Households' Constraints to Effective Adaptation to Drought among Rural Communities in Extreme Northern Region of Jigawa State

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Abstract

Drought is the most problematic phenomenon affecting the socio-economic activities of most of the Jigawa state people especially the rural communities whom rainfed agriculture is the major source of their livelihood. Rainfall variability trigger frequent occurrence of the events. This study assessed households' constraints against effective adaptation to drought among rural communities in Jigawa state. Daily rainfall data for the period of 35 years (1980-2014) was obtained from Jigawa State Agricultural and Rural Development Authority (JARDA) and Kano State Agricultural and Rural Development Authority (KNARDA) Offices, in Dutse and Kano respectively. Normalized Rainfall Index (NRI) was used to depict drought frequency and magnitude. Results show that the study area experienced fifteen drought episodes of different magnitudes representing about 42.86%. Both frequency and magnitude declined especially in the last decade coinciding with the periods of annual rainfall increase. Results obtained from the questionnaire administered shows households suffered various constraints against effective adaptation. Problem Confrontation Index (PCI) was used in assessing households' constraints against effective adaptation. Respondents rated lack of fertilizer as the most problematic constraints against effective adaptation.

Keywords: Households Constraints, Effective, Adaptation, Drought

Introduction

Drought is an intrinsic characteristic of African continent. One-third of the people in Africa lives in drought-prone areas and are vulnerable to the impact of droughts (Bates, Kundzewicz, Wu, & Palutikof, 2008). Since the devastating Sahelian drought of the early 1970s, drought has reoccurred in many parts of Africa (Oladipo, 1993). In West Africa, a decline in annual rainfall has been observed since the end of the 1960s, with a decrease of between 20–40% in the period 1968–1990 as compared to the 30 years between 1931 and 1960 (Nicholson, Some, and Kone,2000 and Chappell and Agnew, 2004). Droughts of various intensities have

been reported in the Sudano- Sahelian region (Oladipo, 1993; Abaje, Ati & Iguisi, 2011 and Aremu, 2011).

Crop production in Nigeria is largely rainfed. Therefore agriculture is heavily dependent on the seasonal characteristics of rainfall. Current evidence clearly shows that rainfall variability is a real threat and that the need for action today cannot be ignored as it is perceived as the major constraints to increased agricultural production. Farmers recalled that the seasons have become less predictable than in the past. Droughts are frequent about 3 in every 10 years (Abubakar & Yamusa, 2013).

Recent food crises in Nigeria are reminder of the continuing vulnerability of the region to the vicissitude of climatic condition. This is in large measure due to weak institutional capacity, limited engagement in environmental and adaptation issues, and a lack of validation of local knowledge (BNRC, 2008). A localized drought together with locust and Quella birds invasion that occurred in Yobe State in 2004 resulted in a high degree of crop failure especially millet, sorghum and rice. Total tonnage of grains lost was estimated to be about 330 metric tons (FME, 2004).

In northern Nigeria, one of the most effective ways of coping with and reducing the risk of drought is irrigation. However, the whole performance of the major public irrigation schemes in Northern Nigeria was reported to be generally poor due to improper maintenance, unreliable water delivery as well as technical deficiency in the infrastructure (Abubakar, 2008 and Othman, Arab, Ibrahim & Kallah, 2010). As at 2021 Nigeria has less than 9% of the total cropped area under irrigation (Sanni, Oluwasemire & Nnoli 2012). Jigawa State Ministry of Agriculture (2013) indicated that less than 15% of the irrigable land in Jigawa State is under irrigation. Therefore, citizens are very vulnerable to rainfall fluctuations especially rural communities.

Apart from irrigation schemes, a number of measures have been taken by the Nigerian authority in collaboration with national and international research institutions in providing various adaptation strategies to the effect of drought. However, most of the drought interventions by Nigerian government in the region have failed to provide effective mitigation strategies to drought **(**Ariyo, Gashua & Oladipo, 1996 and Oladipo, 2010).

Over 80% of the total land mass of Jigawa State is considered arable and about 90% of the State's population are predominantly farmers, making agriculture the major source of livelihood, food security and poverty reduction (Jigawa State Ministry of Agriculture, 2013). However, according to the Nigerian Poverty Assessment in 2007, the incidence of poverty in Jigawa State is 90.9%, the highest in the nation (National Bureau of Statistics, 2007). Increase in the occurrence of drought event in terms of frequency and intensity in the study area may pose serious challenges to the existing adaptation practices. This research attempts to assess constraints against effective drought adaptation in meeting the basic needs of rural households in the study area.

The Study Area

Jigawa State is situated in the north-western part Nigeria located between latitudes 11.00°N and 13.00°N and longitudes 8.00°E and 10.15°E (Figure 1). Kano and Katsina States border Jigawa to the west, Bauchi State to the east and Yobe State to the northeast. To the north, Jigawa shares an international border with Zinder Region in the Republic of Niger. The State has a total land area of approximately 22,410 square kilometres (Dangel, 2008).

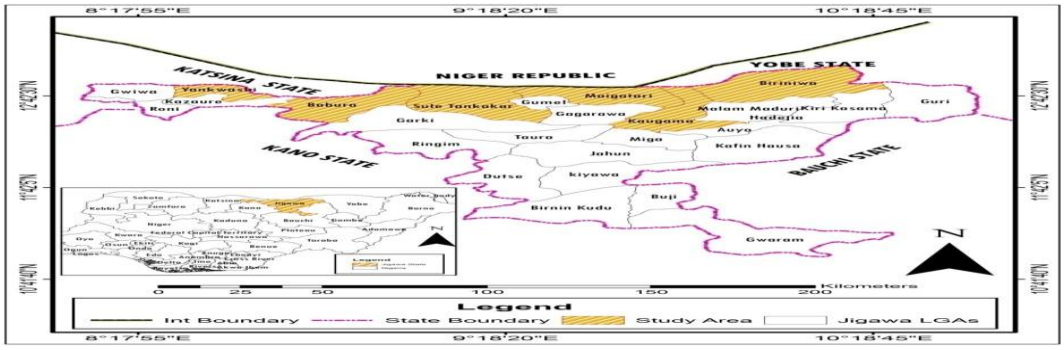

Figure: 1.The Study Area

Source: Modified From Administrative Map of Jigawa State (2017)

The climate of Jigawa State is semi-arid, characterized by long dry season and short wet season. Wet season is roughly four months (June to September) and dry season is seven to eight months (October to May). The rainy season may start in May but early rains in April are not unusual. The bulk of the rainfall comes in June through September. Violent dust storms followed by tornadoes and lightning usually herald

the onset of the rains in May/June and their retreat in September or early October. The total annual rainfall ranges from 600mm in the north to 1000mm in the southern part of the state. Great variations occur in the annual rainfall total and may result in severe and prolong drought which causes crop failure, death of livestock and overall human sorrow (Olofin, 1987 and Onlinenigeria, 2003).

Materials and Methods

This study focused on household constraints against effective adaptation to drought among rural communities in Jigawa State. It covered extreme northern part of the State where drought impact is more pronounced. The study covered a period of 35 years (1980-2014) as studies have shown an increase in the incidence of drought occurrence in the Sudano-Sahelian region in the 1980s, ravaged the zone and left farmers impoverished (Ati, Iguisi and Afolayan., 2007).Daily rainfall data for the period of 35 years (1980-2014) were collected from Jigawa State Agricultural and Rural Development Authority (JARDA) and Kano State Agricultural and Rural Development Authority (KNARDA) Offices, in Dutse and Kano respectively.

Sampling Design and Questionnaire Administration

Jigawa State projected population as at 2016 was 5820200 (Brinkhoff, 2017). The average household size was 6.7. Therefore the projected household was 868686.57.To determine the sample size for this research, Krejcie and Morgan's (1970) method of determining sample size was adopted which states that for an area with a population between 250,000 –1,000,000 the sample size would be 384.

In selecting the respondents, Multi-stage sampling technique was used; whereas purposive sampling technique was used in the first stage to select six most affected Local Government Areas by drought episode representing about 22% of the entire Local Governments in the State. The selected Local Government Areas are Babura, Birniwa, Kaugama, Maigatari, Sule-tankarkar and Yankwashi respectively.

Table: 1 Selected Villages from the Six Selected Local Governments in Jigawa

Local Government Area	Population	Number and Name of Villages Selected
Babura	284500	Aduare, Batali, Giginya, Masko, Unguwar Gawo and Yar Kirya
Birniwa	189800	Birniwa Tasha, Kakori, Kasabur and Yarda Babba
Kaugama	172400	Dusare, Gareru, Turmi and Zaburan
Maigatari	236600	Bagware, Jobi Gari, Matoya and Matsatstsagi
Sule-Tankarkar	180200	Asayaya, Daudu, Tsalle and Yan Damo
Yankwashi	127800	Gangara Kuda and Zoto

State
Source: Brinkhoff, (2017)

In the subsequent stage, random sampling was used in selecting villages from the six selected LGAs. A total of twenty four villages were selected for questionnaire administration. Number of selected villages and are proportional to the population size of that local government in relation to other selected LGAs. The number of respondents in each of the selected village is also proportional to the population size of other selected villages. In the third phase, the technique of purposive sampling was adopted with the help of key informant in each of the selected villages to help in identifying heads of households who have a lot of experience with respect to drought incidence and indigenous coping strategies to administer the questionnaire. For the purpose of administering the questionnaire, head of households above forty (30) years of age were identified and used. The reason for this decision is that these are the people who have experience and the information required about drought, its impact and constraints against effective adaptation.

Data Analysis

Normalized Rainfall Index (NRI) was used in computing drought index for this study. Normalized rainfall index is a measure of magnitude of drought using annual rainfall totals and the standard deviation to indicate the shortage of water of any giving season. Normalized rainfall index for a given station as defined by Turkes (1996) is computed thus: -Asy $= \frac{Rsy - \bar{R}s}{Ss}$

Where A_{sy}= the normalized rainfall index

R_{sy}= the rainfall total for the station during the year (or season).
$\bar{R}s$ = the long term mean (of the period specified for the station).
S_s =standard deviation of the annual (or seasonal) rainfall total for that station.

In this research, a modified classification of NRI was adopted. This is because extreme values greater than 1.76 or less than -1.76 are very infrequent throughout the period under study. The modified classification is given in Table 2.

Table: 2 Modified Normalized Rainfall Index

Rainfall Characteristics	Very wet	Moderately wet	Mildly wet	Near normal	Mild drought	Moderate drought	Severe drought
Index	1.31 or more	0.86 to 1.30	0.51 to 0.85	0.50 to -0.50	-0.51 to -0.85	-0.86 to -1.30	-1.31 or less

Source: Abaje, Ati, Iguisi and Jidauna (2013)

Frequencies and percentages were used in computing households' perceived constraints militating against effective adaptation to drought. To identify the most critical constraints challenging effective adaptation to drought, respondents graded their perceived barriers based on a 0–3 Likert scale (*i.e.*, ranging from "not a problem" to "highly problematic"). The PCI value was estimated using the formula thus: - PCI = $Pn\times 0 + P1 \times 1 + Pm \times 2 + Ph\times 3$

Where: - *PCI* = Problem Confrontation Index;
Pn= *N*umber of respondents who graded the constraint as no problem*;*
Pl = Number of respondents who graded the constraint as low;
Pm = Number of respondents who graded the constraint as moderate*;*
Ph= Number of respondents who graded the constraint as high.

Result and Discussion

Drought Frequency and Intensity in the Study Area

The results of the Normalized Rainfall Index (NRI) are shown in Figure 2.

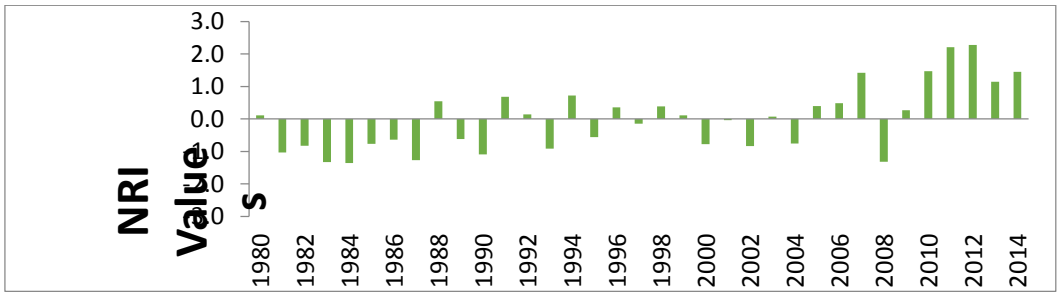

Figure 2: Normalized Rainfall Index Value for Jigawa State

The result shows that the study area suffered frequent drought episodes at varying intensities in the first decade under study (1980-1989). This decade was characterized by more severe and frequent droughts. From then, there was a declined in both frequency and intensity until 2008 when the area witnessed the most extreme drought throughout the period under study. This finding conforms to other findings in the region (Suleiman, 2014).Out of the fifteen recorded drought events eight occurred in the first decade representing about 53.3% of the total drought events. Declined in drought frequency and intensity is a response to the increase in annual rainfall amount recorded in the study area. This also confirmed the earlier findings of decreasing drought events and increasing annual rainfall amount (Abdulhamid, Yakubu, Ati & Iguisi, 2011 and Suleiman, 2014).

Mild drought was dominant drought intensity in this station with 8 years occurrences representing 53.33% of total drought occurrences during the period of the Study. Moderate drought has 4 years of occurrences representing 26.67% and the least occurred intensities were severe drought with 3 years representing 20% of the total occurrences. The 15 years of all the drought intensities occurrence represents about 42.86% of the entire period under study (1980-2014).

Households' Constraints against Effective Drought Adaptation in the Study Area

From the questionnaires administered a number of problems emerged as barriers to effective adaptation and are presented on Table 3.

Table: 3 Households' Perceived Constraints against Effective Drought Adaptation

Constraints	Frequency	Percentage
Lack of Fertilizer	382	99.5
Lack of Capital	375	97.66
Lack of Improved Seeds	265	69.01
Lack of Appropriate Pesticides	378	98.4
Increased Prevalence and Emergence of New Pest and diseases	378	98.4
Farm Implement	190	49.48
Lack of Credit	265	69.01
Security	142	36.98
Extension Services	195	50.78
Price Control	246	64.06

Source: Fieldwork (2017)

Households' constraints to effective drought adaptation are many and highly pressing as most parameters enumerated affects more than 60% of the respondents. However, lack of fertilizer, lack of capital, lack of appropriate pesticides and increased prevalence and emergence of new pest and diseases have higher percentage with more than 97% of the respondents been affected. This is because most of the adaptations used by the respondents are autonomous and responsive as observed by the previous researches (Smit, Burton, Klein & Wandel, 2000) and this result to high crop failure as observed in the region(Adeputu & Barthe, 2007).

PCI Ranking of Constraints to Effective Drought Adaptation in the Study Area

Problem Confrontation Index (*PCI*) assessment results on barriers to effective adaptation practice are given on Table 6.

Table: 4 Constrains to Effective Drought Adaptation Ranking in Jigawa State

Constrains to Adaptation and their degrees	High	moderate	Low	No Problem	PCI	Rank
Lack of fertilizer	239	83	27	11	910	1
Lack of credit	44	87	91	85	397	2
Lack of improved seeds	46	86	69	0	379	3
Farm implement	54	35	73	116	305	4
Lack of appropriate pesticides	3	80	110	93	279	5
Extension services	0	3	5	4	11	6
Lack of capital	0	4	0	0	8	7
Security	0	1	4	5	6	8
Control price	0	0	1	7	1	9

Source: Fieldwork (2017)

Lack of fertilizer is ranked first as the most critical barrier to effective adaptation with PCI value of 910. Non availability and high cost couple with poverty of most of the respondents in the study area makes it to be the most pressing issue to adaptation. In general Nigeria's average fertilizer application per hectare is very low. Even with improve seeds and pesticide agricultural diversification would hardly be possible without corresponding fertilizer application. Lack of credits to farmers ranked second. Jigawa State is ranked among the state with high poverty index and this poverty is more pronounced among rural household that have limited opportunities. Most respondents in the study area could not afford to purchase necessary farm inputs required often at high cost. Lack of improved seeds and farm implements ranked third and fourth impediments to a successful adaptation to drought with PCI values of 397, 379 and 305 respectively. High cost and no availability of improved seeds at village levels make it unaffordable. Fear of buying non genuine also makes it to be a serious problem to most of the respondents. High cost of most farm implements and respondents low purchasing power hinders them from using new implements. Lack of appropriate pesticides, extension services and lack of capital are considered as moderate constrains to effective drought adaptation. Security and price control are the less pressing barriers to effective adaptation.

Conclusion

Droughts are frequent especially in region with highly variable seasonal rainfall. Agriculture is one of the immediate sector where drought impact are felt especially the study area where rainfed agriculture is the major source of livelihood of the rural household. With the increase frequency or intensity of drought, impacts

extends beyond the usual adaptation strategies, hence a significant fall in food production.

The Normalized Rainfall index (NRI) revealed household experiences series of drought with 15 years of occurrences representing about 42.86% of the entire period under study (1980-2014). Result further shows the study area suffered frequent drought episode in the first decade under study (1980-1989). Declined in drought frequency and intensity in the last ten year under study is a response to the increase in annual rainfall amount recorded in the study area.

Household suffered various drought impacts ranging from socio-economic to environmental and adaptation strategies were employed by respondent most of which are autonomous and responsive. Rural household considered fertilizer, credits to farmers and improved seeds as the most pressing constraints against effective adaptation to drought.

Results show the study area enjoys an increase in annual rainfall amount in recent years and this corresponds with decrease in drought occurrence in the study area. These affect the entire farming systems as both frequency and length of the rainy seasons are determined mostly by the annual totals in the study area. These enhance adoptive capacities of the rural household in the study area.

Mild drought was the dominant drought events in the study area with about 53.33%. However the first decade under study was characterized by frequent drought episode with more than 53% of the total occurrence. It is however the decade with more severe drought though the most severe events occurred in 2008. Though, the study area experience decrease in the frequency of drought occurrence, the fragile nature of the adaptation strategies of most household remained sensitive to a slight change in rainfall characteristics. Respondents solemnly rely on traditional adaptation strategies with little or no formal information on current climate issues. This information is vital tools for effective preparation and mitigation to droughts .The evidence of these was low farm output and high crop failure as reported in the study area.

Recommendations

Government should improve accessibility and affordability of farm implements by making it pro-poor especially fertilizer to rural communities. This will improved

volume, varieties, and quality of agricultural inputs. Irrigation in the study area is limited to the very scarce river banks and some low land terrain despites the study area is underlain by sedimentary Chad formation which is good aquifer. Government and nongovernmental organization should intensively exploit abundant underground water resources to enhance and increase irrigation potentials. Government and financial agencies should improve upon accessibility and affordability to agricultural credit to farmers as rural communities in the study area have higher poverty index rate.

Government needs to intensify effort on adult literacy as it is among the major problems extension workers faced in delivering modern agricultural adaptation especially with current climatic trends. It should also incorporate various enlightenment agencies in promoting effective information delivery and feedback especially rural communities. Authorities at local level should research, enhance and incorporates indigenous adaption strategies that are relatively effective. This will encourage active participation and speedy assimilation of modern techniques introduced to rural household upon characterized with stubbornness in accepting new ideas.

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