Drought Perceptions and Coping Strategies among the Marginalized and Resource Poor Farmers in the Sahelian Zone, Jigawa State, Nigeria

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Abstract: **- Drought is a recurring and worldwide phenomenon having spatial and temporal characteristics that varies significantly from one region to another. This study examines the variability of drought perceptions and coping strategies among the resource poor farmers in the Sahelian ecological zone, Jigawa state, Nigeria. The result revealed that farmers are fully aware of drought they have heard several times about it as well as personal experience. On the other hand perception of drought varies among the resource poor farmers some considers extension of dry season as drought, while others drying of crops as well as persistent moisture deficit. The coping strategies includes planting drought resistant variety crop, cross ridging, adopting irrigation farming and delay-farm clearance until mid-of rainy season among others.**

Keywords: **drought, sahel, perception, resource poor farmers, coping strategies.**

I. INTRODUCTION

Much of the available literature suggests that the overall impacts of climate change on agriculture, especially in the tropics have been highly negative (Maddison *et al;* 2007 as cited in Rao*et al,* 2007). Drought is ranked as the natural hazard with greatest negative impact on human livelihood.

Nigeria features wide-ranging ecological zones, but drought is a phenomenon that affects the country as a whole. The degree of vulnerability however differs, with the dry sub-humid and semi-arid regions in the north, usually referred to as the Sudano-Sahelian zone (which includes the Northern Guinea Savanna), being more vulnerable to drought than the more humid regions in the south. These regions already have low levels of biological productivity, organic matter and aggregate stability. Their vegetation and plant cover are relatively sparse, and 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. (Olofin,2014).

The underlying cause of most droughts can be related to changing weather patterns manifested through the excessive buildup of heat on the earth's surface, meteorological changes which result in a reduction of rainfall, and reduced cloud cover, all of which results in greater evaporation rates. The resultant effects of drought are exacerbated by human activities such as deforestation, overgrazing and poor cropping methods, which reduce water retention of the soil, and improper soil conservation techniques, which lead to soil degradation. Between 1950 and 2006, the Nigerian livestock population grew from 6 million to 66 million, an eleven-fold increase. The forage needs of livestock exceed the carrying capacity of its grasslands. It is reported that overgrazing and over-cultivation are converting 351,000 hectares of land into desert each year. The rates of land degradation are particularly acute when such farming practices are extended into agriculture on marginal lands such as arid and semi rid lands, hilly and mountainous areas and wetlands (Yamusa *et al*, 2011).

In northern Nigeria, the Sahel Zone of Jigawa State in particular, drought can be attributed to failure of the rain-bearing monsoon winds from the Atlantic Ocean to penetrate enough into the region (Oladipo, 1993b). This is supported by the work of Yamusa (2001) who observed that, stations north of latitude 120 N in Nigeria have shown no significant correlation between rainfall and southern oscillation index.

II. MATERIALS AND METHODS

The Study Area

Location, Position and Size

The Study area is located between latitudes 12^0 N and 13^0 N and longitudes between 9^0 E and 10.15^0E, in northeastern part of Jigawa state, Nigeria. It has a landmass of about 8,247 Kilometer Square. A large proportion about 80% of this is certified to be arable land. (JSTMA, 2013).

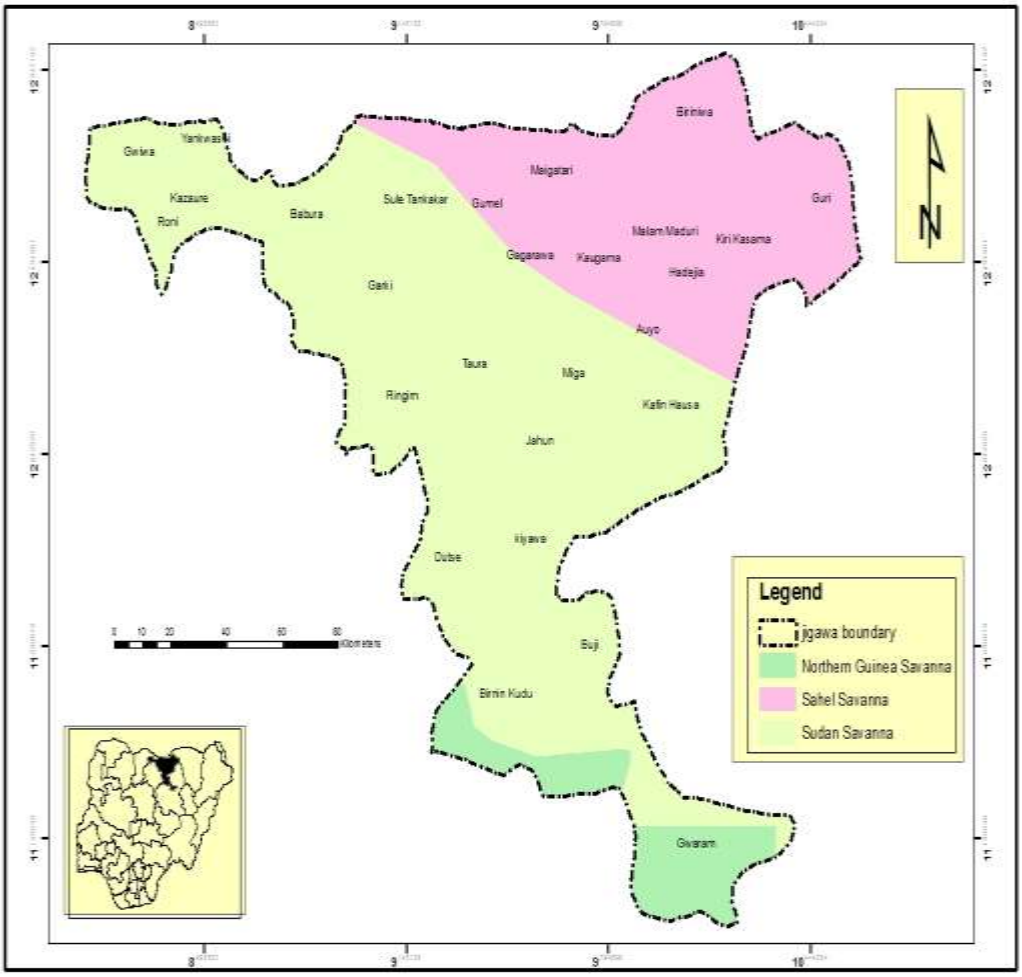

Figure: 1 Map of Jigawa State, Showing the Study Area in Pink Colour.

Source: Adapted and Modified from Jigawa State Ecological Map, 2015

The relief is generally flat with depression along river Hadejia. The area is approximately 300-380 meters above sea level (Lands,2000).The study area been drained by river Hadejia, which cut across the area through Auyo, Hadejia, Guri, and Kiri-kasamma local government areas. The climate of the study area is semi-arid characterized by long dry season and short wet season. The mean annual temperature is about 25^{o}C but the mean monthly values ranges from 21^{o}C in the coolest month to 31^{o}C in the hottest month. However the mean daily temperature could be as low as 20^{o}C during the month of December and January when the cold dry harmattan winds blows from the Sahara desert. The climate of the zone is the tropical wet and dry type, classified by Koppen as Aw. The zone has an average annual rainfall of about 500 mm (Abaje *et al*, 2012 a&b).

The soils are generally sandy at the top and compact at the depth with often hardpan. Aeolian deposit from the Sahara Desert form substantial part of soils in the study area especially towards northern part. (FRN, 2000). More than half of the region is covered by regosols and brown soils, ferruginous tropical soils which are heavily weathered and markedly laterized (Oladipo, 1993b; FRN, 2000). They are mostly formed on granite and gneiss parent materials, and on aeolian and many sedimentary deposits (Abaje, 2007a). The vegetation is the Sahel type with the density of trees and other plants decreasing as one move north and northeast (Abaje, 2007b).

Methodology

The study area comprises ten local government areas of Jigawa state, which make up the Sahel zone of the state.

However to take sample of the study, each local government has a number of wards, so in each local government wards under that local government are listed alphabetically and all the odd number wards are selected systematically to ensure good geographical representation across the study area . This is because the study area is quite large. Questionnaires are administered proportional to the population of each ward, but due to the non-availability of population figures for each ward from the 1991 and 2006 census results, the questionnaires are distributed uniformly among the selected wards, with twenty (20) questionnaires in each ward.

However, purposive sampling was adopted with help of village heads or any person incharge of that ward to identify farmers who have a lot of experience with drought incidences to administer the questionnaire. Purposive sampling, according to Bernard (2002) "is the deliberate choice of an informant due to the quality the informant possesses." Farmers above 30 years in the area, and stay for 20 years and above, were asked about their age and how long they stay in the study area. The reason for this is that those with age bracket will have the information needed about drought adaptation and indigenous coping methods.

Table:1 List of Wards Visited for the Study

	LGAs and Wards visited	Questionnaire Distributed	Questionnaire retrieved
1.	**AUYO**		
1	Auyakayi	20	19
2	Auyan	20	16
3	Gamafoi	20	17
4	Gatafa	20	15
5	Tsidir	20	19
2.	**BIRNIWA**		
1	Batu	20	17
2	Dangwaleri	20	18
3	Kachallari	20	17
4	Kazura	20	18
5	Nguwa	20	16
3.	**GAGARAWA**		
1	G.Chiroma	20	20
2	Gagarawa	20	18
3	Madaka	20	18
4	Maikilili	20	17
5	Yalawa	20	20
4.	**GUMEL**		
1	Baikarya	20	19
2	Dantanoma	20	18
3	G.Gambo	20	20
4	Gusau	20	19
5	K.Arewa	20	18
6	Zango	20	20
5.	**GURI**		
1	Lafiya	20	17
2	Abunabo	20	18
3	Dawa	20	16
4	Guri	20	18
5	M.Baba	20	19
6.	**HADEJIA**		
1	Atafi	20	19
2	Gagulmari	20	17
3	K.Kofa	20	18
4	Matsaro	20	16
5	S.Garu	20	19
6	Yayari	20	18
7.	**KAUGAMA**		
1	Arbus	20	18
2	Dabuwaran	20	18
3	Hadin	20	20
4	Jarkasa	20	20
5	U.Jibrin	20	17
6	Yalo	20	20
8.	**KIRIKA SAMMA**		
1	Baturiya	20	19
2	Doleri	20	18
3	Gayin	20	16
4	Madaci	20	17
5	Tarbus	20	19
6	Tasheguwa	20	18
9.	**MAIGATARI**		
1	Dankumbo	20	20
2	Galadi	20	20
3	Kukayasku	20	19
4	M.Arewa	20	20
5	Matoya	20	20
10.	**MALAM MADORI**		
1	Arki	20	18
2	F.Akurya	20	17
3	M.B Musa	20	20
4	M.Madori	20	19
5	Tagwaro	20	19
6	Tonikutara	20	14

Source: Field Survey, 2015

III. RESULTS AND DISCUSSION

General Characteristics of the Respondents

Demographic characteristics of farmers such as education, age, gender and farming experience plays a significant role in determining what to produce, when and how, as well as decision making and choices of adaptation methods.

Table: 2. Socio-Demographic Characteristics of the Respondents.

		Frequency	Percent	Cumulative Percent
Age	30-39	677	67.7	67.7
	40-49	203	20.3	88.0
	50 and above	120	12.0	100.0
Gender	Male	913	91.3	91.3
	Female	87	8.7	100.0
Marital Status	Single	278	27.8	27.8
	Married	722	72.2	100.0
Duration in the Area	20-29 years	500	50.0	50.0
	30-39 years	282	28.2	78.2
	40-49 years	118	11.8	90.0
	50 and above years	100	10.0	100.0

Source: Field Survey, 2015

Age of the respondents

The table 2 above shows that 67.7 percent (677 farmers) are at the age of 30-39 years; 20.3 percent (203 farmers) are within the age range of 40-49 years; 12.0 percent (120 farmers) are within the age range of 50 years and above years.

Gbetibouo (2009) and Adesina and Forson (1995) observed that there is no consensus in the literature as to the exact effect of age in drought adaptation. On one hand, age may have a negative effect on the decision to adopt new farming technologies, simply because older farmers may be more risk-averse and therefore, less likely to be flexible than younger farmers. On the other hand, age may have positive effect on the decision of the farmer to adopt because older farmers may have more experience in farming and therefore, better able to assess the features of a new farming technology than the younger ones.

Gender of the Respondents

In relation to gender, this study finding shows that 91.3% of the households were males while only about 8.7% were females. This indicates that male households dominates agricultural sector in the study area (Table 2). Asfaw and Admassie (2004) noted that households headed by males have a high probability of getting information about new adaptation methods and farming technologies, and also undertake risky ventures than female households. A similar observation was made by Tange and Hella (2004) who points out that female household are less likely to adopt soil and water conservation practice measures since woman may have restricted access to information, land and other resources due to traditional societal barriers. Nonetheless, Nhemachena and Hassan (2007) have contrary belief to the finding of this study. They argued that female headed households are more likely to adopt different methods of drought adaptation than male headed households.

Level of Education of the Respondents

Education in general, the results of this study shows that majority 91.8% of the respondents were literate, who has between 1 – 18 years of formal education and remaining 8.2% had no formal education. The implication of this finding is that there is high level of literacy among rural youths in the study area. This would contribute to their innovativeness and adoption of various farm adaptation techniques as well as influence the agricultural information. However, this finding was supported by Norris and Batie (1987) who argued that farmers with more education are more likely to have enhanced access to technological information than poorly educated farmers. Furthermore, Igoden*et al* (1990) and Lin (1991) observed a positive relationship between household education level and adaptation of new innovations. As such, farmers with better education are likely to perceive drought and adapt to it.

IV. FARMERS' PERCEPTIONS AND AWARENESS OF DROUGHT

Farmers were asked about their perceptions and awareness of drought. Drought has different meaning to different respondents based on their physical, social as well as economic background, and the degree of involvement in agricultural activities and the level of impact on their well-being.

Table 3 below present the level of awareness of farmers on drought in the area.

Table 3 farmers Awareness on Drought

Local Government Areas		Awareness on Drought		Total
		Yes	No	
Guri	F	66	22	88
	%	75.0	25.0	100.0
Gumel	F	85	29	114
	%	74.6	25.4	100.0
Hadejia	F	91	16	107
	%	85.0	15.0	100.0
Maigatari	F	76	23	99
	%	76.8	23.2	100.0

Auyo	F	62	24	86
	%	72.1	27.9	100.0
Kaugama	F	94	19	113
	%	83.2	16.8	100.0
Kirikasamma	F	89	18	107
	%	83.2	16.8	100.0
MalamMadori	F	92	15	107
	%	86.0	14.0	100.0
Birniwa	F	78	8	86
	%	90.7	9.3	100.0
Gagarawa	F	83	10	93
	%	89.2	10.8	100.0
Total	F	816	184	1000
	%	81.6	18.4	100.0

Source: Field Survey, 2015.

However, the result of the farmers awareness on drought on average indicate that about 81.6% of the respondents are aware of drought, only about 18.4% of the household disclosed that they have no knowledge on drought occurrences.

Table:4 Chi-square Test Result Cross tabulation of Education and Drought Awareness.

LGAs	X^2 Values	df	P. Value	Remarks
Guri	17.657	3	0.001	Sig. difference
Gumel	0.811	3	0.847	No.sig.difference
Hadejia	6.200	2	0.45	Sig.difference
Auyo	0.598	3	0.897	No.sig.difference
Maigatari	12.258	3	0.002	Sig. difference
Kaugama	3.701	2	0.57	No.sig.difference
Kiri-kasamma	16.828	3	0.001	Sig. difference
MalamMadori	0.770	3	0.001	Sig. difference
Birniwa	12.187	3	0.007	No.sig.difference
Gagarawa	3.494	3	0.000	Sig.difference
Total	30.888	3	0.000	Sig.difference

Source: Field Survey, 2015.

There is significance difference between level of education and drought awareness in area, at 0.005 significant level. The Chi square results indicate that education has influence over drought awareness, that is those with education are better able to understand drought. Kaugama 0.57, Gumel 0.847, Auyo 0.897 and Birniwa 0.007 are the local governments where there is no significance difference in terms of education and drought awareness among farmers as the Chi-square test shows between the level of education and drought awareness.

The total Chi-square test indicates that there are significance difference between local governments in the area in terms of drought awareness and the level of education. Educated farmers are better able to be aware of drought than those with less education. There are significant relationship between education and drought awareness In their respective studies, Maddison (2006) and Nhemachena and Hassan (2007) observed that the awareness by farmers on drought attributes – whether precipitation or temperature or both, is of essence in as far as their adaptation decision-making process is concerned. In this study it was therefore found that farmers with access to education were more likely to observe changes in drought and were therefore more likely to adapt than those without education.

Table: 5 below present the farmers perceptions on what they consider as drought in the area. Drought has different meaning and impacts to various farmers and depends with socio-economic characteristics of the farmer.

Table:5 What Farmers Considers as Drought

Local Government Areas		What Farmers Considers as Drought				Total
		Extension of dry season	Drying of crops	Persistence moisture deficit	Others	
Guri	F	21	46	17	4	88
	%	23.9	52.3	19.3	4.5	100.0
Gumel	F	37	54	21	2	114
	%	32.5	47.4	18.4	1.8	100.0
Hadejia	F	34	47	12	14	107
	%	31.8	43.9	11.2	13.1	100.0
Maigatari	F	36	48	12	3	99
	%	36.4	48.5	12.1	3.0	100.0
Auyo	F	23	47	12	4	86
	%	26.7	54.7	14.0	4.7	100.0
Kaugama	F	38	54	12	9	113
	%	33.6	47.8	10.6	8.0	100.0
Kirikasamma	F	35	52	13	7	107
	%	32.7	48.6	12.1	6.5	100.0
MalamMadori	F	33	59	12	3	107
	%	30.8	55.1	11.2	2.8	100.0
Birniwa	F	32	40	6	8	86
	%	37.2	46.5	7.0	9.3	100.0
Gagarawa	F	58	32	3	0	93
	%	62.4	34.4	3.2	0.0	100.0
Total	F	347	479	120	54	1000
	%	34.7	47.9	12.0	5.4	100.0

Source: Field Survey, 2015.

The variability on what farmers considers as drought (Table 5), on average the entire responses indicate that drying of crops 47.9% o is perceived to be as drought and 34.7% of the respondents perceived that extension of dry season as drought.

In general there is statistically significant relationship between farmers of various local governments on what they consider or perceived as drought. The variability indicate that 62.4% of the respondents from Gagarawa perceived drought as extension of dry season, the other local governments give lower percentages less than 40%. Although there is consensus among farmers in the area as they perceived drought as drying of crops. More than 40% of the households in the area perceived drought as drying of crops. However, in terms of households perceptions on moisture deficit as drought, there were few responses among farmers in the area, on average less than 20% of the households in the area disclosed that they perceived persistent moisture deficit as drought in rest of the local governments.

Table: 6 Major Agricultural Adaptation Strategy to Drought.

Local Government Areas		Agricultural Adaptation Strategy to Drought					Total
		Planting drought resistant variety crop	Cross ridging	Adopting irrigation farming	Delay-farm clearance until mid-of rainy season	Others	
Guri	F	52	7	50	7	2	88
	%	59.1	8.0	51.2	8.0	2.3	100.0
Gumel	F	56	12	16	20	10	114
	%	49.1	10.5	14.0	17.5	8.8	100.0
Hadejia	F	53	11	62	7	2	107
	%	49.5	10.3	61.4	6.5	1.9	100.0
Maigatari	F	61	16	7	9	6	99
	%	61.6	16.2	7.1	9.1	6.1	100.0
Auyo	F	36	10	55	4	2	86
	%	41.9	11.6	55.2	4.7	2.3	100.0
Kaugama	F	62	9	30	5	7	113
	%	54.9	8.0	13..5	4.4	6.2	100.0
Kirikasamma	F	43	10	48	10	2	107
	%	40.2	9.3	48.0	9.3	1.9	100.0
Malam Madori	F	52	16	28	8	3	107
	%	48.6	15.0	16.2	7.5	2.8	100.0
Birniwa	F	48	9	13	9	7	86
	%	55.8	10.5	15.1	10.5	8.1	100.0
Gagarawa	F	35	32	18	1	7	93
	%	37.6	34.4	19.4	1.1	7.5	100.0
Total	F	498	132	242	80	48	1000
	%	49.8	13.2	24.2	8.0	4.8	100.0

Source: Field Survey, 2015.

In terms of adopting drought resistance variety crops there is significance difference between farmers in various local governments of the area irrespective of gender or education. However, on average farmers in the study area accept to use drought resistant variety crops to curb the menace of drought. There is much variability among local governments in the area in terms of adoption cross ridging as means of drought adaptation. Less than 20% of the respondents in all of the local governments in the area with exception of Gagarawa 34.4% answered that cross-ridging adoption will curb the menace of drought. Therefore, the variability between local governments in the area is not much. There is variability in the area while using irrigation as a means to adapt to drought. Those local governments that have access to river such as Kiri-kasmma48.0% (households), Auyo55.2% (households), Hadejia61.4% (households),Guri51.2% (households) adopt irrigation to tackle the challenge of drought. While less than 20% of the respondents of the other local governments in drier part of the study area attested that they adopt irrigation to catch up the negative impacts of drought posed in the area. Most of the farmers in the study area do not delay farm clearance. The variability is very negligible less 20% of all the respondents in all the local governments in the area answered that they delay farm clearance till the mid of the rainy season.

V. CONCLUSION

Drought is one of the climatic related hazards that hit the study area. It affected life and properties damages to crops and low yield among others. The study concludes that farmers are well aware of drought in other words they have full knowledge on drought and how it affects their agricultural activities. Despite that they employed several strategies to curb the menace of drought such planting drought resistant variety crop, cross-rigging, delay farm clearance among others.

Recommendations

Based on the findings, the study recommends the following

- Enhancing capacity building and extension of extension services to remote area and public campaign and or sensitization to farmers through various means of communication to enhance the knowledge of drought to resource poor farmers.
- Revitalization of government policies on tree planting and natural regeneration and policies regulating cutting down of trees
- Provision of drought resistant variety crops at affordable price to the farmers and at the right time for planting
- Provision of fertilizer and pesticides at affordable price and right so as tackle the impacts pest infestation

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