E-ISSN: 1115 – 831X P-ISSN: 3027-2963
MPRI-JAVS | INTERNATIONAL JOURNAL OF AGRICULTURAL AND VETERINARY SCIENCE
VOL. 13 NO. 1 - JULY, 2026

EFFECT OF CONFLICT AND CLIMATE CHANGE ON FOOD SECURITY AND LIVELIHOOD IN THE SEMIARID ENVIRONMENTS OF NIGERIA

[1]QUADRI, S. O; [2] JIBRILLA, A; & [3]BONIFACE, G.

[1]International Institute of Tropical Agriculture (IITA), Nigeria. [2,3]Adamawa State University (ADSU), Mubi, Adamawa State, Nigeria

DOI: https://doi.org/10.70382/mejavs.v13i1.044

Abstract

The study was conducted to examine the perception of households on the effect of conflicts and climate variability on their food security and livelihood activities. A multi-stage sampling technique was employed to select respondents. A simple simultaneous Ordered Logit Regression Model (OLRM) was used to assess the effects of the study variables with a correlation analysis to determine the relationships. Evidence from regression results on perceived effect of conflict is statistically significant across all the models at 1 per cent (p-value=0.0000). The average perceptions of households regarding the effect of temperature, rainfall and drought on food availability, accessibility, utilization and stability is approximately 4.0 suggesting that food security is vulnerable to climate variability in the study area. Results indicate a negative and significant relationship between conflict and the four pillars of food security. Model 1 shows that an increase in the prevalence of conflict by 1 per cent, was perceived to have about 0.51 likelihood of decreasing food availability, implying that conflict decreases households' food availability by 51% in the study area. The p-values indicate that climate parameters for all the vulnerability scales have strong significant impact on food security at 1 percent level of significance. The study therefore concludes that the probabilities of a food system shock will be higher than usual through 2026. It is recommended that government should accelerate efforts in making the population less vulnerable through pragmatic conflict transformation strategies, improved agricultural productivity schemes, climate adaptation and mitigation strategies, and effective social safety net.

Key words: Conflicts, Climate change, Drylands, Food security, Livelihood, Semi-arid zone.

EDITOR-IN-CHIEF
Prof. H. U. Nwanjo [Nigeria]

Introduction

The Inter-Governmental Panel on Climate Change (IPCC, 2014) opined that climate change could intensify resource conflicts and civil wars by aggravating poverty. The Pentagon warned that it could increase violent extremism around the world. A recent study revealed that the frequency of violent conflict across the globe could rise by as much as 50 percent by 2050. According to various accounts, Nigeria's long-running battle between farmers and cattle herders over access to land and water is increasingly becoming violent, and somehow playing out alongside the Boko Haram/ISWAP terror activities that has captivated the world since the group abducted more than 300 schoolgirls in Chibok Borno State, April 2014; and recently, May 15, 2026; 49 pupils and their teachers at Orire local government area, Oyo State. On the surface, the two identified conflicts, one centred on Islamic fundamentalism and the other around grass and water; which have both resulted in thousands of deaths over the past few years, appear unrelated. But a deeper look at the scenarios reveals that both conflicts have subterranean links to the collapse of the ecosystems, occasioned by climate change which is breeding poverty, desperation and frustration among the population in the semiarid environment of Nigeria. According to the International Crisis Group, fighting between Nigerian farmers and herders, variously assume ethnic, religious, and political dimensions, with. most of the conflicts stemming from access to land and water.

According to IPCC (2007) report, climate change would "prolong existing, and create new, poverty traps, the latter particularly in urban areas and emerging hotspots of hunger, thereby increasing risks of violent conflicts in the form of civil war and inter-group violence." Ironically, the IPCC has in the past identified [northern] Nigeria as a climate change "hot spot" that is more likely to see major shifts in weather; more heat, less rain; and therefore, increased desertification in the twenty-first century. This scenario according to a 2011 report for the U.S. Institute of Peace on Nigerian conflict, creates "economic, social, and psychic stresses" that contributes to violent unrest, especially around Nigeria's more-affected younger [and volatile] population. Universal evidence suggests that alienated young people lacking resources and economic opportunity are more likely to join rebellions. This position is effectively playing out in the study area, enabling the violent anti-establishment groups (Boko Haram/ISWAP) to easily entice and recruit rafts of jobless young men into the militia.

Thus, critical observations have been made to identify links between environmental degradation, poverty, hunger and violence. It is common knowledge that it was easy for Boko Haram, in the early stages of the insurgency, to recruit northern Nigerians because people are already aggrieved, hopeless and depressed because they are losing their source of livelihood to climate extremes. Accordingly, Climate change and intractable conflicts are currently the twin monsters tasking the economy and livelihoods of the study

EDITOR-IN-CHIEF
Prof. H. U. Nwanjo [Nigeria]

population. Notwithstanding, it would be incorrect to say Boko Haram specifically commits its crimes because of climate change (the Islam-oriented group's name translates to "Western education is sinful," a far cry from a climate-oriented motive) or that climate change is the sole reason why Boko Haram activities is becoming cancerous. There is no panacea for all that ails, neither is there a single explanation why countries, communities or households fall into food insecurity or vulnerability (Quadri, Silwal & Abdulsalam, (2022). Studies have shown that food insecurity could be due to a plethora of reasons; such as the political and socio-economic environment, food price volatility, poverty, corruption, conflicts, terrorism, balance of trade, production shortfall, government policies, natural/man-made disasters, level of education, population, household size, gender, asset preservation; and a host of others that are inter-twined and also became visible at different levels under this study.

Theoretical and Conceptual framework

To the extent that "Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life."; food security remains a significant challenge in the study area, and accordingly Nigeria, with several people facing hunger and malnutrition. In January 2023, the UN estimated that more than 25 million people in Nigeria were facing food insecurity, this is a 47% increase from the 17 million people who were already at risk of going hungry in the study area, mainly due to deteriorating conflicts, with a projected rise in food prices (SIPRI, 2023). Studies have shown overtime that food consumption scores are lower in drylands; proportion of underweight children is higher, vaccination rates and primary school enrolment figures are lower in dryland pastoral areas (Hussain et al., 2016; Cervigni and Morris, 2016; MEA, 2005).

This study is therefore conceptualised taking cognisance of the multiple challenges confronting dryland environments in order to holistically unearth the implications for household food security and livelihood under increasing temperature, epileptic rainfall pattern, persistent drought, intractable conflicts, and perpetual poverty in the semi-arid zone of Nigeria. Thus, the study is located within the Dryland Development Paradigm (DDP) framework and the Food systems concept. The DDP (Reynolds et al., 2007), (table 1), represents a key milestone in dryland science and development. It attempts to capture the functioning of dryland ecosystems and the livelihood systems of the dryland population, in a new synergistic framework that is commonly referred to as the ''dryland syndrome (DS)". Food system concept conveys the food pathway from ''field – to – fork", essentially warehousing the set of activities from production – processing – distribution – consumption. This also technically interphase with the concept of food security

EDITOR-IN-CHIEF
Prof. H. U. Nwanjo [Nigeria]

dimensions of availability, access, utilization, and vulnerability/stability. The performance of the food system determines whether or not food security is achieved.

Table 1: The concept of DDP/Dryland syndrome

Syndrome	Conceptual summary	Interpretation
Ds_1	High variability	Indicating areas where precipitation is scarce and typically unpredictable. High air temperature, low humidity and abundant solar radiation result in high potential evapotranspiration.
Ds_2	Low fertility	Many dryland soils contain small amount of organic matter and have low aggregate strength, with profound socio-economic implications for tillage and grazing.
Ds_3	Sparse population	Comparatively sparse population, particularly with increasing aridity index.
Ds_4	Remoteness	Drylands human population are usually more mobile and more remote from markets.
Ds_5	Distant voice	Drylands human population are usually distant from the centres and priorities of decision makers – marginalization.

Source: Adapted from Reynolds et al., (2007) and Lindsay C. Stringer et al., (2017).

Though Lindsay C. Stringer et al., (2017) came up with contemporary new DDP featuring eight characteristics that are integrated into three principles (unpacking, traversing and sharing); suffice it to say that Reynolds et al., (2007) pioneering efforts remain legendary and captures the essence of this study.

The study area

The study was conducted in three states of Nigeria (Borno, Katsina, and Sokoto) (appendix 1), in the semi-arid zone of the country where the effect of conflict and climate variables on the subject of study can easily be discerned (appendix 2). Spatial spread in this area is considered adequate for spatial explanation of the situation in non-observed locations.

Sampling technique

A multi-stage sampling technique was employed to select the households on which the survey instruments was administered. In the first and second stages, three states (Borno, Katsina and Sokoto) among the fifteen officially designated desertification frontline

EDITOR-IN-CHIEF
Prof. H. U. Nwanjo [Nigeria]

states of Nigeria (NBS, 2010); and three local government areas were purposively selected. In the third stage, communities were randomly selected from each local government area (LGA) from which households that were interviewed were identified in the final/fourth stage.

Sample Size

The significance of large sample size that is adequately reflective of the population for analysis and generalizations cannot be overstated. A confidence interval of 95% (which is conventionally acceptable) was used in the determination of sample size for the study.

Table 1: Population of states and estimated number of farming households

States	Population	Estimated number of Households
1. Katsina	5,801,584	580,158.4
2. Sokoto	3,702,626	370, 262.6
3. Borno	4,171,104	208, 555.2

Source: Nigerian Population Commission (NPC, 2006)

Using Dillman (2007) sample size formula, the sample size is calculated by taking 10 per cent of the population of Katsina and Sokoto farming households and 5 per cent of the (farming households') population for Borno.[1]

Therefore, given the formula:

$$Ns = \frac{N_p(p)(1-p)}{(N_p-1)(^B/_C)^2+p(1-p)}$$

Where:

Ns = completed sample size needed (notation often used is n)

Np = size of population (notation often used is N)

p = expected proportion of active respondents (50% or 0.5 is most conservative)

B = acceptable level of sampling error (0.05=±5%; 0.03=±3%)

C = Z statistic associated with confidence interval (1.96 or 95%)

Substituting the values of the total population and the significant level into the formula, the actual sample size for the study becomes:

$$N_p = 580{,}158.4 + 370{,}262.6 + 208{,}555.2$$

$$N_p = 1{,}158{,}976.2$$

1 The percentage is the researchers' intuition based on the massive population displacement due to insurgency. It has no scientific background.

EDITOR-IN-CHIEF
Prof. H. U. Nwanjo [Nigeria]

$$Ns = \frac{N_p(p)(1-p)}{(N_p-1)(^{B}/_{C})^2 + p(1-p)} = \frac{1,158,976.2(0.5)(0.5)}{(1,158,976.2-1)(^{0.05}/_{1.96})^2 + 0.5(0.5)} = 183.3$$

$$Ns = 183.3$$

Thus, the sample size randomly selected from each State is 183.3. Accordingly, the total sample, Ts, from the selected States becomes;

$$Ts = 183.3 \times 3$$

$$Ts = 549.9 \approx 550$$

Therefore, the total sample drawn across the three states is 550.

Empirical framework

It is generally acknowledged in econometrics literature that when outcome variables are ordinal rather than continuous, the ordered logit model, also known as proportional odds models (Ologit/po) is a common analytical tool. Notwithstanding, generalized ordered logit/ partial proportional odds models (Gologit/ppo) are often a superior alternative technique (Williams, 2016). Gologit/ppo model has the advantage of being less restrictive than the proportional odds model and more parsimonious than methods that ignore the ordering of categories altogether.

However, the use of Gologit has itself been problematic or at least sub-optimal. Researchers typically note that such models fit better but fails to explain why the ordered logit model was inadequate or substantive insights gained by using the Gologit alternative. To address this, gologit2 which is also a user-written program that estimates generalised ordered logit models for ordinal dependent variables was developed. In this case, the actual values taken by the dependent variable are irrelevant except that larger values are assumed to correspond to "higher" outcomes. Gologit2 offers several additional powerful options. A major strength of gologit2 is that it can also estimate three special cases of generalised model: the proportional odds/parallel lines model, the partial proportional odds model, and the logistic regression model. Hence, gologit2 can estimate models that are less restrictive than the proportional odds/parallel lines models estimated by Ologit (whose assumptions are usually violated), and more parsimonious and interpretable than those estimated by a non-ordinal technique, such as multinomial logistic regression (i.e. mlogit). Other key strengths of the gologit2 include options for linear constraints, alternative model parameterizations, automated model fitting, survey data estimation and alternative link functions.

Results and Discussion

Specific estimation was done using a simple simultaneous Ordered Logit Regression Model (OLRM) to assess the effect of conflict (proxy by the respondents perceived effect

EDITOR-IN-CHIEF
Prof. H. U. Nwanjo [Nigeria]

of conflicts ranked in five-ordered scale) as an independent variable and the four pillars of food security (food availability, food accessibility, food utilization and stability) as the respective four dependent variables. The combined outcome of the estimated results across the three states is presented in table 2 below, and appendix 3 – 5 for Borno, Katsina and Sokoto States respectively.

Assessing the outcome of results from appendix 3 across model 1-4 indicates that the general predictive power of the models is statistically significant at 1 per cent (p-value=0.0000), except model 3. The result therefore shows that conflict has negative and significant effect on food availability, food accessibility and food stability in Borno State. Indeed, the impact in terms of the magnitude is very severe (the size of the parameters). Considering conflict and food security parameters for instance, an increase in the prevalence of conflict by one per cent in Borno State, decreases food availability, food accessibility and food stability with about 76%, 55% and 88% per cent. Food security is an important indicator of livelihood status. Thus, it could be deduced that conflict has significant and high negative impact on food security across households within Borno State.

Findings from Katsina State presented on appendix 4, however reveals a different result from the overall results and that of Borno State. This is because, all the models (1,2 and 4) are statistically insignificant in terms of their respective predictive powers, except model 3 that is significant at 5 per cent (p-value=0.0203). That is, conflict has a 0.68 likelihood (probability) of reducing food utilization. The result of Sokoto State in appendix 5 is contrary to the *a priori* expectation that conflict and food security are negatively correlated. The four models are all statistically significant in terms of predictive strength and reliability. However, it shows that the impact of conflict on food availability, food accessibility and food stability are positively and statistical.ly significant. Only the regression coefficient of food utilization is consistent with the other findings of negative and significant relationship

Table 2: Estimated Results for the Effect of Conflict on Food Security from the Three States

Dependent variables:	**Food Availability Model 1**	**Food Accessibility Model 2**	**Food Utilization Model 3**	**Food Stability Model 4**
Independent variables				
Conflict	-0.5788^{***}	-0.3368^{***}	-0.4563^{***}	$-0.5493\ ***$
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
/cut 1	-3.4714	-4.0754	-5.2840	-4.1899
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
/cut 2	-2.2518	-1.7948	-4.4972	$-2.2592.$
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
/cut 3	-1.4882	-0.8138	-2.0407	-1.5873

EDITOR-IN-CHIEF
Prof. H. U. Nwanjo [Nigeria]

Dependent variables:	Food Availability Model 1	Food Accessibility Model 2	Food Utilization Model 3	Food Stability Model 4
	(0.0000)	(0.0000)	(0.000)	(0.0000)
/cut 4	0.5476 (0.0000)	1.0169 (0.0000)	2.6412 (0.0000)	.1298 (0.0000)
Number of Observations	626	626	626	626
Pseudo R^2	0.0325	0.0122	0.0212	0.0302
Log pseudo likelihood	−951.3595	−901.4375	−573.6935	−916.1629
Wald Chi²	73.37 [0.0000]	28.85 [0.0000]	24.41 [0.0000]	68.67 [0.0000]

Evidence from the estimated results from the four models in table 2 generally have good predictive powers at 1 percent level of significant (p-value = 0.0000) and the independent variables (perceived effect of conflict) is also statistically significant across all the models at 1 per cent (p-value=0.0000). In general terms, there is a negative and significant relationship between conflict and the four pillars of food security (food availability, food accessibility, food utilization and food stability).

Model 1 shows that an increase in the prevalence or frequency of conflict by 1 per cent, was perceived to have about 0.51 likelihood of decreasing food availability across all the three states. The result, in other words, means that conflict decreases households' food availability by 51% in the study area. Similarly, model 2 suggests that an increase in the scope of conflict by one per cent, would have 0.31 probability of decreasing households' food accessibility across the states under consideration. Likewise model 3 and model 4 suggest that an increase in the severity of conflict within the region, decrease food utilization and food stability with 45% and 15% respectively. In summary, the overall results reveal that there is a consistently negative and significant relationship between conflict and food security in the households within the study locations (Borno, Katsina and Sokoto States). Furthermore, to establish the relationship between conflict and climate drivers of food insecurity and livelihood shocks among households in the study area, a correlation analysis which shows both the direction and extent of relationships was conducted. Table 3 provides the result of the correlation analysis among the three variables of interest, climate change indicators (temperature, rainfall and drought), conflicts, and the level of household livelihood vulnerability.

Table 3: Correlation Result for All the Variables across the Three States

Variables	HHLV	RFL	DRT	TEMP	CFT
HHLV	1.000				
RFL	0.1785	1.000			
DRT	0.1945	0.7132	1.000		

EDITOR-IN-CHIEF
Prof. H. U. Nwanjo [Nigeria]

Variables	HHLV	RFL	DRT	TEMP	CFT
TEMP	0.0371	0.6585	0.6012	1.000	
CFT	-0.0009	0.1745	0.1566	0.1900	1.000

The result in table 3 shows that all the variables are positively correlated, with the exception of conflict which is negatively correlated with the extent of household vulnerability to the means of livelihood. This is also in conformity with the *a priori* expectation of the model which posits that conflict has adverse effect on household means of livelihood. Table 4 provides the summary statistics for the perceptions of households on how climate parameters (temperature, rainfall and drought) affect each of the food security pillars in their respective communities. The perceptions were measured using Likert scale from 1 to 5, with 1 = not vulnerable, 2 =fairly vulnerable, 3 = indifferent, 4 =vulnerable and 5 = highly vulnerable.

Table 4: Summary Statistics for Food Security and Climate Change Variables

	FAV	FAC	FUT	FST	TMP	RNF	DRT
	Result of Aggregated Data						
Mean	2.784	3.064	3.548	2.962	3.946	3.678	3.564
Std.Dev	1.338	1.111	0.701	1.237	0.926	0.936	0.955
Min	1	1	1	1	1	1	1
Max	5	5	5	5	5	5	5
Obs	625	626	626	626	626	626	626
	Result for Borno State						
Mean	2.456	2.911	3.388	2.685	4.111	3.887	3.750
Std.Dev	1.417	1.157	0.797	1.283	1.007	0.961	0.950
Min	1	1	1	1	1	1	1
Max	5	5	5	5	5	5	5
Obs	384	384	384	384	384	384	384
	Result for Katsina State						
Mean	3.390	3.340	3.740	3.360	0.530	0.550	0.860
Std.Dev	0.909	0.831	0.441	0.927	0.502	0.500	0.349
Min	2	2	2	2	0	0	0
Max	5	5	5	5	1	1	1
Obs	100	100	100	100	100	100	100
	Result for Sokoto State						
Mean	3.241	3.275	3.831	3.373	3.965	3.500	3.380
Std.Dev	1.068	1.079	0.376	1.102	0.588	0.769	0.905
Min	1	1	1	2	2	2	1

EDITOR-IN-CHIEF
Prof. H. U. Nwanjo [Nigeria]

	FAV	FAC	FUT	FST	TMP	RNF	DRT
Max	5	5	5	5	5	5	5
Obs	141	142	142	142	142	142	142

Note: FAV, FAC, FUT, FST, TMP, RNF and DRT stand for food availability, food accessibility, food utilization, food stability, temperature, rainfall and drought respectively. Mean is the average value, Std.Dev is the standard deviation, min is the minimum value, max is the maximum value and Obs is the observations.

Based on the result in table 4, the average perception of households regarding the effect of temperature, rainfall and drought on food availability, accessibility, utilization and stability is approximately 4.0 suggesting that food security is vulnerable to climate variability and accordingly to livelihood shocks in the three sample states combined. And as indicated by the small values of the standard deviation of approximately 1.0 associated with the perceptions on the climate change variables, the responses of the households do not show deviation from the mean. In other words, there is no big variation among the perceptions of the households regarding the vulnerability of food security to climate change in the study area.

The estimated results for the aggregated data on the three sample states combined are presented in tables 5 and 6. It is important to note that the vulnerability scale for 'highly vulnerable' (HV) is missing in table 5. This was done deliberately and automatically by the Stata Software as this vulnerability scale was used as base outcome.

Table 5: Regression Result of the impact of Climate Change on Household Food Security in the three States combined

	(1) FAV	(2) FAC	(3) FUT	(4) FST
Not vulnerable				
Temperature	0.171	0.0373	0.674	0.404**
	(1.51)	(0.21)	(0.97)	(3.29)
Rainfall	0.0976	0.582	-0.0435	0.222
	(0.66)	(1.93)	(-0.13)	(1.34)
Drought	0.0610	-0.0774	-0.424	0.124
	(0.48)	(-0.31)	(-0.53)	(0.72)
Constant	0.0347	0.866	2.771**	-0.627
	(0.07)	(1.06)	(2.62)	(-1.17)
Fairly Vulnerable				
Temperature	-0.374***	-0.850***	0.794***	-0.549***
	(-3.33)	(-6.80)	(3.40)	(-4.49)

EDITOR-IN-CHIEF
Prof. H. U. Nwanjo [Nigeria]

	(1) FAV	(2) FAC	(3) FUT	(4) FST
Rainfall	0.242	0.441**	-0.437	0.317*
	(1.91)	(3.08)	(-1.24)	(2.38)
Drought	0.316**	0.375**	-0.285	0.350**
	(2.71)	(2.82)	(-1.17)	(2.87)
Constant	-0.392	0.971**	2.466**	0.0137
	(-0.98)	(2.84)	(3.25)	(0.04)
Indifferent				
Temperature	-0.453***	-0.682***	0.333**	-0.345**
	(-3.72)	(-5.46)	(2.80)	(-2.66)
Rainfall	0.310*	0.425**	-0.039	0.228
	(2.33)	(3.11)	(-0.29)	(1.60)
Drought	0.508***	0.438**	0.0779	0.502***
	(4.00)	(3.17)	(0.61)	(3.96)
Constant	-1.773***	-0.887**	-0.975*	-1.669***
	(-4.41)	(-2.58)	(-2.56)	(-4.68)
Vulnerable				
Temperature	0.259	-0.151	0.198	-0.006
	(1.15)	(-0.64)	(0.35)	(-0.03)
Rainfall	0.608*	0.165	0.662	0.459
	(2.54)	(0.57)	(1.63)	(1.77)
Drought	0.454*	1.049***	-0.0861	0.545*
	(2.15)	(3.51)	(-0.17)	(2.30)
Constant	-7.352***	-6.382***	-7.228*	-5.948***
	(-8.69)	(-8.55)	(-2.27)	(-8.29)
Observations	623	624	624	624

Food security (impact of temperature, rainfall and drought on vulnerability scale)

The result in table 6 provides the summary of the overall impact of temperature, rainfall and drought on household food vulnerability in the three combined sample states based on the general performance indicators of the entire models.

Table 6: Overall Performance Indicators of the Estimated Parameters in Table5

	FAV	FAC	FUT	FST
Log Pseudo Likelihood	-925.752	-852.425	-570.416	-881.163
Wald χ^2 (Chi-square)	121.730	107.210	32.110	143.190
Prob of χ^2	0.000	0.000	0.001	0.000

EDITOR-IN-CHIEF
Prof. H. U. Nwanjo [Nigeria]

	FAV	FAC	FUT	FST
Pseudo R^2	0.055	0.062	0.024	0.063
Observations	623	624	624	624

The result in table 6 shows the overall performance of the regression estimated models in table5 based on the log pseudo likelihood, chi-square and the pseudo-R-squared values. These parameters can be used to examine the joint significance of the temperature, rainfall and drought on the vulnerability of households to food insecurity. The Wald (chi-square) indicates that the climate change variables, namely temperature, rainfall and drought have statistically significant impact on food security in the three sample states for all the models. This is supported by the high values of the chi-square tests and the very low probability values (0.000 in almost all the models) associated with the chi-square. The p-values indicate that temperature, rainfall and drought for all the vulnerability scales have strong significant impact on food security at 1 percent level of significance. Although, the pseudo-R-squared is of little importance in this case, it can be observed from table 6 that about 2 to 6 percent of the variations in household food security vulnerability are explained by the temperature, rainfall and drought for the three combined sample states.

Conclusion and recommendations

Against the backdrop of the fact that, drylands, typical of the study area are increasingly being described as the hotspots of conflicts, climate change, poverty, and food insecurity; it is becoming an imperative to characterise current and projected challenges of dryland environments, with a view to identifying the limitations of current livelihoods with respect to intractable conflicts and climate change, and galvanise efforts to reduce vulnerability and increase resilience of the dryland population.

Given the high-level banditry and the intractable insurgency in the study area, coupled with the unprecedented weather extremes that rocked the country in 2022, the study concludes that the probabilities of a persistent food system disruption, and accordingly livelihood shock, will be higher than usual through the next three years, up to 2026. Results showed that conflict decreases households' food availability by 51% in the study area. This is validated by the ongoing (Boko Haram/ISWAP) insurgency in the region; and according to Pingali et al., (2005) "per capita agricultural and food production are 10% lower during a conflict [insurgency, instability, terrorism, and politically motivated violence] and in the 5 years following it, than in the 5 years prior to the conflict". The implication of this with respect to the study area is grave as par food and nutrition security and livelihood vulnerability. Solutions must necessarily be comprehensive and multisectoral in design and delivery, to effectively tackle the monster of hunger/food insecurity occasioned by climate and conflicts in the region of concern.

EDITOR-IN-CHIEF
Prof. H. U. Nwanjo [Nigeria]

Thus, in consideration of the study findings, and the dire need for peace, physical, social, food and nutrition security, and livelihood stability of the dryland population of the study area; the study recommend as follows:

1. Making realistic efforts at ensuring the institutionalization of responsible and responsive governance (by the political class) as canvassed by advanced democracies of the world. Food insecurity and its consequences are most prominent in conflict- and disaster-affected population. An estimated 82 percent of the record 149 million Africans facing acute food insecurity are in conflict-affected countries, underscoring the fact that conflict continues to be the primary driver of Africa's food crisis (SIPRI, 2023).
2. Promotion of socioeconomic programmes (by Government and NGOs) to build confidence and mutual trust in the population, as a useful strategy towards checkmating conflicts and nipping potential criminality, violence, and/or insurgency in the bud.
3. Ensuring a peaceful environment and physical security, by government, for farmers to productively engage on the farm, given that this study elicited that conflict reduces food availability in the study area by 51%. Citizens' safety and security being the first and foremost responsibility of government.
4. The young population and women should be properly and effectively engaged by government at all levels, with a clear trajectory for their livelihood options and pathway. Universal evidence suggests that alienated young people lacking resources and economic opportunity are more likely to join rebellions.
5. Conscious and systematic use of social protection but market driven schemes (by government, private and non-government actors) to build capacity of vulnerable households enabling them to crawl out of poverty.
6. Strengthening and expanding the coverage of adaptive socioeconomic safety net program. Safety nets (by policy makers) against food price volatility, and other forms of food shocks for vulnerable households which can be made revolving without hiccups (easy to access by poor households and devoid of political underpins) is germane to a permanent resolution of the problem.
7. The identified socio-economic gap in this respect is the lack of sectoral safety net for fishermen, cow herders, and farmers who can no longer live on barren (degraded) land. Among these group for example, crop failure as a result of climate hazards most often translates to starvation.

Acknowledgement

The research was conducted with partial funding support from the Centre for Dryland Agriculture (CDA), World Bank supported African Centre of Excellence, Bayero University Kano (BUK).

EDITOR-IN-CHIEF
Prof. H. U. Nwanjo [Nigeria]

Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Cervigni, R and Morris, M. (2016). (Eds.) Confronting drought in Africa's drylands: Opportunities for enhancing resilience. Africa Development forum series. Washington, DC: World Bank. ISBN 978 – 1 4648 – 0818 – 0

DFID. (2009). Impact of climate change on Nigeria's economy.

Dillman, D. A. (2007). Mail and internet surveys: The tailored design method (2007 update with new internet, visual, and mixed-mode guide), 2nd edn. New York: John Wiley.

Hussain, A; Resul, G; Mahapatra, B; and Tuladher, S. (2016). Household food security in the face of climate change in the Hindu-Kush Himalayan region. Food secur.. 2016, 8, 921 – 937.

Intergovernmental Panel on Climate Change (IPCC) (2022). Climate Change 2022: Impacts, Adaptation and Vulnerabilityhttps://www.ipcc.ch/report/ar6/wg2/

Intergovernmental Panel on Climate Change (IPCC). (1994). Climate Change: The IPCC Scientific Assessment. Cambridge University Press, Cambridge, UK, pp365.

Intergovernmental Panel on Climate Change (IPCC). (2007). Summary for policymakers. In: Parry, M. L; Canziani, O. F; Palutikof, J. P; Van der Linden, P. J; Hanson, C. E. (Eds) Climate change 2007: impacts, adaptation and vulnerability. *Contribution of working group II to the fourth assessment report of the intergovernmental panel on climate change. Cambridge University Press, Cambridge, pp 7*

Intergovernmental Panel on Climate Change (IPCC). (2014). Climate change 2014: impacts, adaptation and vulnerability: summary for policymakers. Cambridge University Press, Cambridgehttps://www.ipcc.ch/

Millennium Ecosystem Assessment. (MEA). (2005). Ecosystems and human well-being: desertification synthesis. *World Resources Institute, Washington, DC.*

National Bureau of Statistics (NBS). (2010). Annual abstract of statistics 2010. pp. 4

Pingali, P., Alinovi, L., and Sutton, J. (2005). Food security in complex emergencies: enhancing food system resilience. *Disasters 29(Suppl. 1):S5–24*

Quadri, S; Silwal, P; and Abdulsalam, N. (2022): Famine and starvation in drylands Africa: the paradox of persistence and the violation of universal rights. Journal of Renewable Agricultural Tech. Research (JRATR) Vol. 26, No.1, ISSN 2813 – 9650 - Harvard publications and International Journal – conference proceedings vol.21, No. 3. 31st October 2022. https://www.cambridgenigeriapub.com/category/journals/ssaa

Reynolds, J. F; Smith, D. M; Lambin, E. F; Turner II, B. L; Mortimore, M; Simon, P. J; Batterbury, T; Downing, E; Dowlatabadi, H; Fernández, R. J; Herrick, J. E; Huber-Sannwald, E; Jiang, H; Leemans, R; Lynam, T; Maestre, F. T; Ayarza, M;and Walker, B. (2007). Global desertification: building a science for dryland development www.sciencemag.org*SCIENCE vol. 316. 11 May 2007*

SIPRI (2023). Stockholm International Peace Research Institute Year book. 2023 October. https://www.sipri.org/yearbook/2023

Stringer, L. C., Akhtar-Schuster, M., Erlewein, A., Metternicht, G., Minelli, S., Safriel, U., & Sommer, S. (2017). Unpacking the concept of land degradation neutrality and addressing its operation through the Rio Conventions. *Journal of environmental management*, *195*, 4-15.

William (2006). Generalized ordered logit/partial proportional odds models for ordinal dependent variables. The Stata Journal (2006) 6, Number 1, pp. 58–82.

Appendices

Appendix 1

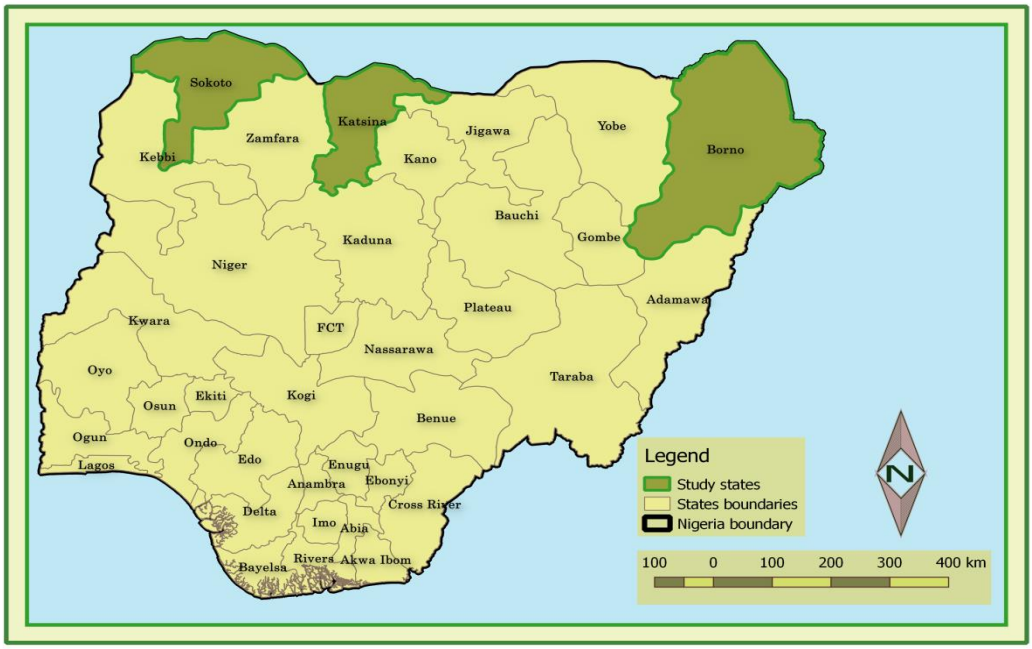

Figure 1: Map of Nigeria showing study area (Sample States)

Appendix 2

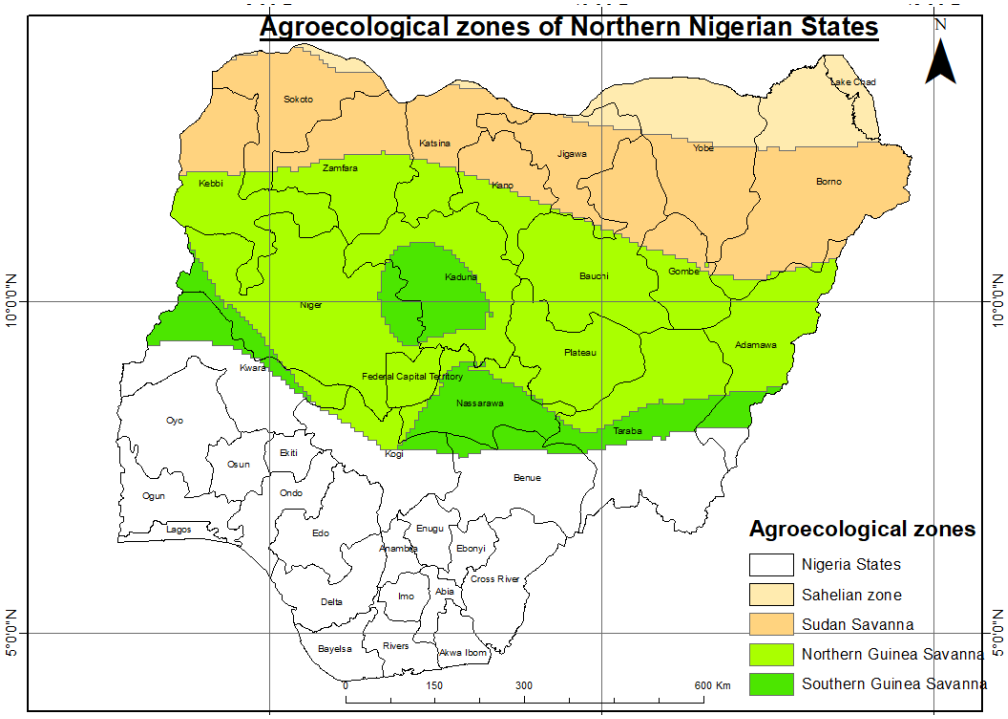

Figure 2: Agro ecological zones of Northern Nigeria showing the study area (semi-arid/Sudan savanna zone). Source: International Crop Research Institute for the Semi-Arid Tropics (ICRISAT), Kano, Nigeria.

Appendix 3: Estimated Results for the Effect of Conflict on Food Security for Borno State

EDITOR-IN-CHIEF
Prof. H. U. Nwanjo [Nigeria]

Dependent variables:	Food Availability Model 1	Food Accessibility Model 2	Food Utilization Model 3	Food Stability Model 4
Independent variables				
Conflict	−0.7653***	−0.5593***	−0.1159	−0.8814 ***
	(0.0000)	(0.0000)	(0.3730)	(0.0000)
/cut 1	−3.8732	−4.9255	−3.6383	−5.3196
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
/cut 2	−2.8475	−2.6654	−2.8254.	−3.4966.
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
/cut 3	−2.1749	−1.5862	−.46021	−2.9008
	(0.0000)	(0.0000)	(0.000)	(0.0000)
/cut 4	−1.1149.	−.5725	3.1361	−1.3447.
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Number of Observations	384	384	384	384
Pseudo R^2	0.0352	0.0196	0.0010	0.0461
Log pseudo likelihood	−564.4805	−565.2091	−418.5598	−552.3048
Wald Chi²	42.20	24.41	0.80	55.06
	[0.0000]	[0.0000]	[0.5721]	[0.0000]

Appendix 4: Estimated Results for the Effect of Conflict on Food Security for Katsina State

Dependent variables:	Food Availability Model 1	Food Accessibility Model 2	Food Utilization Model 3	Food Stability Model 4
Independent variables				
Conflict	−0.1044	−0.1255	−.6781	0.0152
	(0.5810)	(0.4850)	(0.020)	(0.9350)
/cut 1	−1.6035	−1.6592	−3.0920	−1.4098
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
/cut 2	−0.4331	−0.4489	.	−.1606.
	(0.0000)	(0.0000)		(0.0000)
/cut 3	2.3132.	3.1460		2.4835
	(0.0000)	(0.0000)		(0.0000)
Observations	100	100	100	100
Pseudo R^2	0.0012	0.0018	0.0587	0.0000
Log pseudo likelihood	−121.3874	−112.7686	−51.8757	−122.2667
Wald Chi²	0.30	0.48	5.38	0.01
	[0.5814]	[0.4893]	[0.0203]	[0.9351]

Appendix 5: Estimated Results for the Effect of Conflict on Food Security for Sokoto State

Dependent variables:	Food Availability Model 1	Food Accessibility Model 2	Food Utilization Model 3	Food Stability Model 4
Independent variables				
Conflict	1.1903***	0.8799***	−1.0363**	1.1406***
	(0.0000)	(0.0000)	(0.0040)	(0.0000)
/cut 1	−0.1589	−1.4806	−3.0920	2.8416.
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
/cut 2	3.9812	2.1238		3.5882
	(0.0000)	(0.0000)		(0.0000)
/cut 3	6.1826.	2.8704		
	(0.0000)	(0.0000)		
/cut 4		5.0222		

EDITOR-IN-CHIEF
Prof. H. U. Nwanjo [Nigeria]

Dependent variables:	**Food Availability**	**Food Accessibility**	**Food Utilization**	**Food Stability**
	Model 1	**Model 2**	**Model 3**	**Model 4**
		(ooooo)		
Number of Observations	141	142	142	142
Pseudo R^2	0.0607	0.0365	0.0622	0.0588
Log pseudo likelihood	−183.6321	−184.2239	−60.5017	−177.3537
Wald Chi²	23.76	15.27	8.43	20.64
	[0.0000]	[0.0001]	[0.0037]	[0.0000]

EDITOR-IN-CHIEF
Prof. H. U. Nwanjo [Nigeria]