Saudi Journal of Humanities and Social Sciences (SJHSS)
Scholars Middle East Publishers
Dubai, United Arab Emirates
Website: http://scholarsmepub.com/

ISSN 2415-6256 (Print)
ISSN 2415-6248 (Online)

Comparative Analysis of Contribution of Assets Ownership and Livelihood Diversification in Adaptation to Drought of Selected Farming Communities in Northwestern Nigeria

Abdullahi Umar[1*], Ismaila Alfa Adamu [2]
[1]Department of Geography, Federal University, Birnin Kebbi, Nigeria
[2]Department of Geography, Usmanu Danfodiyo University, Sokoto, Nigeria

***Corresponding author**
Abdullahi Umar

Article History
Received: 24.12.2017
Accepted: 29.12.2017
Published: 30.1.2018

DOI:
10.21276/sjhss.2018.3.1.5

Abstract: Drought causes decline in bio-productivity, affects livelihoods and threatens food security. However, it has been observed that access to assets (such as natural capital) and diversification of livelihood help in ameliorating drought risk. The aim of this paper is to examine the contributions of ownership of assets and livelihood diversification in the overall adaptation to drought of farming communities in Bungudu, Dange, Dawakin-Tofa and Rimi in Northwestern Nigeria. A multi-stage sampling adopted by this study led to the selection of four localities and eighty smallholder farmer households. The research used indicators for measuring adaptive capacity to construct an adaptive capacity index. The values of the indicators were normalized. All the normalized scores lie between -1 and 0. Then scorecard method was used to compare and rank contributions of ownership of assets and livelihood diversification to the adaptation to drought of the four communities. The Adaptation Index generated has shown that Dawakin-Tofa with scores the highest score (43.5) has been ranked 1st is among the communities with highest ownership of small ruminants and is the most adaptive among the four communities. The findings of this study have corroborated work that shown that low adaptation to drought is associated with among other things lacking of livestocks (including small ruminants). It is concluded that ownership of small ruminants scored highest and has been ranked 1st in its contribution to adaptation to drought in ¾ communities of the study area. The recommendations of this study are geared towards enhancing sustainable livelihood of the communities.
Keywords: Adaptive Strategies, Drought, Bio-productivity, Farming Communities.

INTRODUCTION

Drought is a slow-onset natural hazard that causes damage to agricultural systems and threatens food security essentially by reducing the amount of rainfalls to plants or forage available to animals and thereby leading to destruction of plants and death of livestock (Zarafshani). It also causes significant decline in biological productivity which seriously affects rural livelihoods such as crop production, animal husbandry, and artisan fishing. The major impacts of drought on rural livelihoods are: crop failure, depletion of water resources which affects fishing and lack of pasture for livestock. Historically, losses from drought events across the world significantly increased with an increase in number of droughts and or drought severity [1].

Severe drought is one of the greatest recurring natural disasters in North America [2]. The recurrence of severe drought also causes human suffering and a major blockage to pro-poor livestock development in sub-Saharan Africa, particularly in pastoral and agro-pastoral systems. The dry-land areas are the most vulnerable regions to drought in Nigeria [3]. It is documented that the Sudano-Sahelian Zone (SSZ) of Nigeria has experienced frequent drought and famine from 1883 to 1987 [4, 5].

Adaptation to drought is an approach that changes human use patterns of the earth system so as to better adapt to (the extreme) climatic conditions before excessive or unsustainable losses occur [6]. Adaptation is a process by which strategies to moderate, cope with and take advantages of the consequences of climatic events are enhanced, developed and implemented. It is in general, an adjustment in ecological, social or economic systems in response to observed or expected changes in climatic stimuli and their effects and impacts in order to alleviate adverse impacts of changes or take advantage of new opportunities [7]. It involves both building adaptive capacity to increase the ability of individuals, groups, or organizations to adapt to changes and implementing adaptation decisions, that is transforming that capacity to action. The importance of

adaptation to climate change is increasingly emphasized [8].

Adaptation describes larger term activities that take into account the threats of environmental extremes or changes [9]. Adaptive strategies entail a long-term change in behaviour patterns as a result of a climatic shock or stress. A common example is that of agro-pastoralists who have adapted to changing conditions of climate, water and vegetation variability by optimizing the mix of cattle, sheep, goats and camels in their herds [10]. Adaptive strategies of farming communities play important role in triggering impacts, worsening, or ameliorating drought situations [11] and enhancing the resilience of vulnerable communities to the impacts of climate change through adaptation is becoming increasingly important [12]. A closer examination of household livelihood and farming systems in drylands of West Africa (specifically Nigeria) shows that adaptive strategies have been evolved in response to crises in rainfall (drought), food supply, livestock management, environmental degradation, and household coping capabilities [13].

Communities' access to some fundamental assets (such as natural capital, human capital, social capital etc) forms an important enhancer of their adaptation. Household with adequate access to a range of different resources (capitals or assets) have greater capacity to adapt to drought. For example, a rural household with extensive friends or other social relations may be able to maintained productivity without outside institutional help during a drought [14]. Smallholder management of natural resources (assets) in the drylands of Nigeria is combined with the pursuit of reproductive and social goals in the context of risk and environmental change prevalent in the region. And in overcoming some of the constraints to natural assets such as: erratic rainfall, poor biological productivity, labour and capital, resources users especially farmers make use of three opportunities available to them namely: intensification of resources use in situ; diversification out of primary production into other income earning activities and migration to other areas where natural resources are still available [15, 16].

It has been observed apart from the ownership of certain assets and intensification of its use in situ, diversification out of primary production (mixed farming, mixed cropping, alternate livelihood or off-farm sources of income etc) helps in spreading drought risk which is very crucial to economic survival of the household and its members. There is also increasing evidence that informal local institutions—such as social capital based on friendship or kinship—strengthen the capacity to reduce the stress of natural and economic hazards (learning from experience, capacity for innovation, flexibility) and are important for organizing these assets into adaptation actions [17].

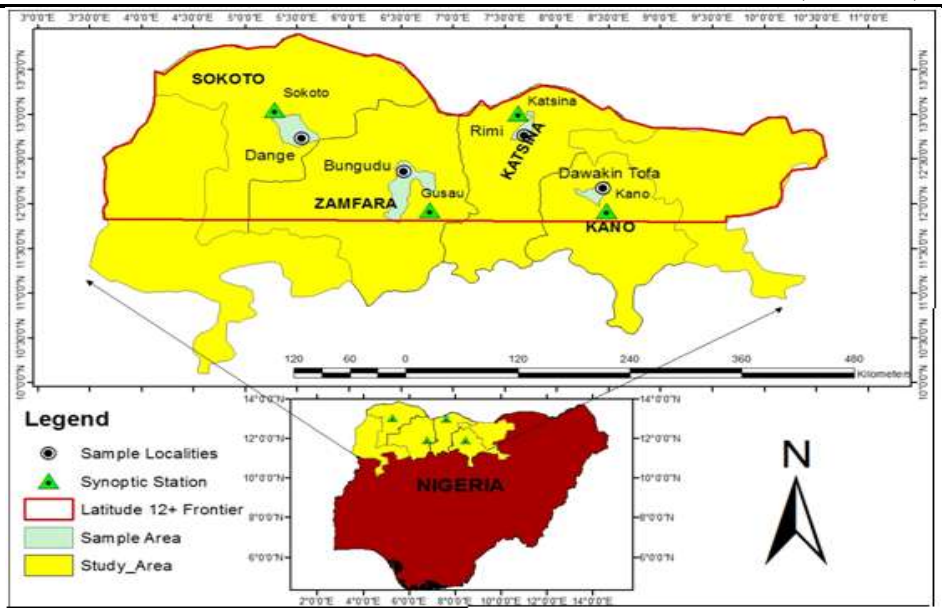
The aim of this paper is to examine the contributions of ownership of assets (such as small ruminants, farm economic trees) and livelihood diversification (in form of mixed cropping, more than one sources of income) in the overall adaptation to drought of farming communities in Bungudu, Dange, Dawakin-Tofa and Rimi in Northwestern Nigeria. To this end the objective of research are:

a. To examine adaptation to drought among communities in the study area;
b. To assess the contribution of ownership of assets (such as small ruminants, farm economic trees) to the overall adaptation of communities in the study area;
c. To assess the contribution of livelihood diversification (in form of mixed cropping, more than one sources of income) to the overall adaptation of communities in the study area

MATERIALS AND METHODS

Study Area

Fig-1 shows the study area which is located between lat 12^0 00^iN to 13^0 45^i N and Longitude 3^0 30^i E to 11^0 35^i E. The climate of area is tropical wet and dry and semi-arid steppe types coded A_W and B_S by W. Koppen [18]. The vegetation comprises of tropical grasslands of the Sudan and Sahel Savanna. Agriculture, the predominant economic activity in the study area, is mostly rain fed. Crops produced include millet, sorghum, rice, cowpea, soy beans, wheat, groundnut, maize, cotton, sesame and vegetables [19].



Materials and Methods

Some of the research tools and materials used in this study include: an open ended questionnaire; Microsoft Excel 2007 and Arc GIS 9.3. The research has been designed and organized in these stages: Pre-field preparation, Reconnaissance Survey, and Fieldwork. A multi-stage sampling procedure adopted by this study led to the selection of four localities and eighty smallholder farmers household. In the first stage four synoptic stations that have the best historical records in terms of temporal resolution and most consistent data were chosen. The second stage involves sampling of communities.

Purposive sampling was employed to select a total of four prominent smallholder farming communities namely: Bungudu, Dange, Dawakin-Tofa and Rimi. Finally, twenty smallholder farmers of not less than forty years and twenty years farming experience were selected through availability sampling. Because there is no exact information or even estimate of the total number of smallholder farmers households of the requisite age and experience in the study area adoption of probability sampling such as simple random or systematic will not be appropriate. This necessitated using other non probability sampling essentially the availability sampling. The research used indicators for measuring adaptive capacity to construct an adaptive capacity index. These indicators include: percentages of farmers who are: having more than 1 income sources; practicing mixed cropping; benefiting economic trees and those who own small ruminants.

The values of the indicators are normalized using the following procedure: The observed values are using the formula in eqn (1)

$$N_{ij} = -1[(X_{ij} - \text{Min})*100]/ (\text{Max. Value} - \text{Min. value}) \qquad \text{eqn (1)}$$

All the normalized scores for the two types of functional relationship will lie between -1 and 0. Then scorecard method can be used to compare and rank contribution of ownership of assets and livelihood diversification to the adaptation to drought of the various communities. Scorecard provides a simple method for comparing and ranking. Subjects such as score for several criteria can be assigned to each subject and various scales can be used. The method can be used for assessing the contribution of subjects such as

RESULTS AND DISCUSSIONS

Table 1 shows the adaptive capacity index generated after nonalization of indicators values. The first collumn are the normalized values which are from =1to 0. The second collumn p*w is scoring or weighted value obtained by assigning the same value (mean) of the observations and multiplied by the normalized value [20].

Table-1: Adaptive Capacity Index

COMMUNITIES	BUNGUDU		DANGE		DAWAKIN-TOFA		RIMI	
Indicators	X	PW	X	PW	X	PW	X	PW
Small ruminants	-1	-14.5	0	0	-1	-14.5	-1	-14.5
Economic tree	0	0	0	0	-1	-10	-1	-10
Mixed cropping	-0.2	-0.06	0	0	-0.83	-4.98	-1	-6
> 1 sources of income	-1	-3.5	-1	-2.31	-0.33	-1.16	0	0

Source Analysis of field data [21]

Score=card has been generated from the second column (PW) or the weighted values of four subjects (indicators) as presented in Table-2. The negative signs of the indexes have been ignored or the values can be multiply by -1. Adaptation on like vulnerability the more its negative values (indexes) move further away from 0 the higher the adaptability. So from table 1 adaptation index has shown that Dawakin-Tofa with scores of 43.5 has been ranked 1st in table 3 and is the most adaptive community among the four selected communities of the study area.

Table-2: Score-card comparison and ranking of subjects

	SCORE AND (RANK)			
	BUNGUDU	DANGE	DAWAKIN-TOFA	RIMI
Subject 1 (Ownership of Small Ruminants)	14.5 (1)	0 (2)	14.5 (1)	14.5 (1)
Subject 2 (Benefiting Economic Trees)	0 (4)	0 (2)	10 (2)	10 (2)
Subject 3 (Mixed cropping)	0.06 (3)	0 (2)	4.98 (3)	6 (3)
Subject 4 (> 1 sources of income)	3.5 (2)	2.31 (1)	1.16 (4)	0 (4)

A comparative analysis of contribution of ownership of assets (small ruminants and economic trees) and livelihood diversification (mixed cropping and more than one sources of income) as presented in table 2 has revealed that ownership of small ruminants scored highest and is ranked 1st in its contribution to adaptation to drought in ¾ communities of the study area. The least in contribution to the aggregate adaptation to drought is having more than one sources of income (see Table-3).

Table-3: Score-card comparison and ranking of subjects

	SCORE	RANK
Subject 1 (Ownership of Small Ruminants)	43.5	1
Subject 2 (Benefiting Economic Trees)	20.0	2
Subject 1 (Mixed cropping)	12.4	3
Subject 1 (> 1 sources of income)	7.0	4

The findings of this study have corroborated work by Abaje *et al*., [22] who conduceted a quantitative vulnerability assessment of some rural areas of Kaduna state, Nigeria and found that Ikara LGA was highly vulnerable and Kagarko and Kajuru are the least vulnerable. Among the factors that cause the high vulnerability include large family size and lacking of livestocks.

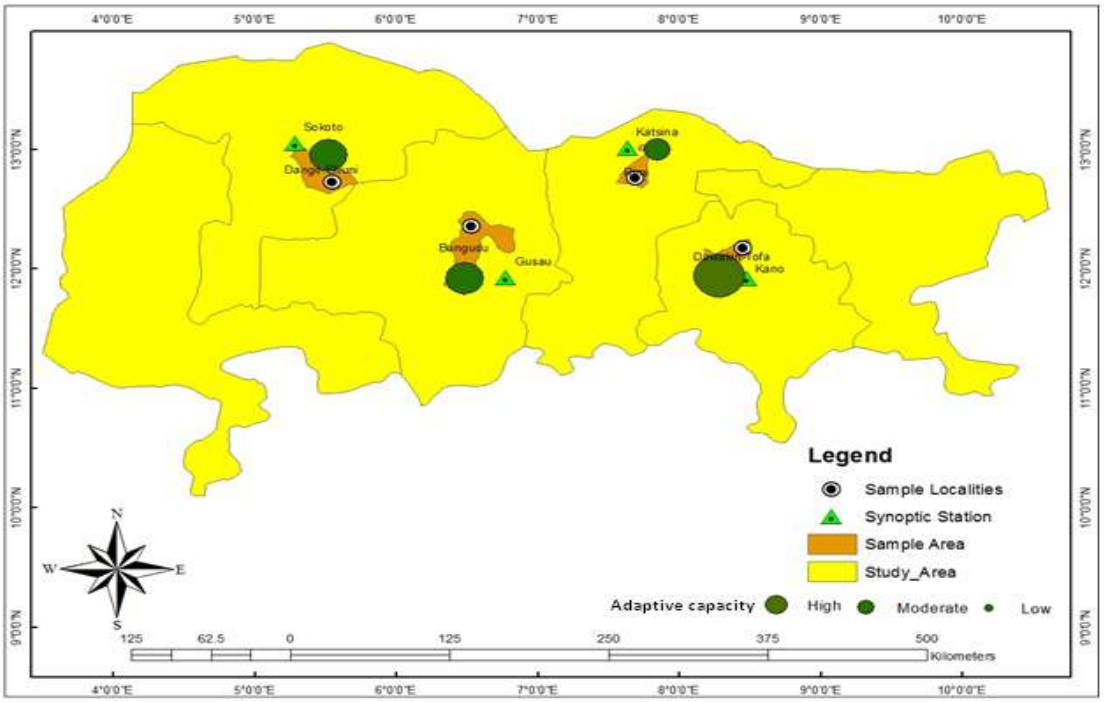


Fig-2: Drought Adaptive Capacity Map of the Study Area

CONCLUSION AND RECOMMENDATIONS

It is concluded that ownership of small ruminants scored highest and has been ranked 1st in its contribution to adaptation to drought in ¾ communities of the study area. The least in contribution to the aggregate adaptation to drought is having more than one sources of income adaptive strategies in the study area are arranged in the order: ownership of small ruminants; benefiting economic trees; practicing mixed cropping; and having more than one income sources in accordance to each contribution to the resilience of the study area. In view of the foregoing, it is therefore recommended as follows:

- ✓ That authorities, Non-Governmental Organizations, private sector an d donor agencies such take note of this try to enhance these strategies through prioritizing them;
- ✓ Also ecological problem of vegetal resources depletion should be given attention in order to safeguard farm economic trees that are very crucial to the communities survival;
- ✓ Members of communities shoul d be more empowered with alternative sources of income other than farming activity among all the communities of the study area,

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