

An assessment of farmer-pastoralist conflict in Nigeria using GIS

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ABSTRACT: Pastoralism in Nigeria faces challenges and these hampers the productivity that consequentially affect the Nation's economy. Available grazing lands are diminishing at an alarming rate and livestock pathways are blocked through land use, urbanisation and frontiers. The old grazing routes that existed for centuries are almost gone. Only 2.82% of the grazing reserves have been acquired and these are poorly managed. The increase in population, drying of waterholes, shifting in rainfall pattern leading to drought as a result of the changing climate affects both pastoralists and farmers. Hence, they compete over land leading to conflict, and embedded within these are growing form of capitalists land tenure and delay in the justice system that exacerbates the situation. This study examines the argument of land use conflict as the major cause of farmer-pastoralist conflict in Nigeria. The Nigerian Forestry Management Evaluation and Coordinating Unit (FORMECU) land use and land cover (LULC) dataset and published articles of previous farmer-pastoralist conflicts in the country are used. Results show that between 1976 and 1995, all land uses gain, attesting to the increase in population and competition over dwindling resources. However, overlap maps show intensive crop farming has expanded into grazing lands in many areas over these years. These areas of encroachment agree with most of the conflict points recorded. For a lasting solution, we propose a possible revisit of symbiotic engagements between farmers and pastoralists. The full engagement of communities, Non-governmental Organisations (NGOs), Alternative Dispute Resolutions (ADRs) and government as overseers are suggested.

KEYWORDS: GIS, land use, farmer-pastoralist conflict, Nigeria

I. INTRODUCTION

In Nigeria, grazing lands have barely been demarcated, and this large sector of agriculture always suffers compared to crop farming or fruit plantation (FAO, 1985). The latter two are mostly demarcated favourably for the fact that most people are sedentary and areas needed are small. The establishment of demarcated rangelands and passageways (cattle corridors) allow the livestock to access water points and pastures without causing damage to cropland (FAO, 2011). Pastoralists usually graze over areas outside farm lands, and these have been accepted to be the norm from time immemorial. Their movements are opportunistic and follow pasture and water resources in a pattern that varies seasonally or year-to-year according to availability of resources (FAO, 2011). The patterns of movement may be controlled by seasonal climate variations. However, increase in population, drying of waterholes, shifting in rainfall pattern leading to drought as a result of the changing climate affects both sectors of agriculture. At the same time, smaller and local agricultural production systems are becoming more and more integrated into the global economy, pushing up land values. These, coupled with the absence of good governance and the increase in level of poverty creates avenue for conflicts. Both customary and statutory land management systems are often not responding adequately to the tenure insecurity these changes bring (Djire et al., 2014).

Extensive livestock production in the form of pastoral livestock keeping is among the most suitable means of land use in arid areas of Africa because of its adaptability to highly variable environmental conditions (McCarthy et al., 2000). Livestock here signifies cattle, sheep and goats. In Nigeria, most pastoralists do not own land but graze their livestock in host communities (Awogbade, 1987). While a few have adopted the more sedentary type of animal husbandry, the increasing crises between farmers and pastoralist presupposes that grazing is a major means of animal rearing in Nigeria. The sedentary type of animal husbandry also proves to be more expensive, difficult to manage and inefficient for the rapid growing market of an ever increasing population like Nigeria.

Pastoralism remained the most ancient trade that is still strong and self-provisioning. While many pastoral regions are the focus of current farmer-pastoralist conflict studies, the long history of sustainability and resilience evidenced by these cultures and their contribution to the economy is of great interest. In Nigeria, there is a large proportion of the population involved in herding and are making a significant contribution to the economy. The groups of people that are actively involved in pastoral activities in Nigeria are the Kanembu,

Kwoya, Manga, Fulbe (Fulani) and the Shuwa Arabs. The Fulbe are the largest owners of livestock accounting for about 90% of the nation's stock, contributing one third of the Agricultural Gross Domestic Product (GDP) and 3.2% of the national GDP (Nuru, 1984; Fabusoro and Oyegbami, 2009). The Nigerian cattle market generates only 6.8 billion USD of a potential 20 billion USD annually due to local strifes and inability of government to fully recognise the industry (Okello et al., 2014).

Pastoralism is economically viable to the extent that it contributes significantly to the economy of many developing countries despite continued underinvestment (Hatfield and Davies, 2006). It contributes largely to the growth of local economies, and a cumulative contributor to the nation's GDP and plays a major role in providing on-demand protein to the wider population. In this part of the world, where inland fish is meagre and offshore fishing have not been well explored to provide sea food as part of a diet, meat, milk as well as butter are the major sources of protein. In addition, thousands of Nigerians make a daily living from the sale, transport, processing and marketing of livestock products that include meat, milk, butter, hides and skins, bones and as ploughing power to farmers. In the Federal Capital Territory (FCT) alone, 4,000 goats and over 400 cattle supplied by the Fulbe are slaughtered every day (Okello, 2014). In Yola town, north-east of the country, over 160 cattle, 600 sheep and 450 goats supplied by the Fulbe are slaughtered every day (informant interview). Cattle owners are the only people paying the Jangali (per head cattle levy) to the government since prior to independence (Adebayo, 1995). This tax, being an additional taxing system imposed by the British colonial system still exists (Okello et al., 2014). There is no doubt that the economic importance of pastoralist is significant to the Nigerian economy. Hence, the conflict between the farmers and pastoralist require a lasting solution to maintain and improve on the contributions of this sector of agriculture.

This paper is organised as follows: In section 1, general background, causes and consequences of Farmer-Pastoralist conflict and grazing reserves are examined. In section two, details of the datasets and the method of analysis are described. In section three, results are presented and discussed. In section four, conclusions and recommendations are outlined.

1.1 Causes and Consequences of Farmer-Pastoralist Conflict

Past conflicts were solely due to overlap of farmlands with cattle routes, where farmers grow crops on the routes. But recently, this conflict has escalated, taking another dimension of ethnic and religious differences with little effort from government or community leaders aimed at addressing them.

John (2014) studied the predicaments of the pastoralists and farmers and the true stories behind their conflicts and how these can be resolved. His results show the existence of one-sided reporting by the media, research articles and interested parties. Majority of those reports tend to highlight and report cases in which the pastoralist faulted farmers and tend to ignore the other side of the stories or even their losses (John, 2014). This appears to aggravate the situation and adds to the speculation and allegations of the pastoralist. Other studies show farmers encroachment on cattle routes is the real cause (Nformi et al., 2014). These mystify who is wrong and how these conflicts can be addressed. Ethnic jingoists and politicians have been benefitting in these strifes and without doubt have succeeded in creating a divide between the farmers and pastoralist, especially in communities that are less educated. Leaders at the Federal, State, Local Governments and even at community levels become perplexed and wondered on how these issues can be resolved.

Farmers and pastoralist in many localities and different countries make their livelihood within the same geographical, political, and socio-cultural conditions which may be characterized by resource scarcity (Braukämper, 2000) or political inequality (Bassett, 1988). Farmer-pastoralist conflicts have been associated with the conflict of land resource use exacerbated by dwindling resources (Blench, 2004). Some researchers have linked this crisis to the theory of eco-violence (Okoli and Atelhe, 2014), where environmental factors and exploitation of scarce resources leads to conflict and violence. This may explain the dwindling grazing resources (land, pasture etc.) and poor management of existing grazing reserves (Adisa, 2012) as culpable. In addition, the population is dynamic and ever increasing compared to land that is relatively static. The population growth rate of Nigeria per year is 3.2% (National Population Commission, 2012). Therefore, more and more people will continue to compete over land.

Other researchers (Okoli et al., 2014; Odoh and Chigozie, 2012; Abbass, 2012) relate the causes of conflict to the global climate change and the contending desertification and aridity that has reduced arable and grazing lands, forcing pastoralist to move southwards in search of pasture for their livestock. Climate change-induced rainfall shifting patterns/amount and desertification reduces crop lands, and farmers have to follow these patterns, leading to overlap on grazing lands. The Fulbe herders in Nigeria, for example are faced with rapidly vanishing grass, forcing them to switch from the Bunaji cattle breed, which depends on grass, to the Sokoto Gudali, which readily browses (FAO, 2001).

The pastoralists are also competing with large-scale agricultural schemes that narrow the grazing lands. The use of tractors, herbicides and fertilizers have revolutionised agriculture in the country leading to more and more grazing lands being farmed extensively (Iro, 2010). As farmlands increase to the detriment of grazing lands, animals can easily veer into farmlands and destroy crops.

Land acquisition by capitalist farmers exacerbates the upsurge of conflict as pastoralist can no longer find where to pass let to talk of where to stay (Abbass, 2012). Changing access rights as traditional communal property are being replaced by private ownership (Adisa, 2012). It is common to see that Burtalis (cattle pathways) close to cities do not exist anymore as houses and filling (petrol/gas) stations have taken over their places. Cattle now have to compete with motorist to the only path that is tarred road. There are many other predominant causes. Blockage of waterholes by farmers and fishermen, crop damage by pastoralist livestock and reprisal attacks on pastoralist by sedentary farmers when ethnic or religious disputes occur somewhere else (Umar, 2002; Abbass, 2012; Audu, 2014). Also, allocation of grazing lands as government layouts without compensating the pastoralist, breakdown of law and order and taking side by local rulers or Judges responsible for dispute resolution (Rasak, 2011; Fabusoro and Oyegbami, 2009). Others are gradual decline of social cohesion, ethnocentric and religious intolerance of leaders who are themselves sedentary farmers and conflict of cultures (Abbass, 2012; Bello, 2013).

Hence, it is important to note that these conflicts have direct impact on the lives and livelihoods of those involved. They also disrupt and threaten the sustainability of pastoral production and agriculture in West Africa (Moritz, 2010). These conflicts reinforce circles of extreme poverty and hunger, and destroy social status, food security and affect mostly the most marginalised groups that include women and children. This affects education of children leading to obstacles in their development and mass displacement. Consequentially, this debilitates the once mutually existing farmer-pastoralist relationships. This awful situation becomes worst, especially when either the farmer or the pastoralist is categorised into a group relating to religion, tribe or region. Abbass (2012) warned that the disharmony in pastoralism and sedentarism reflect enhanced sedentarisation and increased pastoralism leading to constant conflict with the agrarian societies.

Some farmers practicing mixed farming attests that their animals have in one way or another affected other farmers, likewise sedentary pastoralists were in one way or the other affected by farmers (Nformi et al., 2014). This shows that the issue of farmer-pastoralist conflict is more or less shared problem. Therefore, this may not warrant isolation of farmers or pastoralists into ethnic or regional groupings for the sake of levying blames on any as the case may be.

Blench (2010) observed that judicial commissions set up to handle conflict issues do not yield any effective action. Both farmers and pastoralists are in dire need to settle these conflicts preferably by the customary institutions rather than the Courts. Even though, many of these conflicts are settled outside courts through the customary institutions, a lot of people are not aware of the existence of Alternative Dispute Resolution (ADR). The ADR is formal and centres are provided within cities and towns. The arbitrators are professionals at law and cases are solved fairly quickly outside the courts. In Nigeria, the ADRs are established by Arbitration and Conciliation Act, Cap. A18 of the Laws of the Federation of Nigeria (2004).

1.1 Revisiting Grazing Reserves

The Land Use Act of 1978 has granted equal rights and opportunities to Nigerians to live in any part of the country un-deterred and regards all citizens as Nigerians and not Natives, unlike the previous Land Tenure Act of 1962 that did not spell this out (Rasak, 2011). According to this law, the Federal government has the capacity to redraw the boundaries between cattle routes, range lands and farmlands accordingly and envisage co-existence of various groups.

Furthermore, the Nigerian Grazing Reserve Act of 1964 was passed for the purpose of accessing grazing lands to the Pastoralists, thereby encouraging sedentarisation and addressing conflict with a plan to improve productivity and social amenities (Awogbade, 1978; Ibrahim, 2012). This, in broader sense was expected to address constraints facing the cattle market and disease control (Ingawa et al., 1989). However, even though this law was passed, very little implementation was observed. Looking at the impending farmer-pastoralist conflict and a reduced cattle production, in which Nigeria imports about 23% of cattle from the neighbouring Sahel countries, the government again enact the National Agricultural Policy of 1988. The law stipulates that a minimum of 10% of the national territory that is 9.8 million acres be allocated to grazing reserves. However, only 2.82 % was acquired out of 313 reserves (CIEL, 2006; Ibrahim, 2012).

The most recent attempt to establish grazing routes and reserves across the 36 states and the FCT was the National Grazing Route and Reserve Commission bill of 2011 (Kumolu, 2014). On 3rd July 2012, a bill titled ‘The National Grazing Route and Reserve Bill’ was presented to the Nigerian Senate for deliberation (Daily Trust, 2012). The bill however, failed to scale a third reading as the Senators were divided over whether the Federal Government was constitutionally empowered to create grazing reserves and stock routes in any state of the Federation. The inability of the upper house of assembly and the government to promulgate a law establishing grazing reserves raises doubt on the government’s commitment to finding a lasting solution to the conflict. It also raises questions on the government’s commitment to reduce her dependency on oil, and working towards post-oil Nigeria, since her oil reserves may last only up to the year 2053 based on 2012 production rate (World Bank b, 2012).

Sedentarisation is another method used by governments to resolve the farmer-pastoralist conflict. However, RECANIGER (2009) shows that pastoral systems are 20% more productive than sedentary animal rearing. The reasons are that sedentarisation require intensive maintenance of field bio-mass to avoid depletion. Of course, even governments in developed countries would find it difficult to provide basic requirements that will encourage pastoralists to settle in designated areas.

Several researches have been conducted to determine causes and effects of farmer-pastoralist conflicts. However, limited research has been carried out on the expansion of farmlands and the dwindling pastoral land area, which are the principal causes of conflict.

This study intends to build upon the research conducted by Gefu and Gilles (1990), who comparatively studied and analysed changes in land uses meant for grazing and crop production in Nigeria. Their results showed that within a period of 35 years (1951-1986), land primarily meant for livestock grazing diminished by 41.8% (Figure 1), while the number of livestock almost doubled. Such rapid change in land uses has set stage for a land use conflict between pastoral land use and other land uses in Nigeria. Here, we examine the argument of land use conflict as the major cause of farmer-pastoralist conflict in Nigeria. This is to study the changes in pastoral land use vis-a-viz other agricultural land uses. Changes in land use and land cover (LULC) in Nigeria between 1976 and 1995 and the implication this may have on pastoral lands and the potentials for conflict are identified.

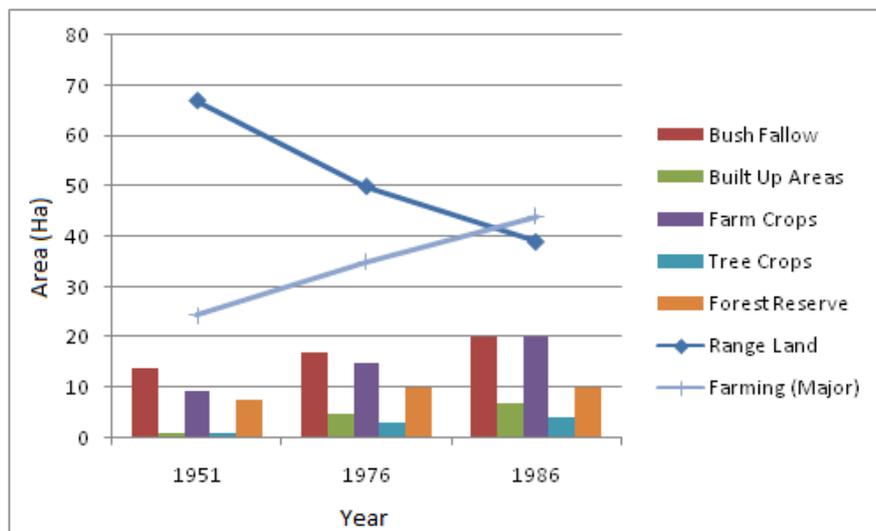


Figure 1: Land Use Changes between 1951-1976, 1976-1986 (reproduced from Table 1 in Gefu and Gilles, 1990). Range lands ceased to be the largest land use while land meant for other agricultural productivity became the largest land use by 1986.

Therefore, the aim of this paper is achieved through the use of Geographic Information Systems (GIS), which is an effective tool for risk analysis, characterisation and decision support in past disasters and crises events (Cai et al., 2006). Mapping of existing affected areas and identifying other areas that are susceptible are conducted.

II. MATERIALS AND METHODS

2.1 The Study Area

The study was conducted in Nigeria, which comprises of 36 States and the Federal Capital Territory (FCT). Nigeria is located in West Africa between Latitude 4°-14° N and Longitude 3°-14° E (Figure 2) with a land area of 923,769 km². The country is bordered to the west by the Republics of Benin and Niger; to the east by the Republic of Cameroon; to the north by Niger and Chad Republics and to the south by the Gulf of Guinea (NBS, 2011). Nigeria is the most populous country in Africa with an estimated population of 168.8 million inhabitants as at 2012 (World Bank a, 2014) and comprises over 250 major and nearly 700 minor socio-linguistic groups.

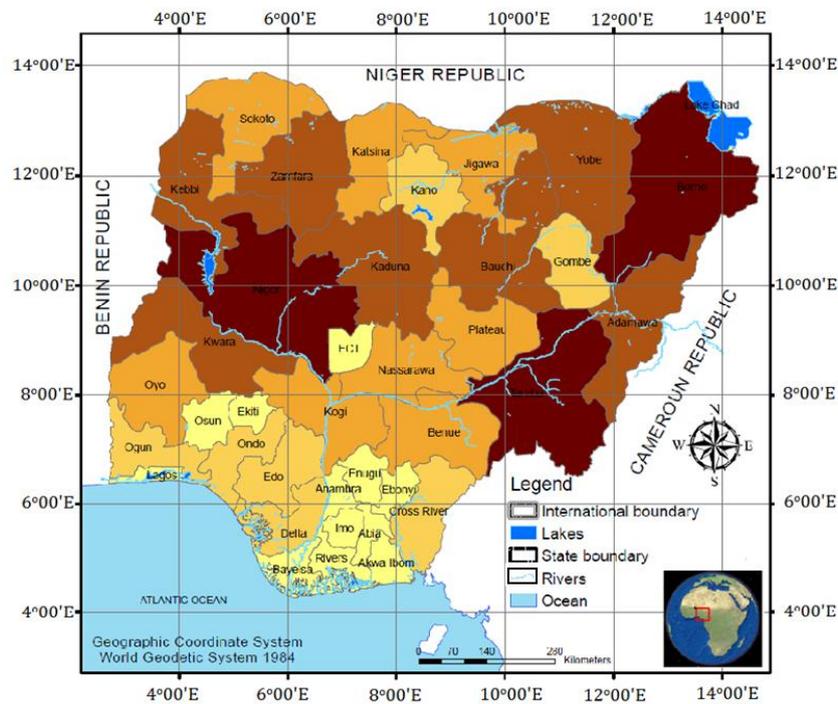


Figure 2: The Study Area showing the 36 States and FCT.

2.2 Data

This study uses spatial data to investigate the causes of farmer-pastoralist conflict in Nigeria. Therefore, the data required for this work is supposedly in the form of maps. The study primarily uses secondary sources that include land use/land cover (LULC) maps of Nigeria and published articles of previous farmer-pastoralist conflicts in Nigeria. The LULC maps of 1976 and 1995 were produced by the Nigerian Forestry Management Evaluation and Coordinating Unit (FORMECU). The FORMECU data set used a combination of Landsat multispectral, SPOT multispectral, JERS-1 Radar, ERS-1 Radar, Landsat TM and AVHRR images covering Nigeria for the periods between 1976 and 1995 (Ademiluyi et al., 2008; Bibi, 2013). It was the first attempt by the Nigerian Government to produce a LULC map of Nigeria covering two different periods. The FORMECU LULC maps were obtained in the form of shapefile polygons and were re-classified using ArcGIS 10.0. It should be understood that the land use data are inclusive for either grazing or farming. Secondary data comprising published information from journal articles and other online sources on previous conflict occurrences across the country were collected (Table 1). These are categorised based on Local Government Areas (LGAs) and States. The likely areas of conflict identified were compared and analysed with the FORMECU LULC maps. However, these conflict data were obtained for the period of January 2002-October 2014. For data processing and analysis, ArcGIS 10.0, Quantum GIS 2.0.1 Dufour (QGIS) and Microsoft excel were used.

Table 1. Farmer-Pastoralist Conflict Occurrences in Nigeria (sample).

Conflict Location	LGA	State	Date	Lat	Lon	Sources
Tonga Maina	Sardauna	Taraba	01/08/2002	6.99	11.16	Odoh (2012)
Zangon-Kanya	Ringim	Jigawa	16/02/2013	12.17	9.20	Cultural Survival
Bali village	Numan	Adamawa	05/02/2005	9.30	11.80	ACLED Data
Bali village	Numan	Adamawa	05/02/2005	9.30	11.80	''
Lamurde	Mubi North	Adamawa	13/05/2012	10.25	13.25	''
Anambra State	AwkaNort	Anambra	02/04/2008	6.33	7.00	''
Gwatukuru	Dass	Bauchi	17/10/2012	10.00	9.52	''
Inbutu	Makurdi	Benue	10/04/2005	7.73	8.53	''

2.3 Method

The FORMECU LULC map products of 1976 and 1995 have several land use classes. In this study, only eight (8) land use classes that relate to crop farming, tree plantation and grazing were considered. These include; rain-fed arable crop plantation, floodplain agriculture, irrigation project, agricultural tree-crop plantation, intensive row crops, extensive grazing, extensive small holder rain-fed agriculture with denuded areas and livestock project. The data on farmer-pastoralist conflict occurrences and locations were used to create a new shapefile showing location of occurrences. Approximate locations of conflict areas based on the data of settlement provided were employed.

A change detection technique was used to find the differences between the land use of 1976 and 1995. This was executed using Geographical Information System (GIS) tool from the Processing Toolbox in QGIS 2.0.1 Dufour. The algorithm subtracts areas of each land use class of 1976 map from the 1995 map. The result of change detection analysis was then overlaid with farmer-pastoralist conflict events to assess the likely areas of conflict. Changes in land uses for each of the eight categories were examined. In addition, the relationship between the reduction of grazing lands and conflict occurrences were assessed. Percentage change in land use area was calculated as:

$$pc_i = \frac{lu_{95_i} - lu_{76_i}}{Tot_{aN}} \times 100 \quad (1)$$

where pc_i is the percentage change in land use i (i.e. percentage change in any of the eight agricultural land uses), lu_{95_i} is the area of land use i in 1995, lu_{76_i} is the total area of land use i in 1976 and Tot_{aN} is the total area of Nigeria.

The conflict occurrences data were compiled in Excel and linked to polygon data of states as database.

III. RESULTS AND DISCUSSION

Various land use and land cover changes have been studied and calculated using equation 1. The land use map of 1976 (Figure 2a) appear to differ from that of 1995 (Figure 2b). The changes in land uses between these years are shown in Figure 2c. In 1976, land uses related to crop farming are concentrated to the northern and southern parts of the country while grazing mostly in the northern and central parts (Figure 2a). In the 1995 land use map (Figure 2b), there is an increase in agricultural land uses in all parts of the country. The major change appear to be intensive row crop farming, covering large areas in Taraba, Benue, Nasarawa, Jigawa, parts of Cross River, Oyo and Niger States. The second change is extensive grazing that spreads across the northern part of the country. The intensive row crop farming has expanded from 1976-1995 with 43,778.60 km² (Table 2). Floodplain agriculture expanded by 11,787.5 km² mostly along the major rivers in the country (Rivers Niger, Benue and Komadugu/Yobe) in the North. The increase in crop farming in wetland areas amplifies the potential for conflict between farmers and pastoralist since such areas are drinking points for animals too. Extensive small holding rainfed agriculture increased by 5,623 km². Extensive grazing has also expanded during this period with 21,913.75 km² in the north covering, especially the central States that is by a half of the increased area of intensive row crops. Main expansions in grazing land use were in Taraba, Plateau and Kwara States. The remaining land uses have increased owing to the annual increase in population. During this period (1976-1995), there are gains in area made by each land use against others (Figure 2c). The major land uses that gained are intensive row crops (43, 778.60 km² or 4.74% of Nigeria's total land area) and extensive grazing (21, 913.75 km² or 2.37% of the country's total land area). These results were contrary to the work carried out by Gefu and Gilles (1990) because they observed that grazing land use having more area in the initial year of their study and then later reduces. In this study, it is shown that all land uses increased, however, grazing land use only increased by a half compared to intensive small holder rainfed agriculture. While both agricultural crop and grazing land uses increased within this period, there is an extension of one land into another (overlap).

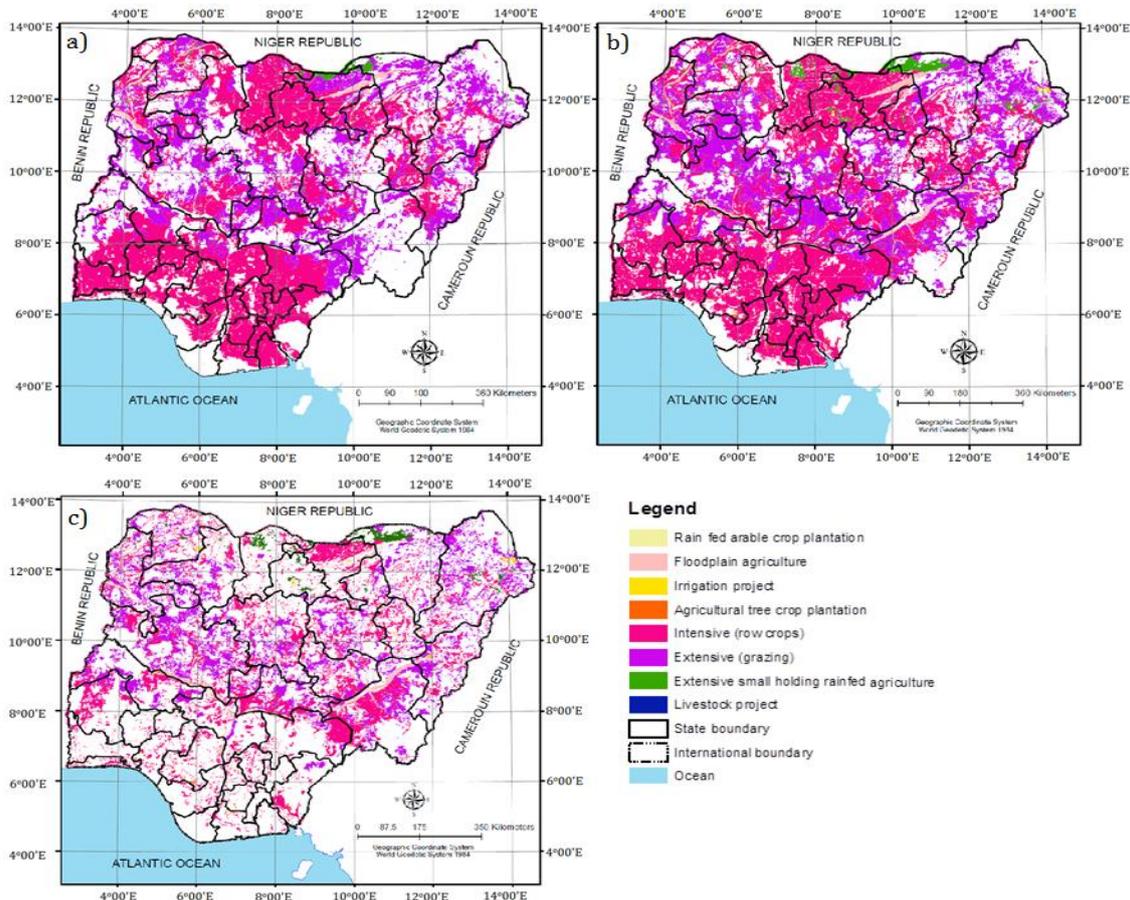


Figure 2. Map of Nigeria showing a) Land use map of 1976, b) Land use map of 1995, c) Land use change between 1976-1995, in this case a particular land use gaining over other land use types. Overlaid (in black lines) are state boundaries. These overlaps are shown in Figure 3.

Table 2: Land use change between 1976 and 1995

S/N	land Uses	1976		1995		Change Area (km ²)	Average	Percent change 1976-1995
		Area (km ²)	%	Area (km ²)	%			
1	Agricultural tree crop plantation	824.78	0.09	1,654.69	0.18	829.91	43.68	0.09
2	Extensive (grazing, minor row crops) Small Holder Rain-fed Agriculture	169,237.66	18.32	191,151.41	20.69	21,913.75	1,153.36	2.37
3	Extensive Small Holder Rain-fed Agriculture with Denuded Areas	4,363.60	0.47	9,986.60	1.08	5,623.00	295.95	0.61
4	Floodplain agriculture	9,616.25	1.04	21,404.20	2.32	11,787.95	620.42	1.28
5	Intensive (row crops, minor grazing) Small Holder Rain-fed Agriculture	327,565.27	35.46	371,343.87	40.20	43,778.60	2,304.14	4.74
	Irrigation project	147.87	0.02	993.76	0.11	845.89	44.52	0.09
6	Livestock project	50.47	0.01	138.96	0.02	88.49	4.66	0.01
7	Rain-fed arable crop plantation	15.85	0.00	517.52	0.06	501.67	26.40	0.05
8	Other Land Uses	411,947.25	44.59	326,577.99	35.35	-85,369.26	-4,493.12	-9.24
	Total	923,769.00	100.00	923,769.00	100.00	0.00	0.00	0.00

These overlaps are taken as the areas where one land use has expanded into another land use, and in the case where crop farming extends into grazing areas and vice-versa, it becomes a potential area of conflict or hot spot. These hot spots cover many parts of the North and Oyo State to the South-West. However, these are concentrated in the central States of Taraba, Benue, Plateau, Kogi, Kwara, Niger, Kaduna and the FCT. Further north, the main hot spot is in Jigawa State but minor hot spots spread almost evenly throughout. Figure 3 shows the hot spots (shaded in orange) and overlaid are the points of conflict (black dots). Although, some of the points of conflict do not fall on the hotspots, differences in the periods of the data used are assumed to be the reason. The point of conflicts data were gathered on a much later date (January, 2002 - October, 2014). However, it was observed that most points of conflict are not far from hot spot areas. Areas where the points of conflict are clustered around hot spot areas include the boundaries between Nassarawa and Benue State, Plateau and Kaduna State, and Taraba and Benue States. Apart from those areas listed, points of conflict extend to the southern states. These are found in Anambra, Enugu, Delta, Oyo, Ogun, Cross River and Ebonyi States. The overlap of crop farming and grazing land uses and the proximity of conflict points are a clear evidence of a growing resource scarcity mentioned by Braukämper (2000) and conflict of resource mentioned by Blench (2004) and Okoli and Atelhe (2014).

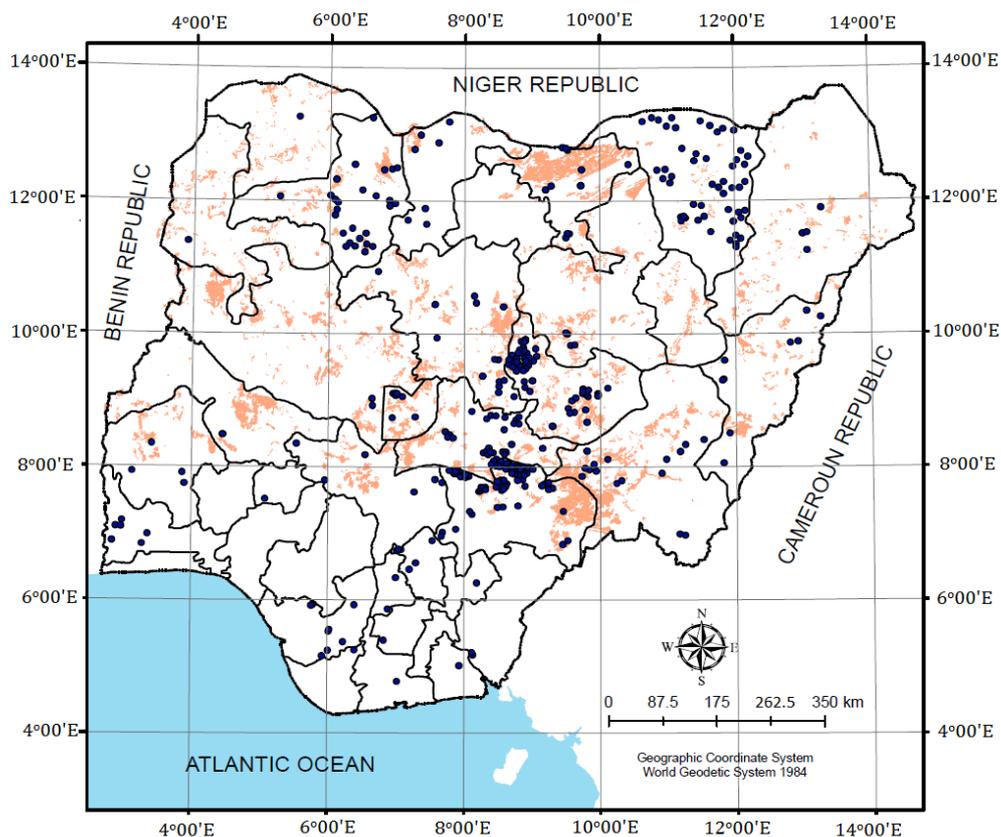


Figure 3: Map of Nigeria showing States and FCT boundaries. Shaded are conflict hot spots, indicating overlap of intensive crop land 1995 on extensive grazing land 1976. Dotted are locations of conflict between January 2002 - October, 2014.

IV. CONCLUSIONS AND RECOMMENDATIONS

In this research, the causes of farmer-pastoralist conflict have been studied with the premise that land use change is the major cause of crises. Using FORMECU land use/land cover data for 1976 and 1995, the study assessed the changes in predominantly grazing land use and all other land uses related to crop farming using GIS. Results show that predominant grazing lands between 1976 and 1995 has increased by 21,913.75 km² and land uses for all crop farming increased by 63, 367.02 km². During the same period, considerable overlaps have been observed in which farmlands extended into grazing lands. These occur mainly in the north and north central parts of the country with the exception of Oyo State in the southwest. Most of the conflict locations obtained for the period of January 2002-October 2014 falls on the areas of overlap, indicating changes in the land use as the major cause of conflict.

In previous years, the relationship between the farmers and pastoralists has been cordial and symbiotic. Increasingly, in recent years this somewhat mutual and complementary relationship between the pastoralist and their host communities is shrinking and being replaced by conflicts and open hostilities. The focal points of conflicts are access to land and water points. In Northern Nigeria, there exist several grazing routes used for transhumance. But recently, because of farm expansion and demand for land from other land uses as shown in Figure 2c and 3, many grazing lands are under pressure.

In general, creation of grazing reserves may in the long run be the formidable solution to the crises. However, the question still remains as how government can do that without necessarily causing a divide in the once, but fairly harmoniously existing peoples. The only way is that the Federal government may engage not only State and Local Governments in this matter but with the knowledge and contributions of community leaders, civil societies and NGOs. This may require a bottom up approach where the government through enlightenment of the benefits of having grazing reserves obtains the response and approval of all stake holders before embarking on such projects.

Suggestive measures to avert conflicts lie in the hands of government and the community. Based on the Landuse Act of 1978, every land belongs to the government and hence citizens could only occupy pending when the government requires that land. The government compensates for any land taken. While it is not possible for all the lands in the country to be farmed, so also it cannot be completely grazed.

The presence of ADR will in no doubt assist in solving local farmer-pastoralist issues without the unwarranted waste of time posed by court proceedings. ADRs are also free, so giving services with no charge will encourage disputed parties to attend and resolve issues amicably. Most cases are also solved fairly quickly without major complications and are rarely brought to the courts.

Communal responsibilities lie on both local sedentary farmers and the pastoralists, and these rests not only on the interests of peace and harmony but also on the economic perspective and trade alike. Children and young people should be encouraged to view the society as theirs and participate in global partnership efforts so they can contribute to developmental efforts, knowledge and innovation. They should collectively consider the society first, all people as one and be educated on future development targets such as the Millennium Development Goals (MDGs).

Communities in conflict and those on the verge of conflict may be given this opportunity to come to a drawing table. Government representatives and NGOs may participate and chair these meetings. Reconciliatory groups be formed and current conflicts may be treated and boundaries demarcated. The principle of ‘Settling before Judging’ (GTZ, 1998) be applied.

Symbiotic relationship between farmers and pastoralists should be enhanced. Many communities of farmers and pastoralists have built interdependent relationships with one another through processes of exchange. These interdependencies are described as symbiotic (Moritz, 2010). In Table 3, we present possible revisit of symbiotic engagements between farmers and pastoralists. Under mutual co-existence, they should be able to benefit from each other economically per each season. During post-harvests periods in northern Autumn/Winter, farmers want cattle to trample the residual plants and at the same time cow droppings would serve as fertilizer. The farmland becomes easier to plough during planting season in Spring. The cattle owner would also benefit from the cattle getting food without travelling afar. During planting season, the farmers could use bulls for ploughing while the rest of the cattle move to rangelands afar. The farmer may pay less compared to hiring tractors. In summer, when all herds are back and farm produce partly on harvest, they could exchange milk with grains.

Table 3.Suggestive symbiotic engagements between farmers and pastoralists.

Season	Farm Situation	Rangeland Situation	Pastoralists want	Farmers want
Winter	Crops harvested	Dry with small shrubs	Farm by-products	Cow dung as fertilizer
Spring	Ploughing and Planting	Few grasses emanating	Move herd to rain belt. Bulls may be left for ploughing but fed domestically.	Bulls for ploughing
Summer	Crop growth	Grasses available	Return of herds	Exchange of grains with milk
Autumn	Harvest period	Some grasses available	Farm by-products	Post-harvest trampling of farmland to ease ploughing

The social attitude to sharing and cultural exchanges should be encouraged between different ethnic groups even if they stay at peace. The government, civil society leaders and parents should be at the forefront in enforcing this to their respective communities. Politicians should desist from engendering difference between people but encourage togetherness despite political difference. Those involved in allocation of land for farming should imbibe responsibility and not allocate along cattle route or over grazing lands.

Support for agricultural development through incentives, especially fertilizers will reduce encroachment of farmers into cattle routes and herding zones. Bare pastures and water may also be provided to the pastoralists, so they travel less for pastures. It has become imperative for people in different aspects of agriculture and other trades alike to simultaneously and mutually articulate their trades for enhanced productivity. This may save the country from the dangers of post-oil economic woes.

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