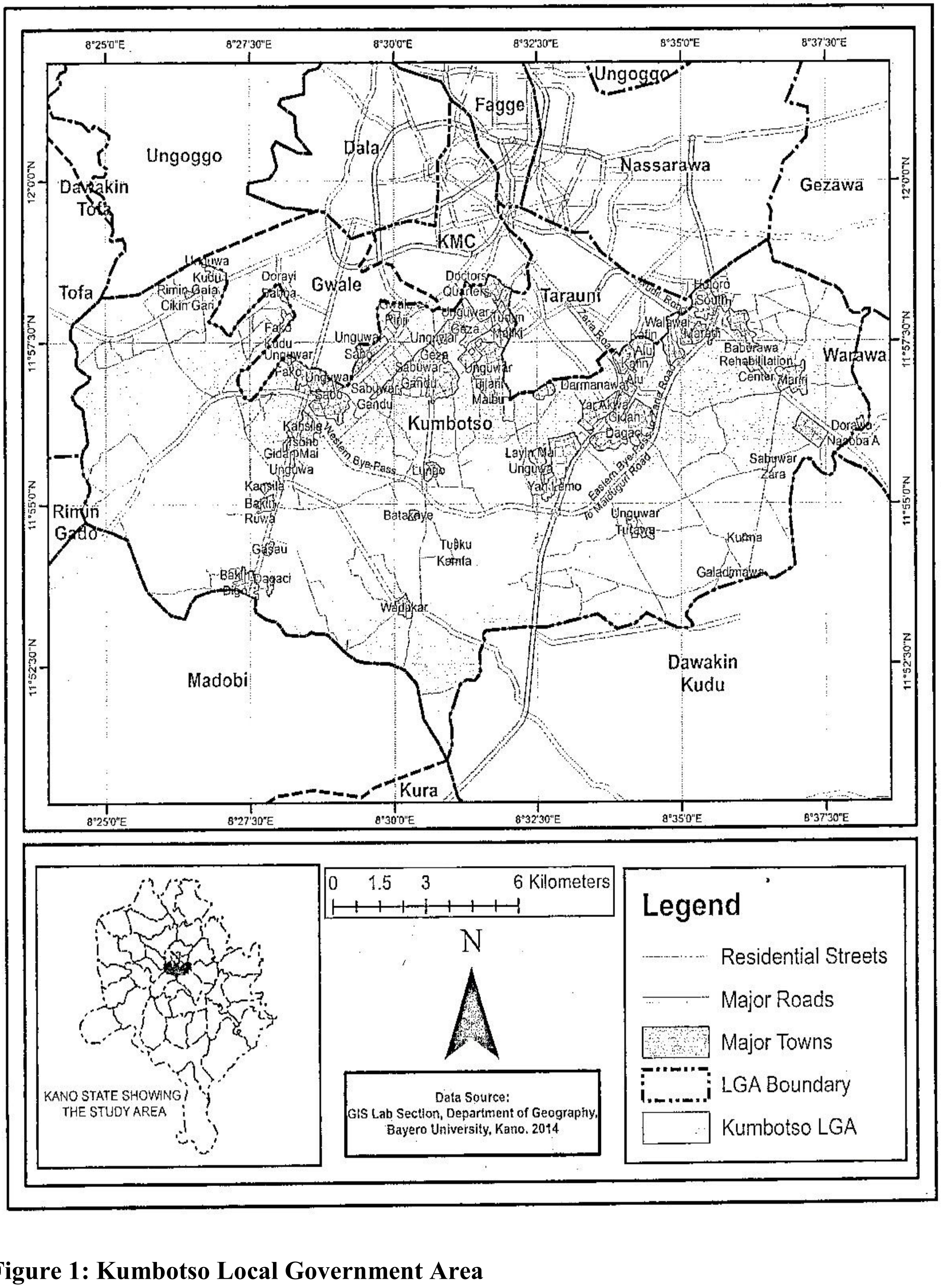


Figure 1: Kumbotso Local Government Area

Produced: by GIS Lab Section, Department of GeographyBayero University Kano, 2014

CHAPTER TWO

LITERATURE REVIEW, CONCEPTUAL/THEORITICAL FRAMEWORK

2.1 INTRODUCTION

The literature reviewed discussed different drought related issues, such as occurrence, impacts, perceptions, responses, coping, and adaptation strategies, in many spatial contexts such as in Kano region and other parts of Nigeria, the rational was to have a wide coverage, and in depth knowledge on these issues. The theoretical framework considered disaster risk reduction model, such as Drought Cycle Management model,

2.2 LITERATURE REVIEW

2.2.1 Occurrence of Drought in Northern Nigeria

According to Ibrahim, (2014)at various scales of drought precipitation index (PI) the seasonal rainfall records revealed that 16 incidences of drought of varying magnitude were recorded in the Kano region from 1931 to 2010. There were 6 incidences of moderate drought with PI of <-0.84 and severe drought (PI= <-1.28) and 3 extreme cases of drought with PI <-1.65. Decadal analysis for the annual rainfall shows that all the statistically significant cases occurred in three sub periods. The sub period 1981-1990 statistically drier at 95% confidence level, than the long term conditions (Abaje, et al 2014).

Drought occurrence varies spatially and temporally, apart from this variation the degree of drought severity also varies temporally and spatially (Olatunde, 2013). Northern Nigeria is evidently proved to be a region that has been suffering from occurrence of drought. A research conducted on the regional occurrence of drought in the northern Nigeria by using the

Bhalmeyand Mooley Drought Index (BMDI) which categorized the drought in to invisible, mild, moderate, severe, extreme, from 1941 to 2010, it was revealed that low intensity, or invisible drought dominates in the Sudan zone, and in Sahel zone extreme drought occurring once (Kayode and Francis, 2012). However extreme droughts were confined to the decades between 1971 and 2000 (Francis, and Kayode, 2013) in addition provided regional analysis of drought occurrence within decades starting from 1941 to 1950 where no extreme drought occurred, in 1951 to 1960 also no extreme drought, the same with 1961 to1970. In 1971 to 1980 extreme drought was recorded. In 1981 to1990 mild and moderate droughts surpassed the number of years of invisible drought.

The severe drought occurred five times and extreme drought once in 1991 to 2000 with More years of mild drought than invisible drought. In 2001 to 2010 there was more invisible drought and extreme drought did not occur. It has been observed that most of the droughts that occur in this region have been found to be associated with a late start of the rainy season and early cessation of the rains resulting in drastic reductions of the length of the season (Oloruntade, et al 2011)

Based on the above analysis it can be observed that amount of rainfall received in the region varies from year to year, with some receiving below annual average and declared as drought years, for example temporal variability in the amount and distribution of rainfall and number of rain days observed within the region has to a large extent contributed to the 1973 and 1984 drought occurrences in the region (Otun, and Adewumi, 2009)

Being a recurrent phenomenon, the World Bank in its 2013 report titled ‘Africa’s pulse’ have predicted that drought may occur in some African countries, the first wave would hit Cameroon,

Coted' ivore, Ethiopia, Ghana, Kenya, Nigeria, Senegal, Tanzania, and Uganda, over 2013-2015, and the second wave of drought would hit the remaining countries in the region over 2016-2018 (Kim, 2013). In the context of Sahel region of Africa (Kano region is integral part) at least one particularly severe drought has been confirmed each century since the 17th century (Batterbury, 2001).

The Nigerian Meteorological Agency (NIMET) in its six months release (February to July 2015) of standard precipitation index (SPI) map for ground water monitoring, indicated that mid-extreme dry conditions continued to affect most places in the north especially over Yobe, Adamawa, Gombe, Kano, Kaduna, Katsina, Sokoto, and Kebbi states. Few areas in the southwest were also affected by dryness compared to the previous month cumulative effect of the little dry season (LDS) this year. This situation however may pose a big challenge for groundwater availability in the affected areas especially in the north.

In northern Nigeria there was a downward trend in rainfall amounts in the 1970s and 1980s which was responsible for drought episodes of 1972/73 and 1980 and an upward trend in the amount of rainfall between 1990 and 2009 (Ifabiyi, and Ojoye, 2013).

According to Ekpor, and Nsa, (2011) in northern Nigeria since the early 1970th climatic anomalies in the form of recurrent droughts, frightening dust storms, and rampaging floods have overprinted their rhythms, creating short-duration climatic oscillations as against the normal cycles of larger amplitudes. Rainfall variability is a major characteristic of northern Nigeria climate, the mean annual rainfall since the late 1960s of to 2008 has decrease over 8 percent, in comparison to 1915 to 2008 long term mean rainfall. The drought years, 1972/1973, 1983/84, and 1992/93 did not only experience below average (for instance, the 1984 annual rainfall was

58.8 percent less than the long term mean) but also experienced late onset and early cessation, which led to a drastic reduction in the length of the rainy season.

More than a century of rainfall data in theSudano-Sahelian shows an unusually wet period from 1950 until 1970 (positive index values) followed by extremely dry years from 1970 to1990 (negative index values) (Climate Change Synthesis Report, 2007). In addition it has been observed that large decreasing rainfall trends were wide spread in the Sahel from the late 1950s to the late 1980s; thereafter, Sahel rainfall has recovered somewhat through2003, even though the drought conditions have not ended in the region (Dai, 2004).

2.2.2 **Impacts of Drought in Northern Nigeria**

When drought occurred, the agricultural sector is the first to be affected because it depends on available soil moisture which is depleted by extended period of dryness. Water that accumulated within the subsurface is affected when drought intensified. Therefore if drought persist for more than three to four months the farmers and the people demanding water for domestic uses will suffer the consequences hence a short term drought that persist for three to six months may have little impacts on these sectors, based on the characteristics of the hydrological system as well as water use requirement (Lindsey, 2003) Unfortunately drought predisposes legume crops to specific diseases that are less prevalent in higher levels of moisture, such as *Fusarium* wilt, dry root rot, nematodes and parasitic weeds. An even more fateful development is that as conservation agriculture (zero tillage) spreads because of its many advantages, the straw left on the surface may contain inoculum of certain diseases that allow subsequent crops to be infected early on in their growth cycle, such as *Stemphylium* blight and collar root rot (Sohl, and van

Ginkel, 2014) However drought has impact on both the urban and other non-farm communities (Botterill, and Fisher,2003).

In northern Nigeria the impacts of drought include: loss of biodiversity and ecological stability, soil degradation reduced river flow, reduction of energy from hydropower plant loss of plant and animal species among others (National Drought Preparedness Plan, 2006) drought may also result in increased indebtedness culminating from the loss of productivity and the income sources (Mortimore, 1989) also added that the loss of productivity may increase the level of hunger and subsequently has effect especially the stimulation of short term and permanent migration and hence farm labor shortage.

Impact of drought in Kano region has consequently brought water stress in the drought period which in turn affects livelihood and agricultural production. A survey by WRECA (1985) revealed a substantial fall in water table due to chain incidence of 1982, 1983, 1984 and 1985 droughts in the region (Ibrahim, 2014). However in Danbatta district, consumed all their subsistence grain and livestock losses were estimated at 4400 Cattles, 5000 Goats, 500 Donkeys, and most of the Poultry (Ribot, and Magalhaes, and Panagedis, 2005)

According to a report in 2013, by a non-governmental organization (NGO) known as Youths against Disaster Initiative (YADI) drought has triggered the recent crisis which erupted between Gwari farmers and Fulani herdsmen, as a result of encroachment of herds of cattle in to farm lands in Gwako, under Gwagwalada, local government area of the federal capital territory. In Nigeria drought have been known to cause the following impacts, diminished crop growth, desertification and erosion, famine due to lack of water for irrigation, habitat damage,

malnutrition and dehydration, mass migration, and reduced electricity production, (Mariere, 2012).

A good example of losses resulting from climate change and drought in Nigeria is that the projected decrease in precipitation and increasing droughts in the savannah and Sahel regions would lead to decrease in groundwater recharge and will results to increasing desertification (Aizebeokhai, 2011).

2.2.3 Understanding Drought in Northern Nigeria

In Kano region the perception of people on drought and desertification is significantly related to their religious belief as they are predominantly Muslims. Thus most people believed that drought and desertification are an act of punishment or warning for wrong doings of contemporary societies. In chapter seven verse thirty, and chapter two verse twenty seven, (Q7:30 and Q2:27) attest to such believe: and indeed we punish the people of Fir'aun with seven years of drought and shortness of fruits (crops) that they might remember (Ibrahim, 2014).

In northern Nigeria the farmers in the lake chad region share similar perception on drought, they perceived drought as the most serious ecological problem that occur with more than 70 percent ranked the 1972/73 drought as the worst, and called it in Hausa *Bangabanga*while some believe drought occurrence is the will of Allah (Joshua, and Ekwe, 2013).

2.2.4 Coping and Adaptation with Drought in Northern Nigeria

To survive the impacts of drought farmers engage in transfer of financial resources such as money and farm implements from poorer to richer farmers (Mortimore, 1989). According to Ibrahim, (2014) human beings are generally responsive to disasters such as drought in the Kano

region at the community and local levels, on the other hand the practical response to drought and desertification are mainly constant prayers repentance, and relief assistance.in addition at the state and national level the adjustment measure include: establishment of plan nurseries, shelter belt, and irrigation schemes at the drought prone areas of Kazaure, Danbatta, Gumel, Birniwa among others. Preparedness strategies to drought include: (a) geographical shifts of agricultural systems; (b) climate-proofing rainfall-based systems; (c) making irrigated systems more efficient; (d) expanding the intermediate rain fed irrigated systems (Sohl, and van Ginkel, 2014)

Adapting to the impacts of drought may include long term adjustment such as the construction of reservoirs, boreholes and pipelines (Devereux, 2001) another way of adapting to drought, climate vulnerability is through the use of seasonal climate forecasting. Communities may be in a better position to adapt to longer term climate changes, if farmers can adapt to current annual variability with the use of advance information on the feature seasons climate, in addition to institutional system put place to respond to short term changes such as early warning system (Mccarthy, et al. 2001).

In the Nigerian section of lake chad farmers participate in rain fed and dry season farming as adaptation strategy (Joshua, and Ekwe, 2013) furthermore reported that other survival strategies adapted by the inhabitants: cultivation of recession land, mixed farming, the use of streams, wells and ponds, delayed farmland clearance, supplementing their major economic activity with minor activities such as buying and selling of agricultural and nonagricultural goods during dry season, handcraft, and the selling of fuel wood to adapt to the continued fluctuation of fresh water resources which mostly affect their socioeconomic activities in the area. In northern Nigeria the livelihood strategies to cope with drought are improve farming techniques, such as early planting, mixed cropping, wetland farming, early maturing/drought resistant crops, improve

water exploitation and storage methods, food storage method ,livelihood diversification, reduction of consumption, sales of assets, exploitation of resources not normally exploited, and migration,(Nyong,2001). Other coping strategies are irrigation development, drought tolerant early maturing and high yielding crop varieties, reduction of postharvest losses efficient weather forecast storage of excess production and development of fishery and livestock industries assist greatly in reducing the risk of drought (Abubakar, and Yamusa, 2013).

In the analysis drought adaptation strategies in northern Nigeria, (Muhammmed, and Umar, 2015) observed that, the farmers coping and adaptation strategies in both Rimi and DawakinTofa are effective in tackling the pattern of droughts that occurs in the areas. This may probably be the reason why despite occurrences of extreme droughts in Katsina at the decades 1970s, 1980s and 1990s these did not triggered humanitarian crises. Because farmers were helped by the governments, friends and relations with relief material and replang seeds, and farmers adjust their feeding habits to suit with the situation.

2.2.5 Coping and Adaptation with Drought in Sub Saharan Africa

In Kenya the recurrent drought in northern arid and semi-arid regions, force the net selling of livestock. In response the Index-Based Livestock Insurance (IBLI) was launched in 2010. Combined with the coping strategy results, IBLI shifts households from being net sellers to net buyers of livestock an outcome likely to have positive over impacts on uninsured household or those who suffered large losses (Carter, and Janzen, 2012) the Turkana pastoralist in northern Kenya have many ways of adapting to drought, in addition to the traditional short-term coping mechanisms, the long-term adaption strategies used include diversification of livelihood sources; livestock mobility to track forage and water resources; diversification of herd composition to

benefit from the varied drought and disease tolerance, as well as fecundity of diverse livestock species; and sending children to school for formal education as a long term investment expected to pay back through income from employment (Opiyo et al, 2015)

Farmers in Ethiopia have their way of adapting to drought it was found that farmers mentioned that they switched from long-cycle crops such as maize and sorghum varieties locally called Degalit, Havesojiru, and Humera, which had been sown in April and May to short-cycle crops such as wheat and barley (Meze-Hausken, 2004).

In Mutasa district Zimbabwe, sale of productive assets such as large stock, implements, and Nonproductive but difficult to replace assets, such as valuable roofing materials in the form of asbestos sheets occur (Brain, 2011), in a research at Mberengwa district, it was concluded that the capacity to coping is a function of the asset base, income distribution, and the capacity to cope with production in good years. Those household with a firm asset base, manage to attain high production out of the land and thus cope better with drought (Masendeke, and Shoko, 2014) also added that the way out for the household in a drought prone area is the development of non-farm rural activities, which help to boost the income and thus enable household to fend for themselves.

The sub Saharan African countries do receive financial support to enable them cope with drought, recently Ethiopia for instance is among the east African countries affected by the severe drought in the horn of Africa between July 2011 and August 2012 which afflicted more than 13 million people. The U.N. Central Emergency Response Fund has disbursed nearly $ 170 million in humanitarian assistance to the region since 2011, while donors have provided more than $330.6 million in the same period (Ocampo, 2013)

Farmers in west Africa have several ways of adapting to impacts of drought, such as adjustment to conserve soil water, groundwater, and growing drought resistant crops e.g. millet, and sorghum, lowering number of grazing livestock, improving land use and marketing regimes(Mortimore, 1989). The ecological destabilization and the consequent displacement of human population as experienced during the 1968-1974 sahelian droughtrepresent very serious warning signals to governments on the inherent dangers of deforestation (Charly, and West, 1997)

2.3 THEORETICAL/CONCEPTUAL FRAMEWORK

The relevant theories for investigating household drought adaptation strategies are those that deal with a disaster risk reduction and the conceptual model to assess a farmer's individual drought adaptation. A disaster is an unexpected natural or man-made catastrophe of substantial extent causing significant physical damage or destruction, loss of life or sometimespermanent change to the natural environment (Schilderink, 2009)

Among the theories are Drought Cycle Management model which is a translation of the theories in to a practical working tool. It is a model that fits well within the Disaster Risk Reduction (DRR) framework, since it explicitly seeks to reinforce ex-ante and ex-post coping capacity and thereby reduce vulnerability (Schilderinck, 2009).

The drought cycle management model (DCM Model) is a practical refinement of the more general disaster risk theories. Drought cycle management attempts to reduce community vulnerability to drought in order to strengthen their livelihoods rather than merely responding to disaster after they occur.The model recognizes four stages in the drought cycle as depicted in the figure 1 below.

The normal stage is a period in which sufficient rain falls. During this stage, mitigation activities such as community development, contingency planning, capacity building, and infrastructural development take place.

The second stage is the alert alarm stage. This is a stage when the first sign of a forthcoming drought become visible. During this period activities will be focused on preparing for the drought. These might include building of food strategic stocks, water conservation measures, preparing human health and veterinary services and supplementary feeding of livestock.

In the relief stage the drought is at its peak causing food and water shortages and resulting in hunger and possibly death among people and livestock. Emergency relief is delivered in order to save lives.

Finally after the emergency, the recovery stage involves reconstruction. Typical measures include the restocking of herds, rehabilitation of dams, capacity building, infrastructural development and natural resource management intervention.

Source: Adopted from Schildrinck (2009)

Figure 2: Drought Cycle Management Model

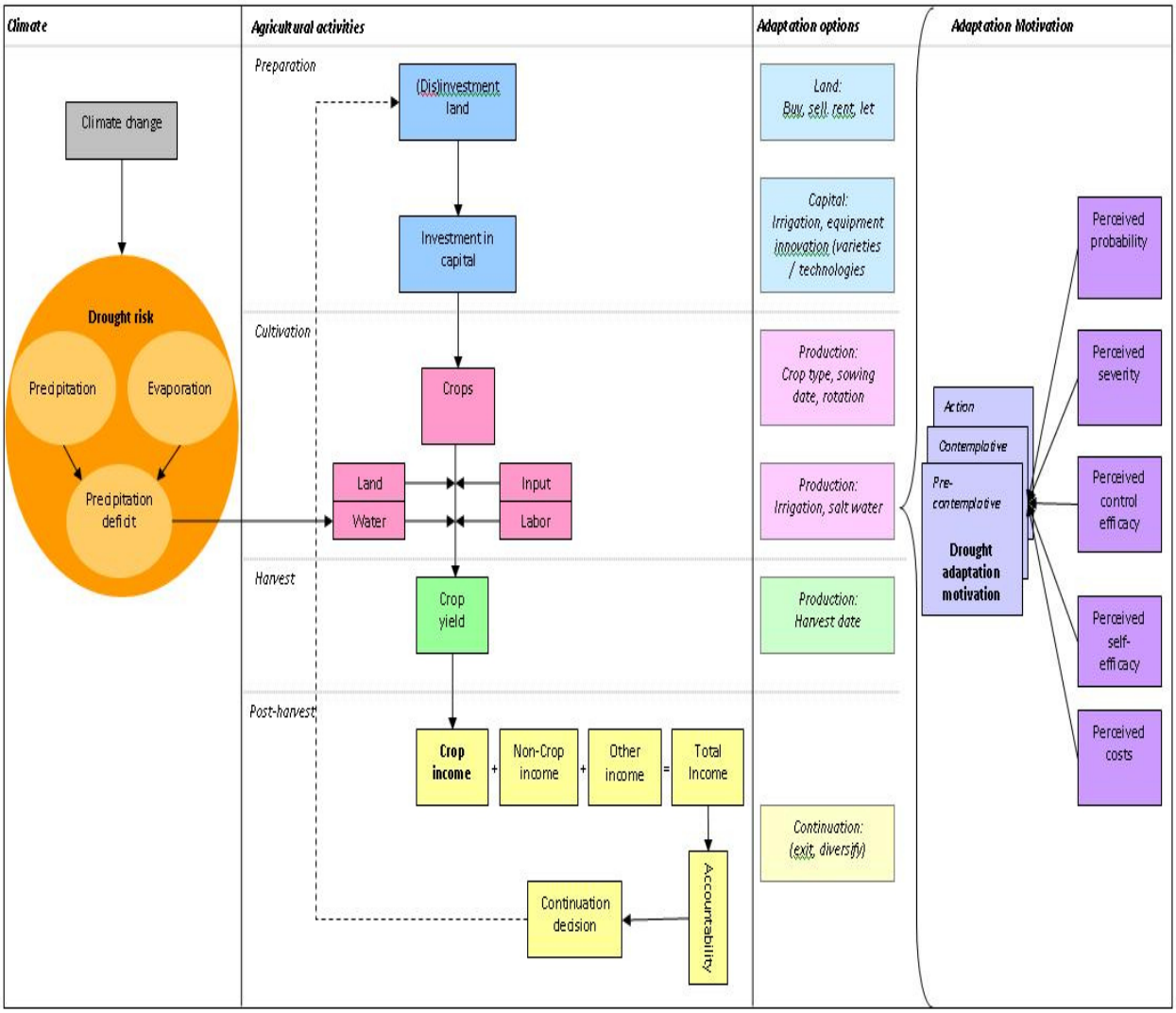
The second theory was the conceptual model to assess a farmer's individual drought adaptation. The model combined the contents two other adaptation models: Protection Motivation Theory (PMT) and the Trans Theoretical Model (TTM).

PMT has been successfully applied in many studies and risk contexts, and in thecontext of climate change (examples). Due to the numerous applications, informationis available on the measurement of the factors incorporated in PMT. This supports thedevelopment of a consistent survey. However, PMT only offers a framework to assesswhether a farmer is motivated to engage in adaptation or not. Hence the combination ofthe extended PMT-TTM model,PMT-TTM distinguishes between several stages between these two extremes. The basic premise is that different groups can be distinguished based on those who have not yet decided to adapt, those who have decided to adapt and those already performing adaptation behavior. PMT-TTM distinguishes between three stages: pre-contemplation, contemplation, and action. Pre-contemplators resist to change, and do not seriously consider changing their behavior, because they underestimate the probability and severity of an event. Contemplators acknowledge that they have a problem, but are not ready to change their behavior. People in the action phase already show adaptive behavior. PMT-TTM can be used to test whether a group can be treated as homogenous with respect to the adaptation stage of a group. In the case, there exist differences among these groups. Insight in these variables can supportdifferentiated communicating strategies among groups.

PMT-TTM allows distinguishing between farmers that do not consider adaptation, that consider adaptation, and those who actually adapted. Using this approach offers the possibility to assess whether different groups can bedistinguished based on the stage of adaptation and which factors explain differencesin attitudes towards adaptation.

In PMT-TTMdroughts affect the water availability, which is an important production factor for crop production. Decreased water availability causes a reduction in crop yield and consequently in farm income. Farmers have several options to adapt to decrease their drought vulnerability.

The choice whether or not to adapt and the choice among adaptation options is a choice under risk. PMT-TTMdistinguishes between several socioeconomic and psychological factor to explain a farmers drought risk adaptation. Furthermore, it helps to gain insight in the factorsthat determine the adaptation stage of a farmer.



Source: Adopted from Duinen, (2011)

Figure 3: The Conceptual Model: Droughts, Agricultural Production, Adaptation and Adaptation Motivation.

CHAPTER THREE

METHODOLOGY

3.1 INTRODUCTION

This chapter deals with method used to achieve the research aim and objectives, and answer the research questions. The issues were research design, sampling frame and techniques, data collection, and data analysis and presentation.

3.2RESEARCH DESIGN

This research wasaimed at assessing household drought adaptation strategies in Batakaye, Rigafada and Zara communities. DCM model was considered because it contained indices that drought adaptation in a cyclical manner (normal or drought free period, when it's envisaged, hits, and terminated). Secondly the indices of the drought, agricultural production, adaptation and adaptation motivation model also was considered for the purpose of examining motives for selecting the adaptation strategies. However socio economic variables were used as proxies. The proxies include: characteristics of household members, such as age, occupation, education, number of people employed, or unemployed, food consumption, savings, assets, source of water, type and number of animals kept, investments, participation in community development associations, and interventions. A survey interview and focus group discussion was conducted for collection of primary dataon the proxies.Through descriptive statistics the data on characteristics and experience of respondents were analyzed, and presented in graphs and tables.

3.3 SAMPLING FRAME AND TECHNIQUES

Purposive sampling was carried out in two dimensions, firstly in selecting the study locations (Batakaye, Rigafada and Zara) due to the fact that these villages have typical characteristics of rural areas.

Systematic sampling was conducted in the communities to obtain respondents for survey interview (farmers). To calculate the sampling size, the number of households in each community were estimated, Batakaye N=520, Rigafada N=532, and Zara N=302. Sampling size was calculated using the formula $n = N.t^2 \times p.q/d^2 N+t^2 \times p.q$ (Yamane, 2001; Getachew, et al 2014).

Where:

N= total number of households in each community

t= number which is the required confidence interval (for 95% confidence CI t= 1.96)

p= probability for an event to occur (p= 0.5)

q= probability for an event not to occur (q=0.5)

d= an acceptable error rate during sampling (0.05 associated with 95% CI)

Table 1: Sampling Size in the Study Locations

locations	No. of Sampling Size in each Location Using Yamane's andGetachew et al Formula			
	$N.t^2 \times p.q$	$d^2N+t^2 \times p.q$	n	n/2
Rigafada	532	3.6068	147	74
Batakaye	520	3.548	146	73
Zara	302	2.4798	121	60

Source: Survey 2015

The sampling size for each community was; Batakaye n=146Rigafadan=147 and Zara n= 121 respectively. But in view of the available resources and time the sample size was reduced (n/2), because the idea behind probability sampling is to provide useful description of the total population (Mohammed, 2010 and Kumekpor, 2002).

Secondly purposive sampling was conducted in the study locations. Four respondents who were indigenes and have more experience on the subject matter, based on the advice of ward heads that they have adequate knowledge on the subject matter, were selected from each study location (Batakaye, Rigafada and Zara).

3.4 DATA COLLECTION

Structured questionnaire were conductedfor the survey interview with the selected respondents. The 3 ward heads for the respective communities, appointed representative who formally introduced the researcher at the households. After the introduction time for the interview was decided in each household. Three research assistants were employed by the researcher; these were literates with background knowledge of conducting the interview. Two among the assistants, were graduates with B.A. Mass communications, and the other was a graduate with B.A. Hausa.Having the skills the contents of the questionnaire were translated in to Hausa language and the response in to English by the research assistants.After two days training was organized and the interviews were conducted within 3 weeks with all the selected respondents with help of assistant.

In the questionnaire the questions have closed-responses where all interviewees were asked the same questions and asked to choose answer from the same set of alternatives (Steiner, 1996). But on the other hand some questions were made flexible by given the respondents chance to add any

experience not mentioned in the options. And the interview method can be seen as face-to-face interaction with respondents in an attempt to generate answers from him or her using questions design for that purpose (Lawal, 2010).

Using checklist Focus group discussion with the selected households in the respective study units was conducted. The focus group discussions were made to clarify the subjective issues and to benefit from the group interactions in getting further insight on the drought adaptation strategies (Getachew, et al 2014).

The focus group discussions were conducted with the purposively selected respondents (they were 12, and 4 were selected from each community) in order to get in depth data apart of the survey interviews questionnaire.

4.5 DATA ANALYSIS AND PRESENTATION

The study employed descriptive statistics such as means, standard deviations percentages and frequency distribution to summarize the survey interview questionnaire data.

Z-score statistic was used to determine relative standing of each adaptation strategy in a distribution x_i…… in order to indicate its level of preference (highly preferred, or not).

Z-score = x - μ/δ

Where:

X = frequency

μ = mean

δ = standard deviation

However the Microsoft Excel vision 2010 was used for the statistical computation of tables and the relationship of each variable among others was determined.

Frequency tables and were used for data presentation, because tables, graphs and pictures usually capture and hold attention hence break the monotony of using words and numbers throughout the text (Jibril and Sheka, 2010), they also bring out trends and relationships more vividly which enables the researcher to make comparisons more readily.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 CHARACTERISTICS OF RESPONDENTS

The variables presented were information on respondents such as age, gender, employment, and status in the households.

4.1.1 Age Distribution of Respondents

In Rigafada 35.1% among the respondents were between the 41-50 years and in Batakaye 32.9% were between 41-50 years and in Zara 30% were between 51-60 years (Table 2). However the calculated mean and standard deviation indicated that the respondents in Rigafada and Batakaye were more than 50 years, and in Zara they were more than 40 years respectively (Table 3) in other words the mean for age of respondents in Rigafada was 44 and standard deviation was 7 this means most of the respondents were 50 years or more. In view of their age the respondents would have adequate experience on the subject matter, hence they were the right people to give information on the subject matter.

Table 2: Age Distribution of the Respondents

locations	Age groupings											
	n	21-30		31-40		41-50		51-60		61-70		70 and above	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Rigafada	74	1	1.1	21	28.4	26	35.1	16	22.8	6	8.1	4	5.4
Batakaye	73	1	1.0	20	27.4	24	32.9	22	28.9	4	5.5	0	0
Zara	60	0	21.7	4	6.7	10	16.7	31	51.7	3	5	2	3.3

Source: survey 2015

Table 3: Mean and Standard Deviation of Respondents Age

Age groupings	Mean and Standard Deviation of Age Groupings					
	Rigafada		Batakaye		Zara	
	mean	Standard deviation	mean	Standard deviation	mean	Standard deviation
21-30 31-40 41-50 51-60 61-70 71and above	44	7	43	7	41	6

Source: survey 2015

It has been asserted that interviewees not only know the information that is required from them, but also understand what is expected of them (Lawal, 2010). Mohammed (2010) added that some respondents might have more experience on the subject matter than others depending on how long someone engaged.

4.1.2 Employment Status of Respondents

Employment is important characteristic of respondents,because the employed persons can be more productive and adapt to droughts easily. Table 4 reported that most of the respondents in Batakaye,Rigafada and Zara were employed (87.7% and 89% and 95% respectively). The unemployed were the few respondents who belong to the age group 61-70 years and 70 and above years. Due to old age their productive capacity was low.

The major occupation of all the respondents was farming but they combined with other forms of occupation, such as trading, and weighed labor (table 5). In Batakaye 34.2% of the respondents combined farming and weighed labor, but the majority in Rigafada (47.3%) and Zara (63.3%) combined farming trading. This is crucial in studying the resilience of the farmers to impacts of drought, as well as determining the choice of adaptation strategies in a given area.

Table 4: Respondents Employment Characteristics

locations	Employment status				
	n	Employed		Unemployed	
		No.	%	No.	%
Batakaye	73	64	87.7	09	12.3
Rigafada	74	66	89.1	08	10.9
Zara	60	57	95	03	5.0

Source: survey 2015

Table 5:Types of Respondents Occupations

locations	Occupations								
	n	farming		Farming and Animal husbandry		Farming and trading		Farming and weighed labor	
		No.	%	No.	%	No.	%	No.	%
Batakaye	73	09	12.3	16	21.9	23	31.5	25	34.2
Rigafada	74	04	5.4	13	17.6	35	47.3	18	24.3
Zara	60	60	1.7	08	13.3	38	63.3	13	21.7

Source: survey 2015

4.1.3 Respondents Type of Relationship in the Household

The relationship of respondents in the household is very crucial; intimacy would determine the adaptation strategy peculiar to the household in view of the fact that they live and share the household resources together.

However in Table 6 below most of the respondents were head of household, or has kin relationship with the head of household. In Batakaye 68.5% of the respondent has kin relationship, in Rigafada it was 52.7% and in Zara it was 43.3%. Head of households were 41.9% in Rigafada and 55% in Zara. Very few did not have any kin relationship with the head of household.

Table 6: Status of Respondents in the Households

location	Relationship in the household						
	n	Head of households		Related to the head of household		Not related to head of household	
		No.	%	No.	%	No.	%
Batakaye	73	23	31.5	50	68.5	0	0
Rigafada	74	31	41.9	39	52.7	4	5.4
Zara	60	33	55	26	43.3	1	1.7

Source: Field Survey 2015

4.1.4 Experience of Respondents on the Droughts

For the purpose of this research the respondents were expected to have historical experience of drought events that took place in Kano state. Table 7 below reported drought experience according to decades. According to the table less than 15% of the respondents have experience of droughts that occurred in 1970/1979 in all the study locations.

Majority of the respondents have adequate experience on droughts that occurred in 1980/1989 (83.6% in Batakaye; 89.5% in Rigafada; and 85.7 in Zara). This can be related to the fact that most of the respondents were 50 years or more (Table 3).

In the two consecutive decades (1990/1999 and 2000/2009) very few respondents mentioned that they have experienced droughts.The same responses were obtained from 2010 to date few among the respondents have experience thedrought event. In the literature it was ascertained that from 1990s to date there was no severe to extreme drought occurrence in Kano state (Adeaga, 2011;Oloruntade, et al 2011;Abaje, et al 2014;Ifabiyi, and Ojoye, 2013; Mohammed, et al 2015).

Table 7: Responses on Historical Experience of Droughts

locations	Experience of Droughts According to Decades									
	n	1970/1979		1980/1989		1990/1999		2000/2009		2010/to data	
		No.	%	No.	%	No.	%	No.	%	No.	%
Batakaye	73	8	11	59	83.6	3	4.1	1	1.4	2	2.8
Rigafada	74	5	6.8	67	89.5	1	1.4	1	1.4	1	1.4
Zara	60	5	8.3	52	85.7	3	5	0	0	1	1.4

Source: Field Survey 2015

4.1.5 Respondents Perception on Drought Impacts

From Table 7 it was found that most of the respondents in all the study locations witnessed the droughts that occurred in the 1980/1989 decades. Therefore it was expected that the respondents have suffered the impacts of the droughts. This is important because the issue of adaption arise when the drought events made negative impact on the people.

The majority perceived that the impact of drought was hunger with 35.1% of respondents in Rigafada, 28.8% in Batakaye, and 21.7% in Zara. There was no communal clash in all the locations, which might occur as a result of competition for natural resources.

Social activities were destabilized during the droughts these includeSallah festivals and marriage ceremonies. Precisely the respondents related this to 1980 and 1984 droughts as a result the ceremonies were suspended.

Migration was mainly temporary and from Rigafada it was 8% among the respondents that migrated. And from Batakaye it was 2.74% among the respondents that migrated, where as in Zara it was 1.7% among the respondents that migrated.

Table 8: Responses on Impacts of Droughts

locations	Responses on impacts of droughts					
	Rigafada		Batakaye		Zara	
	No.	%	No.	%	No.	%
Hunger	26	35.1	21	28.8	13	21.7
Loss of crops and animals	12	16.2	08	11.0	15	25.0
Destabilizing social activities	04	5.4	06	8.22	09	15
Migration	06	8.1	02	2.74	1	1.7
Communal clashes	0	0	0	0	0	0
Water stress	11	14.9	22	30.1	07	11.7
Destruction of vegetation cover	15	20.3	04	5.5	15	25.0

Source: field survey 2015

4.2 PREFERENCE OF DROUGHT ADAPTATION STRATEGIES

Both on-farm and off-farm adaptation strategies were considered, to determine or compare the extent to which the respondents practice each one of them. The off-farm strategies includes; employment diversification, food consumption modification, trading, migration, assets changes, relief assistance, construction and rehabilitation of boreholesand wells. And the on-farm strategies were soil conservation techniques, crop diversification, cultivating early maturing crops, cultivating drought tolerant varieties, irrigation, integrated farming system, and agro forestry.

4.2.1 Preference for Off-Farm Adaptation Strategies in the Study Locations

Table 9 depicted the standard score for adaptation strategies in Rigafada. Trading was the most preferred adaptation strategies (z-score = 1.17), and employment diversification (z-score = 0.99). Trading and employment diversification were important means of generating income to the respondents. The least preferred adaption strategies were assets liquidation and migration, the

score for both strategies were far away from -1 which indicated that migration and assets liquidation were not an adaptation options in Rigafada.

Table 9: Standard Score Distribution for Off Farm Adaptation Strategies in Rigafada

Off Farm Adaptation Strategies	Rigafada		
	Frequency	Standard deviation	Z-score
Employment diversification	16	5.47	0.99
Food consumption changes	12		0.26
Trading	17		1.17
Migration	02		-1.57
Assets liquidation	06		-0.84
Relief assistance	13		0.44
Construction and rehabilitation of boreholes and wells	08 Mean=10.6		-0.48

Source: field survey 2015

In table 10 trading was the most widely practiced adaptation strategy in Batakaye with standard score by far greater than 1 in normal distribution. As mentioned earlier trading was an alternative in a situation where agriculture was disturbed by droughts. And getting relief assistance (in form of price discounted food stuffs, and drought tolerant seeds) mainly from state government agencies was moderately preferred.

Also migration and assets liquidation were the least options in normal distribution (-1.57 and -0.84) as it was in Rigafada.

Employment diversification, construction and rehabilitation of boreholes and wells were poorly practiced strategies (they were not far from mean of standard scores on normal distribution).

Table 10: Standard Score Distribution for Off Farm Adaptation Strategies in Batakaye

Off Farm Adaptation Strategies	Batakaye		
	Frequency	Standard deviation	Z-score
Employment diversification	10	5.75	0.07
Food consumption changes	09		-0.24
Trading	22		2.02
Migration	05		-0.94
Assets liquidation	08		-0.42
Relief assistance	13		0.45
Construction and rehabilitation of boreholes and wells	06 Mean=10.4		-0.77

Source: field survey 2015

However in table 11 food consumption changes was the most preferred adaptation strategy in Zara (standard score was 1.52 on the normal distribution). The food consumption changes involve reducing the quantity of food, changing the food rationing, and use of alternative available food.

Table 11: Standard Score Distribution for Off Farm Adaptation Strategies in Zara

Off Farm Adaptation Strategies	Zara		
	Frequency	Standard deviation	Z-score
Employment diversification	11	3.59	0.68
Food consumption changes	14		1.52
Trading	09		0.12
Migration	03		-1.55
Assets liquidation	06		-0.72
Relief assistance	10		0.40
Construction and rehabilitation of boreholes and wells	07 Mean=8.57		-0.44

Source: Field Survey 2015

4.2.2 Preference for On-Farm Adaptation Strategies in the Study Locations

Cultivating drought resistant seed variety was the best choice of adapting to drought in Rigafada (standard score was 1.15 on normal distribution in table 12). The seed variety could be of any type of cereals such as millet, and guinea corn. Various soil conservation techniques were practiced by the farmers in order to maximize the production (0.94 on the normal distribution). On the other hand irrigation and integrated farming system were not regarded as a choice by many respondents because both strategiesstand at -1.60 on the normal distribution.

Table 12: Standard score Distribution for On Farm Adaptation Strategies in Rigafada

On Farm Adaptation Strategies	Rigafada		
	Frequency	Standard deviation	Z-score
Soil conservation techniques	15	4.72	0.94
Crop diversification	09		-0.33
Cultivating early maturing seed variety	14		0.73
Cultivating drought resistant seed variety	16		1.15
Irrigation	03		-1.60
Integrated farming system	10		-1.12
Agroforestry	07		-0.76
	Mean=10.57		

Source: field survey 2015

In Batakaye the situation was the same with Rigafada, most of the respondents did not preferred irrigation and integrated farming system as adaptation strategies (-1.50 and -0.96 on normal distribution respectively). Integrated farming system involvesmixed farming which requires large capital to execute. The respondents preferred the use of drought resistant seed variety (1.17 on the distribution). Like the situation in Rigafada the respondents did not give much emphasis to agro forestry (-0.07) see table 13.

Table 13:Standard score Distribution for On Farm Adaptation Strategies in Batakaye

On Farm Adaptation Strategies	Batakaye		
	Frequency	Standard deviation	Z-score
Soil conservation techniques	12	5.63	0.28
Crop diversification	14		0.64
Cultivating early maturing seed variety	16		0.99
Cultivating drought resistant seed variety	17		1.17
Irrigation	02		-1.50
Integrated farming system	05		-0.96
Agroforestry	10		-0.07
	mean=10.42		

Source: field survey 2015

Table 14 depicted the relative standing of adaptation strategies in Zara community, and like the situation inBatakaye, the farmers preferred cultivating drought resistant seed varieties as the best option (1.69 on the normal distribution). Unlike in the other communities emphasis was given to agro forestry with standing score 1.60. Agro forestry supplies the farmers with alternative food in the event of severe droughts, and income through the sale of firewood and fruits.

Table 14:Standard score Distribution for On Farm Adaptation Strategies in Zara

On Farm Adaptation Strategies	Zara		
	Frequency	Standard deviation	Z-score
Soil conservation techniques	09	5.35	0.08
Crop diversification	06		-0.48
Cultivating early maturing seed variety	06		-0.48
Cultivating drought resistant seed variety	18		1.69
Irrigation	01		-1.41
Integrated farming system	08		-0.11
Agroforestry	12		0.64
	Mean=8.57		

Source: field survey 2015

4.3 ANALYSIS OF RESPONDENTS INABILITY TO PRACTICE SOME ADAPTATION STRATEGIES

The analysis of on-farm and off-farm adaptation strategies revealed that migration, irrigation, construction and rehabilitation of boreholes and wells, integrated farming system, and agro forestry were not effectively practiced by respondents as drought adaptation strategies in the respective study locations. However decisions on why these strategies were not given emphasis were examined in the tables below.

The respondents from all the study locations have the same opinions on decisions for poor practice of the adaptation strategies, except in Batakaye where majority did not agree that government and community lacked commitment to construct and rehabilitate sources of water.

Migration was not regarded as an option, according to the respondents the drought condition was the same in the neighboring areas (97.3% in Rigafada; 95.9% in Batakaye; 65.0% in Zara). This means that the whole region was under the influence of the drought, therefore no need move. For the lack of irrigation facilities in all the study locations depends on rain fed farming therefore did not consider irrigation as an adaptation option. The integrated farming system includes practices such as mixed farming, mixed cropping, and crop rotation. These practices required huge capital to operate especially land property and the respondents were smallholder farmers with small land holdings (94.6% in Rigafada; 77.0% in Batakaye; 58.3% in Zara). Construction and rehabilitation of boreholes also required many resources therefore individual farmers could not do it except the community or government. Farmers need to be educated on the benefits of agro forestry especially the supply of fruits as alternative food when drought caused shortage of food

and hunger. But according to the respondentsthe extension workers and services were less in their areas

Table 15: Respondents Decisions on Poor Practice of Adaptation Strategies Rigafada

Adaptation strategies	Corresponding reasons For poor adaptation	Responses (Rigafada)			
		agreed		Not agreed	
		Frequency	%	grequency	%
migration	The situation was the same in Neighboring areas	68	91.9	06	8.1
Irrigation	Lack of modern irrigation facilities	72	97.3	02	2.7
Rehabilitation of boreholes and wells	Lack of government and community commitment to construct and rehabilitate sources of water	35	47.3	39	42.7
Intergrated farming system	Lack of capital to develop integrated farming system	70	94.6	04	5.4
Agroforestry	Lack of adequate extension workers to promote agro forestry	51	68.9	23	31.1

Source: field survey 2015

Table 16:**Respondents Decisions on Poor Practice of Adaptation Strategies in Batakaye**

Adaptation strategies	Corresponding reasons For poor adaptation	Responses (Batakaye)			
		agreed		Not agreed	
		Frequency	%	grequency	%
migration	The situation was the same in Neighboring areas	71	95.9	03	4.1
Irrigation	Lack of modern irrigation facilities	33	44.6	41	55.4
Rehabilitation of boreholes and wells	Lack of government and community commitment to construct and rehabilitate sources of water	24	32.4	50	67.6
Intergrated farming system	Lack of capital to develop integrated farming system	57	77.0	17	30.0
Agroforestry	Lack of adequate extension workers to promote agro forestry	52	70.3	22	29.7

Source: field survey 2015

Table 17:**Respondents Decisions on Poor Practice of Adaptation Strategies in Zara**

Adaptation strategies	Corresponding reasons For poor adaptation	Responses (Zara)			
		agreed		Not agreed	
		Frequency	%	grequency	%
migration	The situation was the same in Neighboring areas	39	65.0	21	35.0
Irrigation	Lack of modern irrigation facilities	53	88.3	03	11.7
Rehabilitation of boreholes and wells	Lack of government and community commitment to construct and rehabilitate sources of water	28	46.7	32	43.3
Intergrated farming system	Lack of capital to develop integrated farming system	35	58.3	25	41.7
Agroforestry	Lack of adequate extension workers to promote agr forestry	33	55.0	27	45.0

Source: field survey 2015

4.4 ANALYSIS OF FOCUS GROUP DISCUSSION (FGD) DATA

The data from FGD conducted in the three study locations supported the assertion that severe droughts occurred in Kano state in the past decades, precisely in the 70s and 80s in 90s to date no severe drought was observed (Adeaga, 2011; Abaje. et al 2014; Mohammed, et al 2015). The participants have identified the drought episodes based on the severity of the impacts suffered, and related the events with different regimes such as General Yakubu Gowon regime (the drought in 1972/73) the Shagari civilian government (the drought in 1980) and general MuhammaduBuhari regime (the 1984 drought). They added that nowadays the amount of rainfall received annually does not fall below expectation especially during Abacha regime through Obasanjo civilian government.An elderly farmer in Batakaye said that;

"The drought that occurred during the General Buhari regime (droughtin 1984, and called it Hausa yarbuhariyya)Caused hunger and destabilized social events such marriages that were normally held during the harvest of produce" (FGD, 2015).

Regarding the impacts of the droughts it was discovered that the loss of crops and consequently hunger was the major impact of the droughts; however during the FGD many participants believed that there were social activities that were either ignored or suspended. They emphasized on marriages scheduled to take place at the time when the drought hits. Others mentioned that many among the rich people in the respective communities were unable to give out alms, which is a religious obligation to give some percentage of wealth to the poor annually. According to an elderly farmer in Rigafada;

"During the General Buhariregime I intended to perform the wedding ceremony of two daughters when the produce was harvested. Unfortunately there was drought that year as a result I could not even harvested what can feed my family that year and for the wedding, one was suspended and the other was cancelled" (FGD, 2015)

Another elderly participant added that;

"I can remember that we were trying to survive the hunger that stroke our family and community, therefore no one intended to marry until the subsequent years we pray heard for the rain and had bumper harvest" (FGD, 2015)

Another important issue discussed was the socio economic activities, and most important was that apart of farming which was the main economic activity, the farmers had occupations especially trade, and according to them it supports the family with or without the drought thus they could not depend solely on farming. And among them there were weighed laborers who

earn salaries from their work. This might be the reason why they did not migrate or sale their assets to solve the problem of hunger when the drought hits. In addition they emphasized on relief assistance given to them by government in 1984 this was mainly price discounted food stuffs.According to the district head of Zara;

"The issue of drought…… it is natural we cannot avoid or prevent it but most of our people in this community are traders so if the drought may hit (god forbid) the occupation can support us, unlike what happened in the past when most of the people depend on crop cultivation and animal husbandry. The past droughts (in 70s and 80s)were devastating and learnt the lesson"(FGD, 2015)

Despite the fact that the farmers have diversified employment the agricultural activities were given much priority. According to the interviewees they used to save from their earnings annually in order to purchase fertilizer and drought resistant seeds.In addition apart of the use of fertilizer to enhance the soil quality the farmers conserve the soil through the use of manure and practice mixed cropping. The type of crops cultivated depends on what the farmers envisaged on the climate, if the annual rainfall was expected to be lower than normal the drought resistant cereals were preferred.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 SUMMARY OF CONCLUSION

In terms of the characteristics of respondents it was found that In Rigafada 35.1% among the respondents were between the 41-50 years and in Batakaye 32.9% were between 41-50 years and in Zara 30% were between 51-60 years. However the calculated mean and standard deviation indicated that the respondents in Rigafada and Batakaye were more than 50 years, and in Zara they were more than 40 years respectively in other words the mean for age of respondents in Rigafada was 44 and standard deviation was 7 this means most of the respondents were 50 years or more. In view of their age the respondents would have adequate experience on the subject matter, hence they were the right people to give information on the subject matter.

Employment is important characteristic of respondents, because the employed persons can be more productive and adapt to droughts easily. Most of the respondents in Batakaye, Rigafada and Zara were employed. The unemployed were the few respondents who belong to the age group 61-70 years and 70 and above years. Due to old age their productive capacity was low.

However most of the respondents were head of household, or were related to the head of the households.

The respondents have experience of droughts that occurred in 1970/1979 in all the study locations. Majority of the respondents have adequate experience on droughts that occurred in the decade 1980/1989. This could be related to the fact that most of the respondents were 50 years to above.

In the two consecutive decades (1990/1999 and 2000/2009) very few respondents mentioned that they have experienced droughts. And for the decade 2010 to date also few among the respondents have experience the drought event.

The majority of respondents perceived that the impact of drought was hunger. There was no communal clash in all the locations, which might occur as a result of competition for natural resources. Social activities were destabilized during the droughts these include Sallah festivals and marriage ceremonies. Precisely the respondents related this to 1980 and 1984 droughts as a result the ceremonies were suspended.

Regarding off-farm adaptation strategies in Rigafada Trade and employment diversification was the most preferred adaptation strategies, and. The same inBatakaye trade was the most widely practiced adaptation strategy. But in Zara food consumption changes was the most preferred adaptation strategy.

However for the on-farm adaptation strategies cultivating drought resistant seed variety was the best choice in Rigafada. In Batakaye the situation was the same with Rigafada, most of the respondents did not preferred irrigation and integrated farming system as adaptation. Rather the respondents preferred the use of drought resistant seed variety.The farmers preferred cultivating drought resistant seed varieties as the best option in Zara. Unlike in the other communities emphasis was given to agroforestry.

Whereas the farmers gave much emphasis to some adaptation strategies, on the other hand migration was not regarded as an option, according to the respondents the drought condition was the same in the neighboring areas. The integrated farming system includes practices such as mixed farming, mixed cropping, and crop rotation. These practices required huge capital to

operate especially land property and the respondents were smallholder farmers with small land holdings.

On the analysis of focus group discussion the participants have identified the drought episodes based on the severity of the impacts suffered, and related the events with different regimes such as General Yakubu Gowon regime (the drought in 1972/73) the Shagari civilian government (the drought in 1980) and general MuhammaduBuhari regime (the 1984 drought). Regarding the impacts of the droughts it was discovered that the loss of crops and consequently hunger was the major impact of the droughts; however during the FGD many participants believed that there were social activities that were either ignored or suspended. They emphasized on marriages scheduled to take place at the time when the drought hits.

5.2 CONCLUSION

The rural areas of Kumbotso local government area were not an exception in terms of the impacts of 1970s and 1980s droughts it resulted in loss of crops and consequently hunger and destabilizing social activities. Among the adaptation strategies examined, trade, employment diversification, cultivating drought resistant seed variety, and crop diversification were the most preferred. On the other hand, migration and integrated farming systemwere given less emphasis. This may probably be due to fact that economic wisethis adaptation practice (integrated farming system) requires huge capital to operate especially land property and the respondents were smallholder farmers with small land holdings. From this point of view it is essential to assess spatial and temporal determinants of drought adaptation strategies in Kano state.

5.3 RECOMMENDATIONS

Agricultural practices under integrated farming system are capital intensive that the small holder farmers found it difficult to practice. Therefore government and the community should give priority to the agricultural sector by enhancing the system with policies, and facilities to burst the farmers' capacity in order to engage in to the integrated farming system.

Financial support should be given to farmers to enable them invest much capital in trade, because trading was found to be the major off farm economic activity that support the farmers livelihood when agricultural sector was disturbed by severe drought.

Although the farmers practices rain fed cultivation in the study locations, but modern irrigation technology can be design that can supply water even from far away rivers and Challawa gorge dam cultivation in dry season.

There is for the government, community and individual farmers to inculcate the attitude of maintaining the agroforestry system. If this is done the sustainability of biodiversity will be enhanced greatly.

There is need for the farmers to engage in to agricultural insurance, and stock market investment. This would enable the farmers to enter in to the international market of agricultural products in order to promote their resilience to drought events.

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APPENDIX

BAYERO UNIVERSITY KANO

DEPARTMENT OF GEOGRAPHY

QUESTIONNAIRE

INTRODUCTION

The questionnaire contained questions designed purposely to achieve the aim and objectives of the research, titled survey of drought adaptation strategies in rural areas of Kumbotso local government Kano state. Options are provided for each question, but the respondent can add any information related to a question if it's not mentioned. The questions were made purposely for academic research the respondent may answer the questions which will remain confidential.

CHARACTERISTICS OF RESPONDENT

1. Age	A. 21-30 B. 31-40 C. 41-50 D. 51-60 E. 61-70 F. 70-above
2. Are you employed 3. Type of respondents occupations	A. Yes B. No A. Farming B. farming and Animal husbandry C. Farming and Trading D. Farming and weighed labor E. Others (specify)
4. Status in the Household	A. Head of the household B. Related to head of household C. Not related to head of household D. Others (specify)

HISTORICAL EXPERIENCE OF RESPONDENTS ON DROUGHT EVENTS

1a. Did you experienced any severe drought Event? 1b. Indicate the period when the drought impact was severe.	A. Yes B. No A. 1970/1979 B. 1980/1989 C. 1990/1999 D. 2000/2009 E. 2010/to date
2 Does the drought events made any negative impact on you? 2b What was the major impact of the drought event ?	A. Yes B. No A. It results in shortage of food, and water (hunger) B loss of crops and animals C. Destabilizing social activities D. Migration E. Communal clashes F. Water stress G. Destruction of vegetation cover H. Others (specify)

PREFERENCE FOR DROUGHT ADAPTATION STRATEGIES

In the tables below are selected off farm and on farm drought adaptation strategies, the respondent can tick one that he/she opted as a means of increasing resilience to severe drought.

Off Farm Adaptation Strategies		
s/n	Adaptation Strategies	Description
1	Employment diversification	The farmer may have more one occupation. In other words, combined farming with trade, or Weighed labor.
2	Food consumption changes	Eating alternative available food or changing food rationing by reducing the quantity of food or taking food once or twice per day, instead of thrice.
3	Trade	Buying and selling goods to make profit.
4	Migration	Moving to another place permanently or temporarily for safety.
5	Asset liquidation	Selling or leasing of assets to solve problems arising from drought event.
6	Relief assistance	Aid given to people attacked by disasters such as drought. This is given by international donor agencies, federal and State governments, and wealthy in the communities.
7	Construction and rehabilitation of boreholes and wells.	A means to make water available for irrigation and domestic prupose.

On farm adaptation strategies		
s/n	Adaptation Strategies	Description
1	Soil conservation techniques	Use of fertilizer, manure, improving the drainage System in order to improve the soil quality.
2	Crop diversification	Mixed cropping in order to harvest more food
3	Cultivating early maturing seed variety	Genetically improved seed that requires shorter period (compared to the indigenous variety) to mature and harvested.
4	Cultivating drought resistant seed variety	Genetically improved seed that require little water, and resist the attack of pests and diseases (compared to the indigenous variety).
5	Irrigation	Using alternative source of water for cultivating crops e.g. water from river channel and dams, and wells and ponds.
6	Integrated farming system	This includes mechanized farming, and mixed cropping which is capital intensive.
7	Agro forestry	Management of trees either naturally growing or artificially planted.

REASONS FOR INABILITY TO PRACTICE SOME ADAPTATION STRATEGIES

In the table below are corresponding reasons for inability to practice some adaptation strategies, the respondent can tick the option agreed or not agreed

Adaptation Strategies	Corresponding Reasons For Poor Adaptation	Responses	
		Agreed	Not agreed
Migration	The situation was the same in Neighboring areas		
Irrigation	Lack of modern irrigation facilities		
Rehabilitation of boreholes and wells	Lack of government and community commitment to construct and rehabilitate sources of water		
Intergrated farming system	Lack of capital to develop integrated farming system		
Agroforestry	Lack of adequate government and community commitment in maintaining the system.		

CHECKLIST

The checklist contained items that guide the moderator in the conduct of focus group discussion for this research titled survey of drought adaptation strategies in rural areas of Kumbotso local government Kano state.

1. Identification of severe drought episodes in the communities.
2. Observations regarding trend of annual rainfall.
3. Impacts of the droughts.
4. Economic activities of the participants. Includes;
5. Trade
6. Weighed labor
7. Relief assistance.
8. Source of water for irrigation and domestic purposes
9. Adaptation practices in the farm. Includes;
10. Soil conservation technique.
11. Cultivation of alternative crops.
12. Integrated farming system.
13. Factors affecting farmer's inability to practice some adaptation strategies.