



Spatial Analysis of the Impacts of Crop Farmers and Cattle Herders Conflicts on Community Development in Adamawa State, Nigeria

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Authors' contributions

This work was carried out in collaboration between both authors. Author SB designed the study, performed the statistical analysis and wrote the protocol. Author CHW wrote the first draft of the manuscript, managed the analyses of the study and the literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

The constant conflicts between crop farmers and cattle herders over the years in the Sahel savanna region, particularly the Northeast geopolitical region of Nigeria has been a recurring issue claiming several lives and properties without any holistic approach by the government to ameliorate or solve the problem. In contemporary times, the conflict has assumed a dangerous dimension and therefore, requires urgent measures to curb the menace. It is against this background that this study seeks to investigate the impacts of crop farmers' and cattle herders' conflict on community development in Adamawa State, Nigeria. Three (3) Local Government Areas (LGA) in the state were purposively selected from the 3 senatorial zones in the state. This was followed by the selection of 21 crop farmers and 21 cattle herders from each of the 3 LGAs through purposive and random sampling techniques to obtain a sample size of 126 respondents. Data were gathered with the aid of structured questionnaires and structured interview schedules. Focus Group Discussion (FGD) was also conducted with separate groups of cattle herders and crop farmers. Descriptive statistics (mean, frequency counts, percentages) were used to describe the

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personal characteristics of crop farmers and cattle herders, inferential statistics (Logit regression, chi-square) were used to determine the factors responsible for the cause of conflict and the relationship between the conflict and community development indices in the study area. Results from the findings shows that majority of the crop farmers and cattle herders are male, the perceived causes of the conflicts include encroachment of grazing reserve by farmers, the encroachment of stock route by farmers, grazing of crops by the herders and non-accessibility to water points by the two groups. The study further revealed major impacts of these conflicts to include loss of human lives and reduced household income, reduced access to agricultural land and destruction of infrastructural facilities. The conflict resolution strategies adopted includes but not limited to reactivation of existing grazing reserves, sensitization of conflicting parties by community leaders and amendment of laws on grazing reserves. Finally, the study further linked these constant conflicts to the very poor community development in Adamawa State. The study recommended formal education for both farmers and herders, sensitization of the crop farmers and cattle herders by the government and community leaders on the need for both groups to coexist and implementation of the existing laws on grazing reserves and land use policies by the government.

Keywords: Adamawa; cattle herders; community development; conflicts; crop farmers.

1. INTRODUCTION

Today, conflict is perceived in almost all parts of the world. From Europe to America, Africa to Asia, conflicts are common phenomena [1,2]. Conflict has been defined in different ways by different scholars. For instance, Robert and Jeanette [3] defined conflicts as the division among people over class, religious, language or gender issues to mention a few. It is a struggle that grows out of the interplay of two opposing forces in plot or actions. Ekong [4] also defined conflict as that form of social interaction in which the actors seek to obtain scarce reward by eliminating or weakening their contenders.

Nigeria has experienced and still experiencing conflicts of grave proportions among several ethnic and religious communities across the states. These conflicts significantly vary in dimension, process and the groups involved. It was observed by Momale [5] that, while some conflicts arise between the same source user group such as between one farming community and another, others occur between different user groups such as between herders and farmers or between foresters and farmers. Adisa [6] observed that the farmers and herdsman conflict has remained the most preponderant resource-use conflict in Nigeria. According to Abbas [7], a study of major sources of conflict between Fulani herdsman and farmers shows that land-related issues, especially on grazing fields, account for the highest percentage of the conflict. In other words, struggles over the control of economically viable land cause more tensions and violent conflict among communities.

Social and economic factors continue to provoke violent conflicts among Fulani herdsman and farmers. The intensity and variations of the conflicts largely depend on the native and type of the user groups where the pastoralists graze. These conflicts have constituted serious threats to the means of survival and livelihood of both the farmers and pastoralists and also the development of the communities affected. The conflict (though provocative) over access rights to farmland and cattle routes have become ubiquitous and seems to have defied solutions [7]. However, Coser [8] has noted that the inevitability of conflicts in the claim for source resources is considered here as the bane for the struggle over the inestimable value for land and its resources, with the claim for ownership and the claim for its position as a common resource. Nevertheless, the complex land-use system that has changed markedly over time has culminated in the present-day tension and conflict between Fulani herdsman and host communities.

Historical tensions between Nigeria's pastoralist Fulani and settled indigenous crop farmers have intensified in recent years, with dwindling natural resources and land availability greatly contributing to the ongoing, escalating conflicts in the century [9]. Berger [10] considered that pastures, moody vegetation, water resources, and land are taken as a common property resource. The increasing number of reports of violence at this occupational boundary makes understanding cattle herder-crop farmer, conflicts an urgent task. We need to know not just why friction began, but also why and how; as some

conflicts unfold, they articulate with religious, ethics, and political conditions [11]. Competition-driven conflicts between arable crops farmers and cattle herdsmen have become a common occurrence in many parts of Nigeria [12]. The competition between these two agricultural land user-groups has oftentimes turned into serious overt and covert hostilities and social friction in many parts of Nigeria [6]. Cases of herders-farmers conflicts are widespread in recent times. Nweze [13] also state that many farmers and herders have lost their lives and herds while others have experienced dwindling productivity in their herds.

In most of the encounters, citizens are regularly killed and the destruction or loss of properties leaves an already endangered populace even poorer. The frequency and scale of these communal conflicts have become alarming [14]. The dimension of militancy in the conflicts is associated with the advent of the aggressive Udawa and Bokologi pastoralists of guns and other sophisticated weapons in the conflicts as well as the use of mobile phones, accompanied by banditry. All these have produced adverse consequences in the destruction of villages, settlements, crops, irrigation facilities, human and animal lives. The incidence of serious cases of conflicts for survival between pastoralists and farmers also led to the loss of lives and destruction of properties with the emergence of insecurity due to the continuous desire for vengeance by the parties involved [15].

The rate of the incessant conflicts between Fulani herdsmen and crop farmers made the Local, State and the Federal Government of Nigeria to employ different mechanisms in order to end the menace. For instance, the Federal Government of Nigeria has commenced the construction of grazing reserves and has clearly delineated stock routes covering 1,000,000 hectares in Numan Local Government Area (LGA) of Adamawa state [16]. The Federal Government of Nigeria also came up with another strategy called RUGA to curb the menace. The RUGA policy (human settlement policy) is a controversial policy in Nigeria, introduced by the government of President Mohamadu Buhari, aimed at resolving the conflict between nomadic Fulani herdsmen and crop farmers. The policy, which is currently suspended, was expected to "create reserved communities where herders will live, grow and tend their cattle, produce milk and undertake other activities associated with the cattle

business without having to move around in search of grazing land for their cows. Similarly, Tonah [17] opined that farmer-herder differences are not only seen as resource conflict but are also sometimes represented as an ethnic conflict involving the two groups. Since herder and farmer groups have very different values, customs, physical and cultural characteristics, disputes between them are frequently characterized as ethnic conflict. According to the 2009 official report of the Federal Ministry of Agriculture and Water Resources, Nigeria has officially demarcated 4,125 grazing reserves or routes. Out of this number, only one third is put in use, whereas 270 grazing reserves have been put into cultivation. In order to curb crop farmers-herdsman clashes, the Federal Government in September 2009 carried out demarcation of a grazing routes running through the central state of Nasarawa, Benue, and Plateau. Other grazing routes also marked out and demarcated were started across Katsina and Bauchi states, spanning across Abuja. Further grazing routes were also demarcated from Sokoto in the Northwest to Oyo state in the Southwest as well as another 2,000 km grazing routes from Adamawa state in the Northeast to Calabar in the Niger Delta. All these were done to strengthen the relationship between farmer and herdsman, but the relationship keeps on degenerating. The question not yet answered is "why have all these efforts and resources not produced the desired result?"

This menace is known because few researchers have carried out studies on herdsman and farmers conflicts in the Northeast, Northwest and Northcentral geopolitical regions of Nigeria, but not without some research gaps. Not much has been written on these conflicts in Adamawa state as more are journalistic reports of the happenings in the region. Even with the few researches, none has been able to comprehensively explain and differentiate between what used to be a clash between the farmers and herders, and the gruesome attacks the people are experiencing by the Fulani and also the impact of the conflict on community development. This is the gap that this present research seeks to fill.

The study is restricted to the impacts of crop farmers' and cattle herders' conflicts on community development of some selected LGAs in Adamawa State. These LGAs include Madagali, Numan, and Gerie LGAs (Fig. 1). The community development indicators as high-

lighted in Emeh et al. [18] are access to basic welfare facilities and services like potable water, modern health care facilities, educational facilities, regular electricity supply, roads, and business-opportunities.

1.1 Research Objectives and Hypothesis

In order to achieve the aim of this study, the following objectives were rigorously pursued:

1. Examine the socio-economic conditions of the respondents in the study area.
2. Identify the contributing factors to the insecurity that impeded human development in Adamawa state.
3. Investigate the strategies adopted to ameliorate the impact of the conflicts in the study area.
4. Examine the overall impact of farmers-herdsmen conflict on community development in Adamawa state.

The null hypothesis formulated for this study states that:

No: There is no significant factor responsible for the conflict between crop farmers and cattle herders in Adamawa State, Nigeria.

1.2 Study Area

The study is carried out in Adamawa State, North-eastern Nigeria, located between latitude 7° and 11°N and between longitude 11° and 14°E. Adamawa State was chosen because of the recurring crop farmers and cattle herders conflict which has retarded community development in the state. The state is made up of 21 LGAs. It has a total land area of about 36,917 km² [19]. It shares a boundary with Taraba state in the south and West, Gombe state in its North-west and Borno state to the North. The state has an international boundary with the Cameroon Republic along its eastern side.

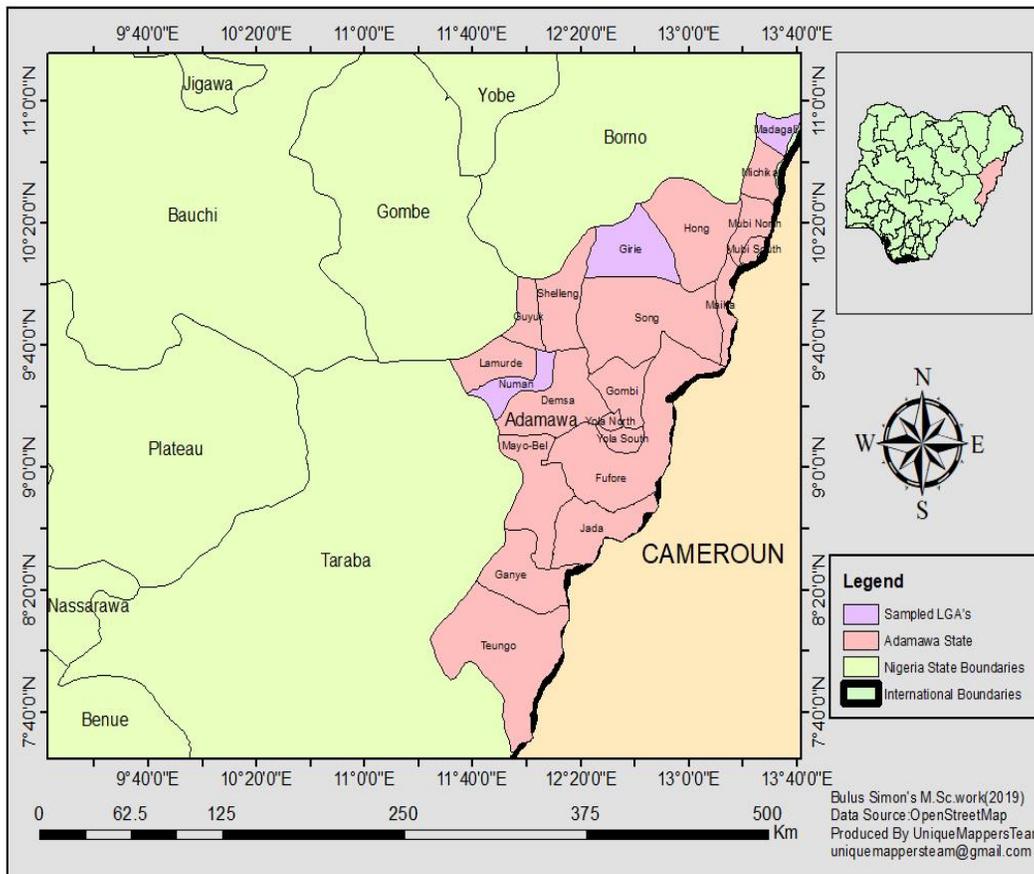


Fig. 1. Adamawa State showing the study areas

Adamawa state has a typical wet season which spans between April to October. Mean annual rainfall in the state ranges from 700 mm in the North-west to 1600 mm in the extreme southern part of the state [19]. The state is naturally divided into two ecological zones, the Guinea and Sudan savannah zones. In general, the distribution of vegetation reflects the combined control of rainfall, topography and to a lesser extent that of soil.

The Adamawa is sometimes dubbed the “water tower” of Cameroon since a large number of the country’s Rivers rise in the area. All of these falls into a tropical regime, with a period of high water from May to September during the rainy season, and a period of low water or even complete dryness from October to April. Some of these are subject to seasonal flooding as well.

2. RESEARCH METHODOLOGY

The study which is purely a survey research utilized the two most popular data collection methods, i.e. structured schedule interviews and the use of questionnaires. The primary data were generated with the use of structured questionnaires and structured schedule interviews designed to accommodate necessary variables that constituted the impact of conflicts on development. Focus Group Discussion (FGD) was also conducted with separate groups of cattle herders and crop farmers in the study area. The secondary data were obtained from Adamawa Agricultural Development Programme (AADP) and other methods like preview journals.

The target population of the study comprises all the farmers and pastoralists in Adamawa State who operate in conflicts prone areas and have experienced conflicts at one time or the other. Local Government Areas with perennials farmers-pastoralists conflicts at one time or the other are Gerie, Gombi, Maiha, Madagali, Mubi South, Mubi North, Hong, Michika, Numan and Song LGAs. Out of these ten LGAs with perennials farmers-pastoralists conflicts, three LGAs (Numan, Gerie, Madagali) were purposely selected because of the frequency of occurrence and fresh report of crop farmers-pastoralists conflict. These 3 LGAs represent thirty percent (30%) of the LGAs with perennials conflict between crop farmers and cattle herders. Also, they represent three senatorial zones in the state, Madagali from the North, Gerie in the central and Numan from the south.

List of Registered crop farmers from these selected LGAs were obtained from Adamawa Agricultural Development Programme as shown in Table 1.

Six hundred and thirty-six crop farmers were obtained from Adamawa Agricultural Development Programme (AADP), 10% was used for the study. In the case of cattle herders, 63 were randomly selected from the sampled LGAs as clearly explained in the sampling techniques and sample size. Multi-stage sampling was used to select the respondents for the study.

The data were analyzed using SPSS (Statistical Package for Social Science) computer package and descriptive statistics of frequency counts and

Table 1. Registered crop farmers

S/N	Senatorial zones	LGAs.	Registered farmers
1.	North	Madagali	213
2.	South	Numan	212
3.	Central	Gerie	211
Total			636

Source: AADP, 2019

Table 2. Showing sample size of respondents

S/N	Senatorial zones	Selected LGAs.	Sampling frame for crop farmers	Sampling frame for herders	Sample size for crop farmers	Sample size for herders	Sample size for respondents
1.	North	Madagali	213	193	21	21	42
2.	South	Numan	212	208	21	21	42
3.	Central	Gerie	211	199	21	21	42
Total			636	600	63	63	126

percentage, mean, standard deviation and charts while the hypothesis was tested using inferential statistics (Logit Regression Analysis) at 0.05 level of significance. The Logit Regression Model is well suited for studying the degree of relationship between a categorical or qualitative outcome, variable and one or more predictor variables. In the simplest case of one predictor x and one dichotomous outcome variable y , the logistic model predicts the logit or y from x . the logit is the natural logarithm (\ln) of odds or y (Gujarati, 2004). The logit regression model is explicitly specified.

$$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 +$$

$$\beta_7 x_7 + \beta_8 x_8 + \beta_9 x_9 + \beta_{10} x_{10} \quad (1)$$

Where,

Y = Interpersonal conflict (any conflict mentioned = 1; otherwise 0)

X_1 = Encroachment of grazing reserve.

X_2 = Grazing of crops and crop residues (crop change)

X_3 = Destruction of water source

X_4 = Burning of rangeland

X_5 = Inadequate water point

X_6 = Inadequate grazing reserves

X_7 = encroachment of stock route

X_8 = change in climate condition

X_9 = inadequate pasture

X_{10} = cattle thief and killing

β_0 = constraint

$\beta_1 - \beta_{10}$ = regression coefficients

u = error term

3. RESULTS AND DISCUSSION

This section shows findings, relevant discussion and comparison of findings. The results/findings were presented under various theme namely, socio-economic characteristic of the respondents, the cause of the conflict, the impact of conflict to the state, institutions responsible for provisions of basic service during times of conflicts, rating of basic services by sector, respondents' main food crops cultivated and the size of land planted per season, identification of basic facilities (Educational and Health) present in different communities, the state of infrastructure and ways on how farmers-pastoralists conflict affect household where applicable. These themes were further divided into sub-themes in order to make the presentation of the data in a sequential and logical manner.

3.1 Socio-economic Characteristic of Crop Farmers and Cattle Herders

3.1.1 Age

The result of the analysis in Table 3 shows that the majority of the respondents were within the age range of 40-49 years for crop farmers (42.9%) and 30-39 years for the herdsman (41.3%) respectively.

It could, therefore, be inferred that both farming and cattle herding is predominately carried out by middle-aged people within the range of 30-50 years who are energetic, more productive in the economic sector and more prone to conflict. These findings agreed with several authors [20,21]. The mean age of the farmers was 41. Among the herdsman, the mean age was 37 years. All these, perhaps, show that cattle herding attracts more of youth than farming.

3.1.2 Sex

The result of the analysis in Table 3 also indicate that 59 crop farmers representing 93.7% of the sampled crop farmers are male and only 4 representing 6.3% are female. In the case of the herders, all of them (63 respondents) representing 100% of the sampled herders are males. This result was consistent with the findings by Aliyu [22] that all respondent herdsman were males. As evident from the findings, both crop farming, and cattle herding seems to be male-dominated business in the survey area.

This may likely have resulted from the cultural barrier imposed on women as it is being practiced in most parts of the core North where women are restricted from taking certain occupations that are basically considered as male business. By implication, the tendency to be involved in conflicts is greater in males who are more energetic and therefore regarded as the protector of every village.

3.1.3 Educational level

Table 3 further shows that farmers (80.9%) were far ahead of the herdsman (34.9%) in terms of formal education. The majority (65.1%) of cattle herders interviewed had no formal education at all, while only 9.5% of the farmers have exceeded the primary level and 1.6% from the herders only. About 3.2% of the farmers have attended tertiary education which was very

successful in family business according to them, also 47.6% of the farmers have attended adult class, while 30.1% attended primary and secondary education. In the case of the herders, 17.4% have attended adult education classes, while 15.9% attended primary education.

Delta State, educated people are more likely to bring a better understanding of issues than uneducated people. An educated person may likely be more open to dialogue during the conflict.

3.1.4 Ethnic group

According to Ofuoku and Isife [23] in their research findings on the farmer-herder conflict in

The result of the analysis in Table 3 reveals that the respondents selected from the three LGAs

Table 3. Distribution of respondents according to socioeconomic characteristics

Variables	Crop farmers (n=63)		Herders (n=63)	
	Frequency	Percentage %	Frequency	Percentage %
Age (yrs)				
20 – 29	7	11.1	16	25.4
30 – 39	20	31.7	26	41.3
40 – 49	27	42.9	10	15.9
50 – 59	5	7.9	6	9.5
760	4	6.4	5	7.9
Sex				
Male	59	93.7	63	100
Female	4	6.3	4	
Educational level				
Qur'anic	12	19.1	41	65.1
Adult	30	47.6	11	17.4
Primary	15	23.8	10	15.9
Secondary	4	6.3	1	1.6
Tertiary	2	3.2	-	
Ethnicity				
Fulani	0		63	100
Margi	21	33.3	-	
Bachama	21	33.3	-	
Higgi/Magi	21	33.3	-	
Marital status				
Married	56	88.9	55	87.3
Not married	5	7.9	8	12.7
Divorced	0	-	0	-
Widow	2	3.2	0	-
Farm size(ha)				
<1	3	4.8	-	-
1-2	16	25.3	-	-
3-4	18	28.6	-	-
5-6	11	17.5	-	-
7 & above	15	23.8	-	-
Size of herd				
1-29	-	-	10	15.9
30-59	-	-	20	31.7
60-99	-	-	19	30.2
100 and above	-	-	14	22.2
Years of residency				
1-5	0	-	5	7.9
6-10	2	3.2	9	14.3
11-15	10	15.9	11	17.5
16 and above	51	80.9	38	60.3

(Crop Farmers) were of different tribes, 33.3% are Bachama from Numan LGAs, 33.3% are Margi from Madagali and 33.3% from Gerie, these constitute half of the respondent. In the case of the herders, 100% are Fulani. It is quite evident that the study was carried out in different tribe where each LGA possess its own language different from Fulani. Therefore, Ethnicity may play a significant role in the conflict as noted by Tonah [17] who stated that, farmer-herder differences are not only seen as resource conflicts but are also sometimes represented as an ethnic conflict involving the two groups. Since herders and farmer groups have very different values, customs, physical and cultural characteristics, disputes between them are frequently characterized as ethnic conflict.

3.1.5 Marital status

Table 3 further reveals that more than three-quarters of both farmers (88.9%) and herders (87.3%) are married, while only 7.9% of farmers and 12.7% of herders are single. This means that the majority of the respondents from both groups have at least one dependant, making them economically vulnerable, hence greater tendency to challenge all kinds of occupational threats. All the 2 female farmers are widows. The marital status agrees with the findings of Kehinde [20] in his study on socioeconomic and environmental factors influencing farmer-herder conflict in Kabba/Bunu LGA of Kogi State.

3.1.6 Farm size

The majority of the farmers (58.7%) owned a farm of less than 4 hectares per farmer, while only 41.3% own more than 4 hectares per farmer. This may be due to an increase in population which resulted in high pressure on land for farming, this is visa-vis the traditional land tenure system of inheritance, whereby the land is usually fragmented and shared among several family members. The implication is that there is an increase in the tendency of the farmers to encroach more land reserve and cattle tracts, thereby creating an avenue for conflict.

3.1.7 Herd size

Table 3 shows that the majority of the herders (52%) keep a herd size of more than 60 cattle, 15.9% within the range of 1-29 cattle, while 31.7% maintain within the range of 30-59 cattle. The optimum herd size according to the Fulani in this sample lies between eighty and one hundred

cattle. The smaller herd size is due to the activities of cattle rustlers and Boko Haram, which according to the herders is posing a serious threat in their livelihood and existence.

3.1.8 Years of residence

The result in Table 3 shows that the majority of both the farmers (80.9%) and herders (60.3%) have been living in the area for more than 16years. 7.9% of herders spent less than 6 years in their respective areas, while none of the farmers had lived for less than 5years. This result shows that the majority of the respondents, being within the middle age category grew up in the study area. According to the findings by Kehinde [20] in a research conducted on the farmer-herder conflict in Kabba/Bunu LGA of Kogi State, herders that lived in the community between 1-4years were found to be in conflicts with crop farmers, while those that lived in the area above 8 years had the least frequency of conflict with crop farmers.

3.2 Perceived Causes of Farmers-herders Conflict

Respondents were requested to identify what they perceived to be the cause of their mutual conflict. The responses were graduated on a 5-point Likert scale, from strongly Disagree = 1, Disagree = 2 undecided = 3, Agree = 4 strongly Agree = 5. The cut-off point was the mean of the cumulative point 1-5 which was calculated as 3.

Table 4 revealed that a very large number of the respondents (F=61) have strongly agreed that the grazing of crops and the residue by cattle is one of the causes of their mutual conflict. The result further indicates that the majority of the respondents (F=88) strongly agreed with the destruction of the water source as a cause of farmer-herders' conflict in the study area, only 9 remain neutral, while no respondent disagrees.

Table 5 shows that 63.5% of the respondent (farmers) said they don't have access to adequate potable water supply and 34.9% of the respondent (farmers) indicates that they have access to adequate potable water. In the case of herders, the majority 84.1% of the respondents revealed that they don't have access to adequate potable water, 9.5% of the respondents indicate no idea on what is potable water, they said, water is water, while 6.4% of the respondents reveal that the Government have made provision

Table 4. Perceived causes of farmers – herder conflicts

	Strongly disagree	Disagree	Undecided	Agree	Strongly agree	Total	Mean
Encroachment of grazing reserve	3	5	8	22	88	126	4.5
Grazing of crops and cattle residues.	4	20	9	32	61	126	4.0
Destruction of water source.	0	0	9	29	88	126	4.6
Burning of Rangeland.	16	31	29	50	0	126	3.0
Inadequate water point.	5	36	40	45	0	126	3.0
Inadequate grazing reserve.	3	22	42	36	23	126	3.4
Encroachment of stock route.	12	24	14	31	45	126	3.6
Change in climate condition.	5	18	35	22	46	126	3.7
Inadequate pasture.	12	21	22	44	27	126	3.4
Cattle thief and killing	22	34	23	44	6	126	2.8

Farmer and herder (n=126)

Table 5. Respondents opinion on accessibility to adequate potable water

Variables	Farmer		Herders	
	Frequency	Percentage %	Frequency	Percentage %
Yes	22	34.9	4	6.4
No	40	63.5	53	84.1
No idea	1	1.6	6	9.5%
Total	63	100	63	100

Table 6. Reasons for no accessibility to adequate potable water

Variables	Farmer		Herders	
	Frequency	%	Frequency	%
1. The area was/is heavily cultivated.	-	-	29	54.7
2. The presence of the armed Fulani group around water points frightened us.	13	32.5	-	-
3. Polluted water by armed herdsman group.	10	25	-	-
4. Water shortage due to conflicts.	17	42.5	15	45.3

Table 7. Impact of farmers-herders conflict on household and community development

Variables	Farmer		Herders	
	Frequency	%	Frequency	%
Loss of human life and reduction in household income causing migration.	50	79.4	61	96.8
Reduced access to Agricultural land and displacement of farmers	60	95.2	6	9.5
Infrastructural Damage (Health, Education and recreation centres)	46	73.0	33	52.4
Reduced access to water sanitation and electricity	44	69.8	47	74.6

for potable water in their settlement areas. This study shows that a greater proportion of the population lacks access to potable water resulting in poor health or water-related diseases and other ailments.

In the case of Herders, Table 6 shows that 54.7% of the respondents stated that the area is heavily cultivated by farmers even the waterways. While 45.3% reveal that the reasons why there is no adequate potable water in their communities are as a result of armed conflict between herders and farmers. In the case of farmers, 32.5% of the respondents stated that the presence of the armed group(s) around water points resulted to the inadequate potable water, 25% of the respondents reveal that the water point became polluted by the armed Fulani herdsmen and 42.5% described water shortage due to the big number of armed groups in the area. owing to the serious threats cited above which are life-threatening, the majority of the respondents were not able to access water for their daily consumption and need. The respondents stated that without conflict, accessibility to potable water should have been 80 percent.

3.3 Impact of Farmers-herders Conflict on Community Development

The result from Table 7 indicates that 79.4% (farmers) respondents confirmed that herders-farmers conflict causes loss of human life and also reduced household income which probability leads to migration from rural areas to urban centers. In the case of the herders, the majority (96.8%) of the respondents agreed that conflict between crop farmers and cattle herders affect community development indices and reduce household income while so many of them lost their lives as a result of the conflict which also lead to migration from that area. The result also revealed that 95.2% (farmers) affirmed that the herders-farmers conflict reduced access to agricultural land and led to the displacement of farmers. They further revealed that as a result of the conflict so many farmers are taking refuge at Internally Displaced Camps (IDPs) in the state. For the herders, only 9.5% of the respondent agrees with the claim to be another factor responsible for their displacement.

The result in Table 7 further indicates that 73.0% (farmers) agree that the conflict between the two

different groups led to the destruction of facilities like school, health and even recreational centers. While in the case of herders, 52.4% shows that the herders-farmers conflict led to infrastructural damage. 69.8% (farmers) of the respondents agree that conflict hinders them from access to good water, sanitation, and electricity while in the case of herders, 74.6% of the respondent reveals that conflict hinders them from access to good water for consumption which the Government of Adamawa had provided.

In essence, all four ways identified and listed above adversely affect households and community development. For instance, if the household has limited access to agricultural land, its food production capacity will be reduced hence exposing the household to low food production that leads to hunger, malnutrition, disease, and poverty. On the other hand, since children are not allowed to go to school as a result of conflict, the illiteracy rate will increase and this will exacerbate poverty, hence promotes ignorance, and backwardness in terms of community development.

Table 8 reveals that about 15.9% (farmers) of the respondents said that the road is paved, 11.1% described it as stabilized, and 73% of the respondents cited that the road was unpaved. In the case of herders' majority (95.2%) indicated that the roads are unpaved while 4.8% said that the roads are paved. In a real sense, so many roads in Adamawa State are unpaved, the major road that links North Senatorial zone are been neglected due to the Boko Haram conflict and now herders-farmers conflict. The workers are afraid to go back to the site. Another reason is kidnapping, as a result of herders-farmers conflict, sophisticated weapons are now rampant in the communities and they use it for kidnapping activities.

3.4 Crop Farmers-cattle Herders Conflict Resolution Options

Table 9 shows that conflicts were formerly settled through traditional and local leaders who were well involved in finding lasting solutions to conflict. The majority of the respondents (98.4%) of the crop farmers and 100% of the herders revealed that traditional rulers were involved in disputes resolutions in olden days. The result from Table 10 also revealed that 79.4% of the crop farmers and 85.7% of the

Table 8. Road status in the area inhabited by the sample population

Variables	Farmer		Herders	
	Frequency	%	Frequency	%
Paved	10	15.9	3	4.8
Stabilized	7	11.1	-	-
Unpaved	46	73	60	95.2

Table 9. Conflict resolution strategies according to the respondents

S/No	Strategies adopted by herders/farmers	Farmers (n=63)		Herders (n=63)	
		Frequency	%	Frequency	%
1.	Reactivation of grazing reserves.	12	19.0	63	100
2.	Sensitization of conflicting parties on peace by community leaders.	43	68.2	21	33.3
3.	Management of factors of conflicts by institutions involved in the conflict resolutions.	50	79.4	54	85.7
4.	Herdsman keeping to agreed routes and farmers avoiding encroachment of the grazing routes.	30	47.6	63	100
5.	Amendment of laws on grazing reserve.	22	34.9	62	98.4
6.	Provision of available seed for establishment of forage in grazing reserves by government and Non-governmental organization or Agency.	43	68.3	60	95.2
7.	Involvement of traditional and local leaders in finding lasting solutions to conflict.	62	98.4	63	100

herders opined that factors of conflicts must be properly managed by institutions involved in the conflict resolutions.

The conflict resolution committee according to the respondents should comprise representatives from the relevant departments of the LGA, State Security Services, the Police, farmers and Miyeeiti Allah Cattle Breeders Association with similar committees also to be formed at the community levels. All (100%) of the herders and 47.6% of the crop farmers revealed that another method of resolving conflict is that herdsman must keep to agreed routes and farmers to avoid encroaching the routes while 34.9% of the farmers and 98.4% of the herders maintained that reactivation of gazetted grazing reserve is a sure way of resolving the conflicts.

The implication of the result in Table 9 is that the social, economic and political tensions created as a result of numerous-escalations of violent conflicts between herders and crop farmers have put a question mark on the suitability or relevance of the state alone to manage and resolve such conflicts. Therefore, there is a need for involving traditional leaders.

3.5 Test of Hypothesis

The null hypothesis which states that there are no significant factors responsible for the conflict between crop farmers and cattle herders was tested using the result of Table 4. From the result, 9 variables out of the 10 variables were significant at $P < 0.01$ and $p < 0.05$ levels of probability in predicting the outcome of herders-farmers conflict. Therefore, the null hypothesis is rejected and the alternate hypothesis which states that there are significant factors responsible for the conflict between the cattle herders and crop farmers is upheld.

Three variables included in the model had positive signs, implying their direct relationship with the respondents' involvement in the conflict. The -2log likelihood (-2LL) of the above model estimated the causes of conflict between crop farmers and cattle herders in Adamawa State. This also indicated that there is no difference between the estimated Logistic Model and the hypothesized Model. This implies that there is a significant relationship between the probabilities of engagement of farmers and herders in conflict and the explanatory variables included in the model. The Nagel Kerke R-square value and the

Table 10. Logistic regression estimates of the factors responsible for the conflict between cattle herders and crop farmers

Variables	Coefficient	Standard error	t-value
Cattle thief and killing	2.233	0.700	3.165
Grazing on crops and crop residues.	1.489	0.505	2.175
Destruction of water source.	1.237	0.525	3.44
Burning of Rangeland.	1.888	0.690	2.737
Inadequate water point	1.392	0.545	3.022
Inadequate grazing Reserves	0.775	0.570	1.512
Encroachment of stock route	0756	0.509	1.485
Change of climate condition	1.002	0.515	1.621
Inadequate pasture	1.015	0.525	1.506
Encroachment of Grazing Reserve	0.333	0.614	0.713
Constant	4.23	0.652	4.631
Model chi-square	51.15		
Log Likelihood	0.008		
Nagelkerke R-square	0.62		
N = 126			

**p<0.05 and ** p<0.01 levels of probability*

model Chi-square also suggest that the estimated conflict model had good explanatory power.

All the variables in Table 10 have positive relationship with the conflicts. Encroachment of grazing reserves for instance has a statistically significant (P<0.01) direct relationship with the crop farmers-cattle herders conflict. The implication is that farmers' encroachment on grazing reserves would lead to an increase in the probability of occurrence of the conflicts. Cattle thief and killing on the other hand is the only variable that do not have positive relationship with the conflicts.

4. CONCLUSION AND RECOMMENDATIONS

This study has clearly examined the socio-economic conditions of crop farmers and cattle herders in Adamawa State. It was discovered that both crop farming and cattle herding is predominantly carried out by middle-aged people within the range of 30-50 years who are energetic, more productive in the economic sector and more prone to conflicts. Findings from the study further showed that both crop farming and cattle herding are male dominated business. Also, the very low level and in most cases, absence of formal education amongst the two groups is seen as a contributory factor to the prevalence of the conflicts.

The perceived causes of the crop farmers-cattle herders' conflicts are the destruction of the water source, grazing of crops and crop residues (crop damage by cattle) and encroachment of grazing reserves by farmers. Cultivation of crops was extended into grazing reserves and cattle routes, while crops are being eaten by cattle. These are issues that has consistently been at the forefront of most of the farmers-herders' conflicts. However, majority of the respondents (crop farmers 98% and cattle herders 100%) identified traditional rulers as vital in settling disputes between the two different groups.

Interestingly, the study linked these perennial conflicts to the very poor community development in Adamawa State. Agricultural production and productivity drastically reduced because farmers don't feel safe due to insecurity, and therefore leading to population displacement, migration, food insecurity, loss of lives, livelihoods and assets, poverty, deterioration of socioeconomic conditions and collapse of basic service delivery in the study area. The destruction of both physical and economic infrastructure by the warring parties is indeed a major concern and this not only affects the community development in Adamawa State but also has serious implications on the civil population (herders – farmers); their means of survival are either destroyed or abandoned due to insecurity in the state.

The conflict resolution strategies adopted includes but not limited to reactivation of existing grazing reserves, sensitization of conflicting parties by community leaders and amendment of laws on grazing reserves.

The following recommendations are suggested to minimize the impact of the cattle herders-crop farmers conflict in Nigeria in generally and Adamawa State in particular:

1. Formal education for both the herders and the farmers should be encouraged through sensitization using individual and mass communication with the aid of extension agents and radio programs respectively. Also, nomadic education and vocational training schools should be strengthened to perform better.
2. Competent institutions such as reputable International Aid Agencies or NGOs and the government-line Department/ Ministries should support household to diversify their livelihoods including both material and social resources and activities required for a means of living in order to be able to cope with shocks and stresses as a result of natural or man-made calamities.
3. The government should ensure proper re-demarcation of grazing reserves for herders.
4. There is a need for sensitization of crop farmers and cattle herders in the areas of awareness on the need for co-existence, the only remedy to human comfort.
5. The government should be firm and fair in its resolution and implementation of decisions.
6. Government at all levels should explore better involvement of indigenous resource user groups in policies relating to natural resource management and utilization and also in developmental planning.
7. Farmers and herders should form more cooperative and associations that can represent their interests and enable the groups to speak as one. This may reduce the frequency of 'Jungle Justice' by seeking redress from relevant authority whenever a dispute arose.
8. The government should increase international border patrol during the dry season in order to obtain information on the influx of Udawa and Bukoloyi herders with sophisticated arm from the neighboring countries especially the Niger Republic. This will enable the Government

to take a proactive decision on how to prevent violent confrontation.

CONSENT

As per international standard written participant consent has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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