Nature of Land Fragmentation in the Rural Milieu of Yobe State

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ABSTRACT

The phenomenon of land fragmentation poses significant challenges to agricultural development, particularly in rural areas like Yobe State, Nigeria, where over 80% of the population depends on agriculture for their livelihood. This study investigates the patterns, causes, and impacts of land fragmentation within Yobe State, employing a mixed-methods approach to gather both qualitative and quantitative data. Key findings highlight that land fragmentation is driven primarily by inheritance practices, urbanization, and infrastructural expansion. This division of land into smaller, scattered parcels has been observed to significantly reduce agricultural productivity, raising concerns about food security in the region. Using cadastral maps and land records, the research documents that most landholdings are small and irregular in shape, with distances between parcels affecting efficient land use. The study reveals that approximately 46% of households own more than eight fragmented parcels, each averaging less than 1 acre. The impacts of these small, scattered parcels on the productivity of crops, particularly rice, are severe, making it difficult for farmers to operate at a commercially viable scale. This fragmentation is also exacerbating the region's vulnerability to environmental degradation and food insecurity. The research underscores the urgent need for policy interventions that regulate land division, improve land consolidation practices, and enhance agricultural productivity. Addressing these issues is vital to ensuring sustainable agricultural practices and securing food supply in Yobe State.

Keywords: Nature, Land Fragmentation, Rural Milieu

1.0. Introduction

A substantial proportion of the global population depends on land as a critical source of income. As an essential component of production, land significantly contributes to wealth through agricultural output, thereby impacting livelihoods and living standards. However, land is a finite resource. The increasing global population has escalated the demand for agricultural land, thereby exerting pressure on land resources and leading to degradation, which undermines people's survival (Djurfeldt et al., 2017; McLennan & Garvin, 2012; Srinivas & Hlaing, 2015).

This population growth has resulted in ongoing land fragmentation, reducing the amount of available cropland. Notably, out of the over 570 million farms worldwide, more than 475 million encompass less than 2 hectares of land (Lee & Huang, 2018; Litescu et al., 2015; Platonova et al., 2011). This reduction in farm size is particularly evident in South Asia and in low- and lower-middle-income countries. Reports by Eze et al. (2011) and Kaugama et al. (2014) indicate that the majority of small farms are located in Asia and the Pacific, which account for 87% of all smaller farmlands globally.

Beyond small land sizes, factors such as spatial distribution, parcel types, and quantities contribute to land fragmentation (Burton & King, 1982). There is no explicit definition of land fragmentation in any of the nation's existing legislation. Indirectly, it is referred to as the minimum lot size for subdivision in laws like the Yobe State Land Act of 2007 and the Yobe State Land Rules and Regulation of 2009. Local Area Plans (LAPs), however, set the minimum size for development in metropolitan areas.

Land, therefore, remains a vital resource for job creation and economic development through agriculture, despite its arbitrary division into rural and urban areas in Nigeria. Over 80% of rural residents in Nigeria rely

on agriculture, making rural land their most valuable asset (Ifegbesan et al., 2016; National Planning Committee, 2011; Olowa et al., 2013). The agricultural sector forms the backbone of Nigeria's national economy, significantly contributing to the GDP. Studies by Anigbogu et al. (2014) and Djurfeldt & Sircar (2018) demonstrated a strong positive correlation between the agricultural sector and GDP, underscoring the importance of rural land resources. Using data from the World Development Indicators (WDI) for selected periods, Akintayo & Lawal (2016) affirmed this relationship.

Currently, desertification affects eight states in northern Nigeria (Yobe, Sokoto, Katsina, Jigawa, Kano, Kebbi, Borno, and Zamfara. These states alone comprising 27.5% of the country's area, which are predominantly rural (Dary et al., 2017; Mabogunje, 2010; Papadopoulou et al., 2011; Sudhakar Reddy et al., 2018). This highlights the critical role of rural lands in the national economy, necessitating their acquisition (Gashua et al., 2018; Liu, 2018; Long et al., 2012; Tian et al., 2017). According to Kakwagh et al. (2011) and Olayiwola & Adeleye (2015), primary methods of acquiring land in rural areas include leasing, outright sales, pledges, community land exchange, and inheritance, collectively known as the "land tenure system" (Asiama, Bennett, & Zevenbergen, 2017; Jürgenson, 2016; Sulieman, 2018).

The increasing pressure on limited land resources is a major concern for the state, exacerbated by land fragmentation and the inheritance of small parcels, which reduces productivity by making parcels too small for significant economic use. As a result, many farmers resort to subsistence farming. Despite the recognized issue of land fragmentation, Yobe state has not been the focus of empirical research due to its limited arable land. The ongoing land fragmentation in Yobe state may eventually affect food security. Therefore, a comprehensive understanding of the causes and effects of land fragmentation is crucial, and this study aims to assist government agencies and policymakers in developing practical solutions.

2.0 Methodology

2. 1 Study area

Yobe State was carved out of the former Borno State by Ibrahim Badamasi Babangida's military regime on 27 August 1991. It has its capital located at Damaturu. It has a total land area of 47,153 km^2 and is located between latitude 11° North and longitude 13.5° East (Yobe State Government, 2016; Zemba et al., 2018). Its traditional neighbours to the east and southeast are Borno state, Jigawa state to the northwest, and Bauchi and Gombe states to the south-west.

Additionally, the 323km-long north and the Niger Republic have a shared international boundary (Kaugama et al., 2014; Tiwary, 2017). According to the last census conducted, Yobe State has a total population of 2.321 people, however the population projection for 2011 shows that number to be 2,757,000 million (National Population Commission, 2010).

As reported by the National Population Commission, the total population figure of Yobe State is about 2,321,591 million, which comprises a total number of 1,206,003 Males while the total number of females is 1,115,588. However, considering its high population growth rate estimated at 2.8% per annum according to the National Bureau of Statistics (NBC), the State's population is estimated to be about 3.712 million in 2023. On the other hand, Children under the age of 5 constitute about 20% of the population by implication; the State needs to take urgent measures to boost the economy and invest comprehensively in social and physical Infrastructure to tolerate even the existing standard of living of the population (CBN, 2017; National population Commission, 2010).
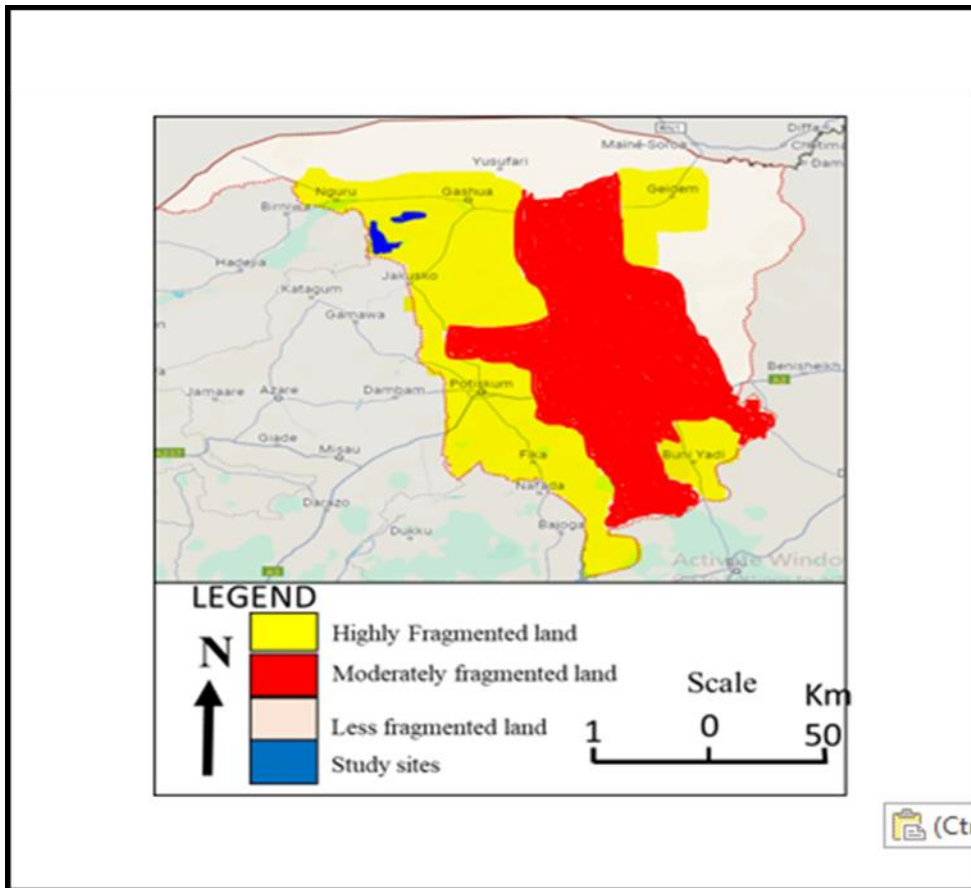
Figure 4: Map of Yobe State showing land fragmentation situation

2.2 Methods of data collection

This study is exploratory in nature and aims to comprehend how people feel and think about the nature of land fragmentation in Yobe State (Creswell, 2013; Ranjit Kumar, 1996). Because there is limited information available and no prior research on land fragmentation in Yobe State, this technique was selected to shed light on its definitions, underlying causes, and implications. Data collection for the study includes both primary and secondary sources. A combination of a qualitative and quantitative technique was used to gather the main data. Focus group discussions (FGD) and semi-structured interviews with key informants were two methods used by the qualitative approach to gather data. Through a structured interview, the quantitative technique assisted in gathering the opinions of the homes (HHs). The topic was better understood because to the mix of qualitative and quantitative methodologies (Creswell, 2014). Multiple-choice and category questions were created using the data gathered from the Key-informants and the FGD and distributed to the HHs in the research region.

2.3 Primary data collection

2.3.1 Key-informants interview

In-depth conversations were conducted during the semi-structured interview with the key informants, during which the respondents were questioned using pre-written, open-ended questions (Shamsoddini, 2015; Sulieman, 2018), followed by probing follow-up questions to extract their own ideas (Leavy, 2017). Our knowledge of the concept of land fragmentation, its causes and effects, and practical solutions to reduce land fragmentation in Yobe State has considerably increased because of the study by Gao et al. (2018). The State Ministry of Agriculture (SMoA), the Ministry of Work and Housing (SMoWH), which are all in charge of managing and administering land in Yobe State, were the main informants (Table 1).

Table 1: list of Agencies of Key-informants (semi-structured interview)

Agency	Department/Division	No. of respondents
YOGIS	Department of Land Administration and	1
YOGIS	Management (DoLAM)	1
YOGIS	Department of Survey and Mapping (DoSAM)	1
SMoA	Cadastral Information Department (CID)	1
SMoWH	Department of Agriculture (DoA)	1
District Administration	Department of Human Settlement Land Sector	1

2.3.2 Focus group discussion (FGD)

A focus group discussion (FGD) can include up to twelve people and last up to two hours, according to (Ntihinyurwa et al., 2019). The open-ended nature of the questions allows for more in-depth analysis of the present opinions and the generation of fresh ideas. FGD allowed the researcher to learn about their viewpoints and understandings because the district head and other village leaders are the ones who are aware with the state of land fragmentation in their region. (1996, Ranjit Kumar). Additionally, this medium encouraged open communication and idea sharing, which aided in the gathering of information that is more pertinent and insights into the scenario of land fragmentation, as well as its causes, effects, and preventative actions in the study region (Pugalis et al., 2014). The FGD employed a similar interviewing process to that of key informants, concentrating primarily on the research region.

2.3.3 Structured interview with the HHs

The structured interview used a predetermined set of closed-ended questions and a few open-ended questions to interact with the respondents and ensure data comparability (Dijkstra & Poelman, 2014). The answers to closed-format questions may be given quickly, but the answers to open-format questions allow for greater expression and, as a result, less prejudice (Ntihinyurwa et al., 2019). They were compared to the opinions presented in the FGD and key informant responses. Face-to-face interviews with the HHs was place in their homes utilizing an android tablet and the open-source application KoBo Toolbox. The equipment helped to collect data from the HHs which were utilized to determine the Euclidean distance of the land parcels from the residence.

2.4 Secondary data collection

The YOGIS was used to gather secondary data, including cadastral maps and land records for the research region. The research area's land fragmentation pattern and other parameters were examined using cadastral maps between 2008 and 2019. In addition, materials from pertinent government organizations, including YOGIS, SMoWH, and SMoA, including books, reports, and laws, were utilized.

2.4.1 Data analysis

Thematic analysis was used to examine the qualitative information from the key informant interview, FGD, and open-ended questions from the structured interview (Maguire & Delahunt, 2017). Descriptive statistics were used in this part to process the structured interview's closed-ended questions using Kobo Toolbox and Microsoft Excel. Pie charts, graphs, tables, and text summaries were used to convey the findings. QGIS software was used to handle the spatial data, which included position coordinates and cadastral maps. By superimposing cadastral maps (shapefiles) between 2005 and 2020, spatial analysis was conducted to examine the trend of land fragmentation in the study area. The title number and citizenship identity number supplied by the HHs were used to retrieve the land information, such as parcel identity number, parcel sizes, land holding, and kind of land, from the research region's land records.

3.0 Result and Discussion

The fieldwork's findings are presented in this section. The perception of the HHs in the research region is provided after the perceptions of the key informants and the FGD. The main informants provide a general understanding of land fragmentation in Yobe State. The FGD sheds light on the study area's land

fragmentation, and the HHs offer their perspectives based on the findings from the key informants and FGD. This section explains how land fragmentation is defined in the context of Yobe State, then lists the many factors that determine land fragmentation, as well as its trend and underlying reasons.

3.1 Land fragmentation

From a planning standpoint, however, they see it as the division of land that results from the various topographies and diverse land types. In his words, "for instance, if an owner's land is in two separate landscape types—plain and slope—these two land categories must be distinguished during the planning phase by dividing the area into non-developable and developable. When the land is partially surrounded by buffer zones like river, stream, and high-tension ones, fragmentation also happens. The SMoA representative divided land fragmentation into three categories.

Table 2: The concept of land fragmentation as perceived by HHs.

Definition	Frequency	Percentage
Division of land parcel	32	97
Decreasing parcel size	16	48
Dispersed land parcels	2	3

Table 3 shows the similarities and variations in how the three sources of information define land fragmentation. Key-informants, FGD, and HHs.

Respondents / Definition	Key-informants	FGD	HHs
Division of land	✔	✔	✔
Decreasing land size	✔	X	✔
Scattering of land parcel	✔	✔	✔
Land ownership, land use fragmentation	✔	X	X

✔ =mentioned X=Not mentioned

3.2 The characteristics of land fragmentation

The following table illustrates the many aspects of land fragmentation, including the number of fragments, landholding and HH size, land type, shape and size of the portions, and distance from the home.

3.2.1 Number of parcels per HH.

Figure 5 shows that only 18% of the HHs (6 out of 33) possess one to two land parcels in the research region, whereas the remaining HHs own more than two parcels. Maximum is the owner of more than 8 parcels, or 46% of all HHs. The average number of parcels the HH owns is 8. Using the information from HH's interview, such as the title number and citizenship identity number, the land record was used to get this result.
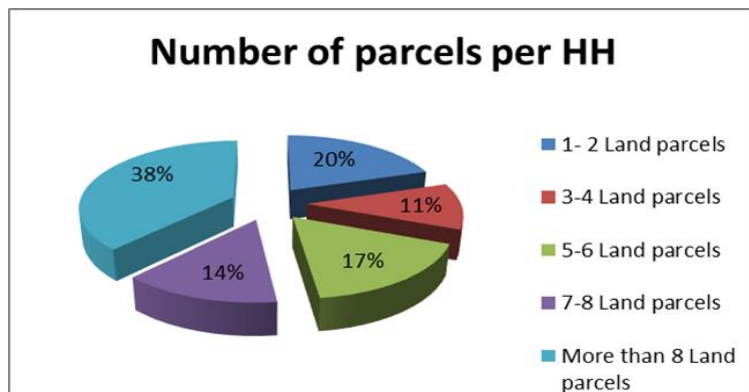

Figure 5: Number of parcels per HH

3.2.2 Landholding per HH and the household size

With 7 HHs (21%) owning property parcels with a size of less than one acre, the average size of a landholding is 3.212 acres. With an average of 8 people per HH, there are 266 total household members for the 33 HHs. There can be a maximum of 17 members and a minimum of 2. Using the title number/citizenship number, this information was taken from the land record.

3.2.3 Land Use Types

According to the results collected from the land records, the sole uses of the land in the research area are for agriculture and residential purposes. Paddy is grown on the majority (62%) of the parcels in the research region. No HH in the research region is cultivated exclusively for commercial purposes (figure 8), since only 1% of the land is utilized for cultivating cardamom (Figure 6). Through a multiple-choice response, the HHs provided this result.
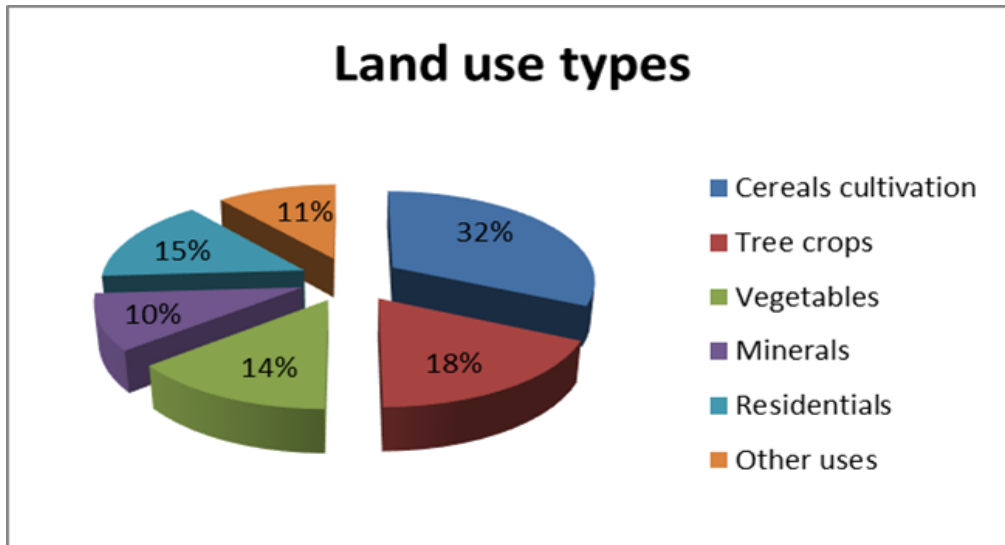

Figure 6: Land use type in the study area

3.2.4 The shape of the parcels

Results for the parcel shape were obtained using categorical responses, and they showed that 67% of HHs had portions that are irregular in form. There are no Households who claim that the form of their land parcel are particularly regular. However, according to 33% of Households, their shipments are practically uniform in shape (Table 4).

Table 4: The shapes of the land parcels in the study area.

Shapes of the parcels	Frequency	Percentage
Yes, quite regular.	5	15
Almost regular	9	27
No, not regular at all	19	58
Total	33	100

3.2.5 Distribution of the parcels: Distance and location

For the plots held by the HH who were interviewed, the Euclidean distance between them was calculated (section 3.4). With a high of 3425 meters and a low of 9 meters, the parcels' average distance from their home was 346 meters (m) (Figure 7). Majority of the HHs (28 out of 33) possess parcels that are between 0 and 500 meters away from their homes. Whereas 10 HHs (30%) own parcels that are between 500 and 1000 meters away. 11 HHs (33%) have portions that are 1000 meters or higher. 23 HHs (70%) further support this fact by claiming that their parcels are far away (Figure 9). Only 2 HHs (6%) said that their parcels were placed quite

distant from their home in their response. In Figure 10, a representative parcel distribution is displayed. 18 pieces make to one HH, with distances ranging from 32 to 771 meters. The parcels are dispersed and situated amongst parcels belonging to various HHs, as is evident.
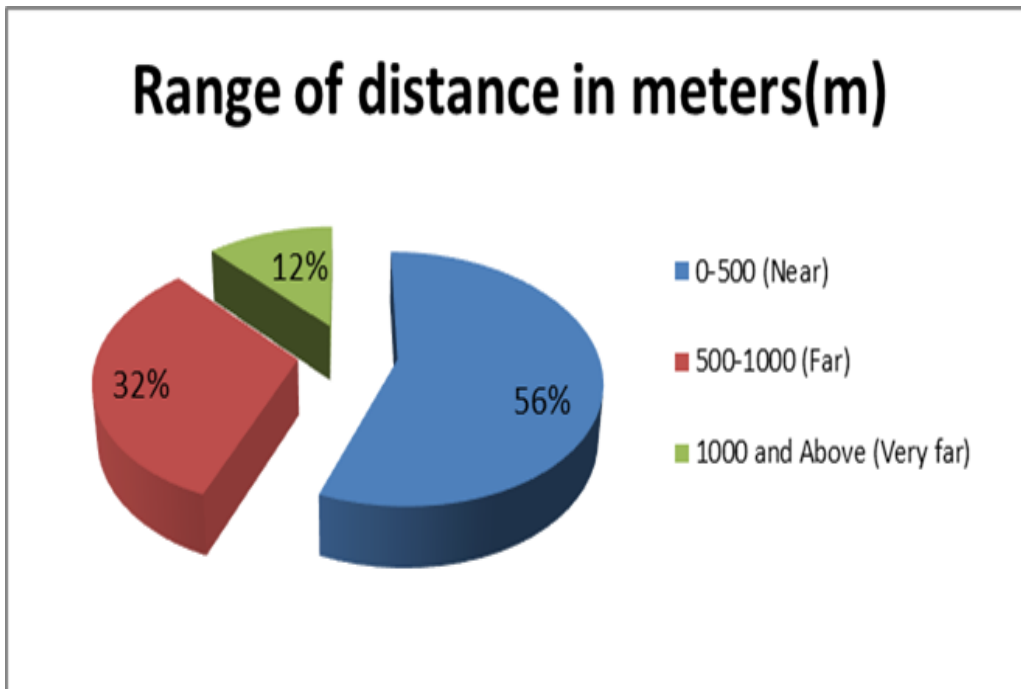

Figure 7: Distance of the parcels from the HHs in the study area

The average land size is 0.375 acres, whereas the largest and smallest sizes are 3.84 acres and 0.02 acres, respectively (table 6). The cadastral map was used to generate the parcel sizes. Maximum HHs have property sizes between 0.10 and 0.60 acres, while 19 HHs hold properties that are less than the 0.10 acres required for Yobe State land subdivision. Very few (8HHs) have plots that are larger than 1.20 acres. Overall, fewer than 1-acre properties make up the majority of HHs.

Table 6: Number of parcels and HHs with respect to the parcel sizes.

Range of parcel size (Acres)	Parcel		HHs	
Frequency	Percentage	Frequency	Frequency	Percentage
0-0.10	37	14	19	58
0.10-0.30	117	43	29	88
0.30-0.60	78	29	29	88
0.60-1.20	27	10	17	52
1.20 and above	12	4	8	24
Total	271	100		
Average parcel size = 0.375 acres		Maximum size=3.84 acres		
The total area of the parcels =102 acres		Minimum size=0.02 acres		

Note: There were 33 HHs interviewed in all. However, each HH may possess parcels of varying sizes, thus there will ultimately be more than 33 HHs in this situation.

4.3 The causes of land fragmentation

Table 7 lists the causes of land fragmentation in Yobe State as reported by the key informants and the FGD after an open debate.

Table 8: Different causes of land fragmentation in Yobe State

Causes \ Respondents	Key-informants						FGD
	DoSAM, YOGIS	DoLAM, YOGIS	CID, YOGIS	SMoWH	SMoA	LRO	
Inheritance system	✔	✔	✔	✔	✔	✔	✔
Conversion of land-use to other use	✔	✔	✔	✔	✔	✔	✔
Infrastructure development	✔	✔	✔	✔	✔		
Sale of land	✔	✔	✔	✔	✔		
Legal provisions in Land Act, 007	✔	✔	✔				
Urbanization	✔	✔					
Population increase		✔	✔				
Difficult terrain		✔					
Natural factors		✔					

The respondents explained the causes of land fragmentation as follows:

Inheritance, Conversion of land-use to other land use, Infrastructure development, Sale of land

Legal provisions in Land Act, 1978, Urbanization and Population growth.

Table 8: Perception of HHs on the causes of land fragmentation.

Causes of land fragmentation	Frequency	Percentage
Inheritance system	33	100
Sale/purchase	9	27
Conversion of agricultural land to other land use	6	18
Population growth	6	18
Infrastructure development	6	18
Urbanization	3	9

Table 9: Modes of land acquisition in the study area

Land acquisition	Frequency	Percentage
Inheritance	33	100
Purchase	5	15
Government allotment	1	3

4.4 The HHs' perceptions of the factors leading to land fragmentation.

Table 8 displays the HHs' perceptions about the causes of land fragmentation. This information was gathered using a multiple-choice question where they had the option of selecting more than one response. Inheritance was cited by 33 out of 33 HHs (100%) as the main driver of land fragmentation. This is further supported by the fact that, as shown in Table 9, 100% of HHs who indicated that inheriting land from their parents was the primary method of acquiring land in the research region. Out of 33 HHs, 9 (27%) listed sales and purchases as another cause of land fragmentation. Other causes of land fragmentation include land conversion, infrastructural expansion, and population increase. Three out of the 33 HHs also thought that urbanization was a factor in the fragmentation of land. However, none mentioned the study area's challenging topography and other natural characteristics as drivers of land fragmentation.

4.5 The nature of land fragmentation.

The features of land fragmentation, the majority of HHs in the research region have landholdings between 1 and 5 acres, and they possess more than two parcels. Most of the parcels are asymmetrical in design (table 4); they are dispersed and border other HHs' parcels on three sides (Figure 10). The estimated separation between the lots and their homes was, on average, 346 m (Table 5). Few HHs have lot sizes of 1.20 acres or more, whereas the majority of HHs have parcel sizes under 1 acre. In the study area, the tendency of land fragmentation has resulted in the fragmentation of around 18% of the land between 2008 and 2019.

4.0. Conclusions

Based on comprehensive interviews with key informants, focus group discussions (FGDs), and household (HH) surveys within one study region, this research investigates the nature of land fragmentation in the rural area of Yobe State. The study utilized cadastral maps and land records to examine the occurrence and evolution of land fragmentation. It effectively defined land fragmentation and identified its origins, consequences, and potential solutions within the context of Yobe State. Hence, the study explored diverse perspectives from government officials, local leaders, and households. Commonly, land fragmentation was perceived as the subdivision of land into smaller parcels. The study identified both ownership and physical fragmentation in the region. Contributing factors included large household sizes, limited landholdings, and parcels that were irregularly shaped, small, and scattered.

The current land fragmentation has raised concerns due to the increasing pressure on limited land resources and the threat it poses to national food security. The inheritance system, which divides land among family members, emerged as the primary factor driving land fragmentation in Yobe State. If this trend continues without the implementation of clear regulations and restrictions, future land fragmentation is expected to escalate. The principal source and consequence of land fragmentation were changes in land use from agricultural to residential purposes. This shift, if unchecked, could undermine the nation's goal of achieving rice self-sufficiency. As land parcels become smaller, they become less viable for agricultural use, leading to decreased food production and posing a significant challenge for the growing population reliant on agriculture for their livelihoods. In summary, the study underscores the urgent need for a comprehensive understanding of the causes and effects of land fragmentation in Yobe State. It emphasizes the necessity for government intervention and policy formulation to mitigate the adverse impacts of land fragmentation on food security and economic stability.

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