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Suitability Site Selection Analysis for Grazing Areas in Yobe State, Nigeria

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Abstract
This study uses statistical analysis and identifies viable, suitable, reliable criteria that can be adopted for the establishing grazing areas in Yobe state of Nigeria that can completely eliminate or at least prevent conflicts between the herdsmen and the farming communities. It reveals the ambiguity of what type of grazing land policy is needed vs. what type of grazing land policy is possible and give insights into suitability or not suitability of sitting it. Four hundred sample data was used for the study. From the survey, 38.8% of respondents prefer private ranching as against the present government grazing reserve for establishing grazing lands and it should be sited in each senatorial district of the state. The grazing area to be allocated should not be less than 900km² in size. The study further reveals that there is a significant relationship between frequency of conflict verses frequency of herdsmen migration and education background. Further scientific research was recommended that can use remotely sensed images and topographical maps for the studying the grass above-ground biomass productivity and spatial distribution in the grazing areas so that the carrying capacities of the grazing reserves will be determined.

Keywords: *Grazing land, suitability analysis, conflict management*

1. Introduction

Human population dynamics largely affect the demand for land in any society (Martin, et al., 2020; Wang, et al., 2020). One may say that, this dynamism leads to scarcity of land resources in communities (Nhim, et al., 2019; Depauw, et al., 2019). Globally, competition for the acquisition of land leads to conflicts and disputes (Berry, 2018; Kandel, 2017); and this have culminated in loss of lives and properties in many countries and more severe in Nigeria in recent years (Furini, 2019). Herdsmen have intermingled with farmers for centuries, with established reciprocal-trade relationship. However, these ancient practices and many generations of coexistence have been threatened by many modern factors such as; population growth, advancement in technology, increasing commercialized agricultural production and climate change (Fratkin, Elliot 1997). These factors have led to the expansion of agriculture on formerly shared grazing lands and have increased tension and conflicts between farmers and herdsmen in many parts of West Africa. Azuwike (2010) recorded almost 30 conflicts between Fulani herdsmen and different communities across Nigeria which is as a result of grazing activities (improper/ over grazing). Soetan (2015) quoted The Punch Newspaper report in its 15th Aug, 2015 publication, of a death toll of 621 people in 7 months, from clashes involving Fulani herdsmen, with more than half of this deaths occurring in Benue state in a single day of violence that left many thousands of people homeless.

Farmers and herdsmen in Nigeria have been at conflict for several years over the use and control of land for farming and grazing. Most of the grazing reserves that were designated for grazing of cattle were overtaken by farmers and corrupt government officials. This scenario brought about conflicts between the farmers and the nomads that resulted into loss of lives and properties over the years.

The management of this conflict started as far back as colonial era when the use of land was designed to cater for the farmer for farming and the pastoralists for grazing cattle. Grazing lands, farmlands and game reserves were provided in most of the states in Nigeria. In addition, cattle routes were also provided for the purpose of migrating pastoralists from one place to another as the session and climate changes. These provisions didn't take into consideration the growing

population in Nigeria. The increase in population has increase the demand of land and causing conflict among the inhabitants of the land.

Urbanization and rapid population growth in the developing world Nigeria inclusive have put the nomads under pressure, from the land use and land cover change analysis of different author across Nigeria for years, there has been a great change due to pressure on land (Chigbu et al. 2016). This is as a result of urban expansion and development from a growing population. This led to the question what do the future hold for the nomads if there is no law, policy and provision for a land for grazing for them across the globe and particular in a nation with diverse tribe, ethnic culture and religion. Increased enclosure and fencing of land have reduced the amount of land available for this practice.

Changes in weather pattern distribution, average weather condition are one of factors that contributes to periodic movement of the nomads from one place to the other in search for pastures. More than35% of Nigeria land is threatened by desertification and that makes livestock malnourished and underfed. Also, a vector borne and 12 other infectious diseases of humans and animals were discovered to its spread owning to climate change (Shuaibu, 2011).

Failure of traditional instruments of reconciliation, such as compromise and consensus fuel conflicts between the nomads and farmers. On the one hand, local institutions have largely lost their authority, and on the other, few institutional innovations have been developed (Hasseling and Ba 1994; Kirk and Adokp-Migan 1994 in Kirk 1999).

Crop damage by herders' livestock, cattle corridors and grazing lands encroachment, and blockage of water points by farmers are the predominant manifest causes of the conflicts. A perennial water pond, an international stock route, and some Fulani rainy season camps (in Mashekari, Zamfara State) were all blocked/converted to farmland in the exercise.

The aim of this study is to use statistical tools in order to establish a criterion for sighting viable, suitable, reliable and sustainable grazing area in Yobe state of Nigeria that can completely eliminate or at least prevent conflicts between the herdsmen and the farming communities. This was achieved through the following objectives.

- Social survey data acquisition from the herdsmen and farmers for the establishment of grazing areas in Yobe state
- Statistical analysis of the acquired survey data.

2. **Material and Methods**

2.1. Study Location

The study area is Yobe State. The state lies approximately within latitude 11^0 50' to 12^0 30' N and longitude 11^0 20' to 10^0 40' E. It falls within the zone 32 of the WGS 1984 on UTM projection. Yobe State borders the Nigerian States of Bauchi, Borno, Gombe and Jigawa. It also borders the Diffa Region and the Zanders region to the north in the Republic Niger. Figures 1 shows the location of Yobe state in the map of Nigeria.

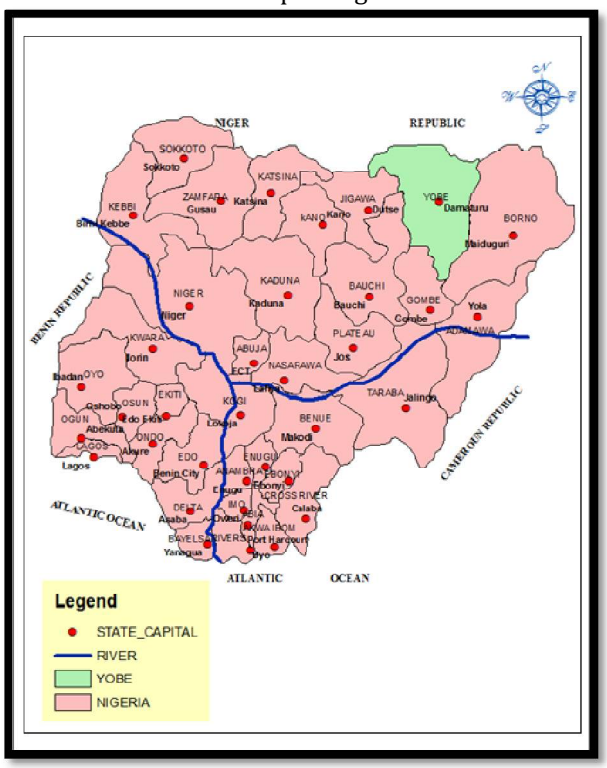

Figure 1.0: Map of Nigeria Showing Yobe State in Green

2.2. Method

The materials used in this study was Statistical Package for Social Sciences (SPSS) for analyzing the social survey that was conducted. The data acquired from social survey include the respondent's opinion on grazing land policy, the government plan to create grazing reserve in each state of the Federation, ideal size of the grazing reserve and its location in Yobe state. Number of clashes between a farmers and herdsmen and causes of conflict and migration.

A sample data of 400 respondent was chosen for the research. The data acquired from the social survey were:

- Best grazing land policy to be adopted by government,
- Size of grazing area
- Reasons for nomads and farmers conflict

These data were acquired from 400 respondent as sample data that is represents the entire farmers and nomads in the state.

3. Results

Frequencies of the following data was obtained:

- Best grazing land policy to be adopted.
- Suitable location of grazing area.
- Major causes of conflict between herdsmen and farming host communities.
- Reasons for herdsmen migration.
- Frequency of herdsmen migration.
- Average distance covered by cattle per grazing day.

Relationships between various variables were established in order to determine whether one variable is dependent on the other. These established relationships are:

- Occupation Vs involvement in conflict.
- Migration status Vs involvement in conflict.
- Migration status Vs causes of conflict.
- Frequency of conflict Vs herdsmen relationship with host community.
- Frequency of conflict Vs education background
- Frequency of conflict Vs frequency of migration.

The higher the frequency indicate the acceptable opinion of the respondents. Table 1-5 below shows the frequency distribution for each question.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	36	8.7	10.3	10.3
	private ranch	160	38.8	46.0	56.3
	public ranch	43	10.4	12.4	68.7
	grazing reserve	47	11.4	13.5	82.2
	4.00	62	15.0	17.8	100.0
	Total	348	84.5	100.0	
Missing	System	64	15.5		
Total		412	100.0		

Table 1: Best_Grazingland_Management

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	34	8.3	10.0	10.0
	in each local government	26	6.3	7.6	17.6
	in every senetorial district	170	41.3	49.9	67.4
	in every state	53	12.9	15.5	83.0
	in each geo political zone	58	14.1	17.0	100.0
	Total	341	82.8	100.0	
Missing	System	71	17.2		
Total		412	100.0		

Table 2: Grazingland_Location

	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	farmers encroachment into cattle route and grazing areas	122	29.6	30.7	30.7
	nomads encroachment into community farms	193	46.8	48.6	79.3
	cattle rustling	29	7.0	7.3	86.6
	insufficient foliage and water	53	12.9	13.4	100.0
	Total	397	96.4	100.0	
Missing	System	15	3.6		
Total		412	100.0		

Table 3: Cause_of_Conflict

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	1	.2	.2	.2
	lack of foliage and water	187	45.4	45.8	46.1
	security	195	47.3	47.8	93.9
	pest and disease	20	4.9	4.9	98.8
	all of the above	5	1.2	1.2	100.0
	Total	408	99.0	100.0	
Missing	System	4	1.0		
Total		412	100.0		

Table 4: Reason_for_Migration

		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	.00	2	.5	.5	.5
	twice a year	61	14.8	14.8	15.3
	annually	55	13.3	13.4	28.7
	every two years	88	21.4	21.4	50.1
	>2years	205	49.8	49.9	100.0
	Total	411	99.8	100.0	
Missing	System	1	.2		
Total		412	100.0		

Table 5: Migration_Frequency

		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	.00	2	.5	.5	.5
	1-5km	90	21.8	22.0	22.5
	6-10km	110	26.7	26.9	49.4
	11-15km	199	48.3	48.7	98.0
	>15km	7	1.7	1.7	99.8
	12.00	1	.2	.2	100.0
	Total	409	99.3	100.0	
Missing	System	3	.7		
Total		412	100.0		

Table 6 : Livestock_Distance_Coverage

Chi-squared test was used to test the measure of relationship between the observed variables vii to xii. Chi-square measures reliability by comparing the observed frequency distribution with expected distributions. The basic computation eqaution for X^2 is:

$X2 = \sum(\text{observed frequency} - \text{expected frequency})^2/\text{expected frequency}$.

In order to accept or reject the establish relationship between variables, a level of significance of 0.05 was adopted for accepting or rejecting the hypothesis. Thus, a statistical test can be fairly significance, significant, highly significant and most highly significant. If the hull hypothesis was rejected at $\alpha = 0.10$, $\alpha = 0.05$, $\alpha = 0.01$ and $\alpha = 0.002$ respectively.
The following table 7-12 are the statistical analysis using the chi square method.

		number_of_times_of_conflict				Total
		none	1-2 times	3-4 times	>4times	None
Occupation	livestock rearing only	46	35	14	12	107
	crop cultivation only	35	35	6	4	80
	both 1 & 2	69	73	26	12	180
	none	20	6	2	0	28
Total		170	149	48	28	395

Table 7A: Occupation * number_of_times_of_conflict Crosstabulation
Count

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	17.966(a)	9	.036
Likelihood Ratio	19.412	9	.022
Linear-by-Linear Association	2.241	1	.134
N of Valid Cases	395		

Table 7B: Chi-Square Tests
a 2 cells (12.5%) have expected count less than 5. The minimum expected count is 1.98

		number_of_times_of_conflict				Total
		none	1-2 times	3-4 times	>4times	none
migration_frequency	twice a year	56	62	27	12	157
	annually	43	39	5	8	95
	every two years	17	5	3	5	30
	>2years	16	5	4	2	27
	5.00	1	0	0	0	1
Total		133	111	39	27	310

*Table 8A: Migration_Frequency * Number_of_Times_of_Conflict Crosstabulation*
Count

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	22.443(a)	12	.033
Likelihood Ratio	24.242	12	.019
Linear-by-Linear Association	2.851	1	.091
N of Valid Cases	310		

Table 8b: Chi-Square Tests
a. 8 Cells (40.0%) Have Expected Count Less Than 5. The Minimum Expected Count Is .09

	Cause_of_Conflict				Total
	farmers encroachment into cattle	nomads encroachment into	cattle rustling	insufficient foliage and water	farmers encroachment into cattle

		route and grazing areas	communi ty farms			route and grazing areas
migration_frequency	twice a year	58	71	9	15	153
	annually	33	28	8	25	94
	every two years	13	6	5	5	29
	>2years	10	8	5	3	26
Total		114	113	27	48	302

*Table 9A: Migration_Frequency * Cause_of_Conflict Crosstabulation Count*

	Value	**df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	25.426(a)	9	.003
Likelihood Ratio	24.146	9	.004
Linear-by-Linear Association	2.128	1	.145
N of Valid Cases	302		

Table 9B: Chi-Square Tests

a 4 cells (25.0%) have expected count less than 5. The minimum expected count is 2.32

		Community_relationship					Total
		very good	good	bad	very bad		very good
number_of_times _of_conflict	none	97	68	4	2	4	175
	1-2 times	61	74	12	3	1	151
	3-4 times	10	36	2	0	0	48
	>4times	14	12	2	0	0	28
Total		182	190	20	5	5	402

*Table 10A: Number_Of_Times_Of_Conflict * Community_Relationship Crosstabulation Count*

	Value	**df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	31.957(a)	12	.001
Likelihood Ratio	34.069	12	.001
N of Valid Cases	402		

Table 10B: Chi-Square Tests

a 10 cells (50.0%) Have Expected Count Less Than 5 the Minimum Expected Count Is .35

		Education_background					Total
		Islamic	Western	Both 1 & 2	None	8.00	Islamic
number_of_times _of_conflict	none	71	10	77	17	0	175
	1-2 times	80	22	36	11	1	150
	3-4 times	25	2	10	11	0	48
	>4times	13	1	5	9	0	28
Total		189	35	128	48	1	401

*Table 11A: number_of_times_of_conflict * Education_background Crosstabulation Count*

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	46.920(a)	12	.000

Likelihood Ratio	43.422	12	.000
Linear-by-Linear Association	.076	1	.783
N of Valid Cases	401		

Table 11B: Chi-Square Tests
a 7 cells (35.0%) have expected count less than 5. The minimum expected count is .07.

		migration_frequency					Total
		twice a year	annually	every two years	>2years	5.00	twice a year
number_of_times_of_conflict	none	56	43	17	16	1	133
	1-2 times	62	39	5	5	0	111
	3-4 times	27	5	3	4	0	39
	>4times	12	8	5	2	0	27
Total		157	95	30	27	1	310

*Table 12A:Number_of_Times_of_Conflict * Migration_Frequency Crosstabulation Count*

	Value	**df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	22.443(a)	12	.033
Likelihood Ratio	24.242	12	.019
Linear-by-Linear Association	2.851	1	.091
N of Valid Cases	310		

Table 12B: Chi-Square Tests
a 8 Cells (40.0%) Have Expected Count Less Than 5, The Minimum Expected Count Is .09

4. Discussion

Thirty-eight (38.8%) percent of the respondents prefer the private ranching against the current grazing reserve land policy that is currently operating in the state. only 11.4% prefer the current government own grazing reserve system. See table 1.

From Table 2, 41.3% of the respondents prefer to site the grazing area in senatorial district of the state. This means, in each senatorial district, there must have an area that is earmarked as grazing area for private use.

The site of each grazing site to be given to any individual should not be less than 900km^2. From Table 6, it can be seen that the average distance covered by cattle per day for grazing is 11 - 15km. That means the diameter, or one length of the grazing area is 30km, thus giving the approximate area of coverage to be 30km x 30km.

Table 3 indicates that the main cause of conflict is the encroachment of nomads into farmlands by the migrating herdsmen. From table 4, security, lack of foliage and water are the primary reasons for migration. Occupation is not factor that determines the rate of conflict. Table 7B reveals that there is no relationship between occupation and rate of involvement in conflict since the minimum expected count is more than 0.1. In Table 8 it shows the there is a significant relationship between frequency of migration and the rate of conflict. That means those that are always in migration are more prone to involvement in conflict. Table 10 indicate that there is no relationship between conflict frequency and the herdsmen relationship with the host community. Table 11B indicate there is a significant relationship between education background and conflict frequency. Those that are educated are mostly not involved in conflict as indicated in table 11B. there is also a significant relationship between frequency of migration and frequency of conflict. This was demonstrated in table 12B

5. Conclusion

This study reveals that private ranching system of grazing land is preferred against the present grazing reserve area that is owned by government. Groups or individuals should apply land as ranch for both grazing and farming. The land should not be less than 900km^2 for single allocation, and it should be within any of the three senatorial districts. Security, water and foliage will be the irresponsibility of the occupant with support from the government.

A very good relationship between the herdsmen and the host farming communities must also be established using media, traditional institution and religious leaders in promoting peace, love, and tolerance. The settlements within or nearby the ranches will be provided with basic amenities such as health centers, schools, water, that can also accommodate the settle herdsmen. This will reduce the rate of migration and minimize conflict between the herdsmen and farmers and boost productivity of agriculture.

6. Recommendation

From the analysis obtained, it was revealed that government should start processing and allocating land as private ranch for individuals or group for grazing and farming purposes and that that each senatorial district will have a land earmarked for these purposes. Each grazing reserve must have an area of not less than 900km^2. livestock security guards must be established and deployed to each grazing reserve in order to minimize cattle rustling and kidnapping of the herdsmen. The government should provide water supply facilities and ensure the availability of water and foliage throughout the seasons as a support to both herdsmen and farmers. This will prevent or minimize migration of herdsmen, enhance security and boost productivity.

Further research on this study to be conducted using remotely sensed images and ground survey techniques in order

- Identify, map and measure the size of all the existing grazing reserves and cattle routes within Yobe state including the encroached areas by farmers and other government agencies.
- Determine and map out all the access roads and neighboring settlements within reserves.
- Monitor foliage and water resources of available grazing reserves over a period of 15 years and hence determine rate of depletion.

This will Ultimately create a model that will enable farmers and herders use geographic space optimally.

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