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Original Paper

Planning, Housing and Environmental Challenges of Hilltop Settlements in Zinariya and Azurfa Areas of Jos, Nigeria

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Abstract

Jos is a town in central Nigeria whose growth and development is closely associated with the commercial exploitation and mining of tin ore by the British colonisers at the beginning of the twentieth century. The terrain of the area is generally over 1000m above sea level. Hilltop settlements within Jos have sprang up as a result of the early mining settlements, rapid urbanization, urban expansion and rapid population growth which have exerted high demand for land for housing. The Government and Urban authorities have failed to provide planned and serviced lands on desirable sites to the expanding population, who in turn have resorted to self-help through the open market to provide shelter for themselves often without planning approvals and basic infrastructural facilities. Settlements on steep slopes and hilltops pose peculiar planning challenges arising from the nature of their terrain, costs of construction and maintenance of buildings, poor structural quality of housing, provision of social services and public facilities; poor drainage, inadequate liquid and solid waste management, haphazard development and proclivity to environmental hazards. The growth of hilltop settlements is expected to have major consequences on both humans and the environment, which are inextricably linked. Implications of these hilltop settlements on physical planning in Jos North includes; deviation from the city master plan, difficulty in the provision of services (both physical and social), chaotic and disorderly growth of the city, inaccessibility to vehicular traffic due to poor road network or lack of it. To carry out the study, descriptive research design and quantitative approach were used. primary data was collected from those households living on the hilltop settlements of Azurfa and Zinariya, which are the case study areas, the researcher distributed 400 questionnaires, out of which, 391 (97.8%) responded by filling and returning the questionnaires. Both qualitative and quantitative data were obtained using primary and secondary sources of data. Appropriate recommendations were made, and if implemented by government, planning agencies and property developers, this will improve the housing, environmental, infrastructural and the quality of lives of residents of the studied hilltop settlements.

Keywords

Nigeria, Jos, hilltop settlements, unplanned informal settlements, absence of basic services and infrastructure, absence of development control, affordable housing for the poor, need for inclusive planning

1. Introduction

Hilltop settlements refer to human settlements on steep slopes that gradually creep to the crest of the hills (Dung-Gwom & Jugu, 2017). UN-Habitat (2013), has defined hilltop settlements as "settlements on government, public or private land by the urban poor without lawful authority on topographically challenged areas of over 12° or 1300m above sea level". The pooled effect of high population upsurge and urbanization in a declining economy has thrown Nigeria into serious housing problems, Ironically, the low-income groups who constitute the majority in the society are the most affected by the current economic crunch and are pushed to the edges of the cities and undesirable sites for provide housing for themselves.

The problems of housing shortage are growing worse by the day in many developing nations including Nigeria. Conceivably, a major trait of housing crisis which is notable in urban centres in most developing nations is that of inadequate supply relative to demand (Olotuah, 2000). According to Onibokun (1990) Nigerian urban centres experienced acute problems of housing which was both quantitative and qualitative. This situation has not significantly changed in the past 30 years. Rapid population growth has exerted corresponding demand for land for housing and resulting in the spontaneous development of informal settlements and slums at peri-urban areas, on steep slopes and hilltop (Dung-Gwom & Oladosu, 2004; Dung-Gwom, 2007, 2008). The Urban authorities have failed to provide serviced lands on desirable sites to the teeming population who in turn have had to fend for themselves for residential land through the open market to provide shelter for themselves usually without basic infrastructure. This process has been described by Dankani (2003) in reference to Kano as 'shelter first' and 'planning later'. The teeming urban poor are more interested in shelter (of whatever form) than planning or public infrastructure.

2. Literature Review

2.1 Urbanization and Hilltop Development

Rapid urbanization in the second half of the 20th century accelerated urban growth and significantly influenced urban form in very profound ways, especially in the exploding cities of the less developing countries. In such countries, urbanization has been characterized by high levels of urban poverty (Dung-Gwom & Jugu, 2017). The urban poor unable to obtain land and housing through the formal channels have been forced to seek shelter in marginal lands with high environmental and ecological risks (UN-Habitat, 2005b). As noted by Basussi et al. (2010) advances in technology and the share scale and pace of contemporary urban growth, the most rapid changes in urban form, pattern and structure are taking

place where historical roots are weakest. They noted the share pace and scale or urban sprawl in both western and non-western cities and the need to move away from traditional analytical methods to new ones, which requires social science to interact with the earth sciences, urban economics and GIS in attempt to understanding and addressing these processes and physical outcomes.

2.2 Hilltop Settlements: A Theoretical Context

The term Hilltop settlements has a broad meaning and is known in various terms such as steep slopes (Huchzermeyer & Karam, 2016). Hilltop settlements are characterized by lack of basic services and durable housing conditions, insufficient living spaces and sanitation, insecure tenure, poverty and exclusion (UN-HABITAT, 2015). Hilltop developments are also characterized by low quality buildings made out of materials (such as corrugated irons, plastic, and cardboard), lack of proper utilities facilities. Hilltop settlements resemble the physical characteristic of slums and, shanty towns but they sometimes lack legal land ownership documents. These settlements are usually named differently in different countries-bustees (in India), favelas (in Brazil), pueblo (in Peru), kampong (in Indonesia), barong-barong (in Philippines), setinggan (in Malaysia), chumchaonbukruk (Thailand) and Gecekondu (Turkey); (see, Suditu & Vâlceanu, 2013; Willis, 2010).

2.3 Concept of Hilltop Developments.

In a restricted sense, slope is often used to refer to the angle which any part of the earth's surface makes with a horizontal datum. Four components of hill-slope morphology are identified. These are dimension, shape, slope and degree of surface irregularity (Young, 1971). Settlements or towns located in hill regions can be distinctly classified into four categories, as hill towns on gentle slope, hill towns on steep slope, hill towns on concave slope and hill towns on convex slope. According (Lakshya Geography India).

Table 1. Classification of Hills According to the National Building Code, 2005, India, Part III, Annexure G.

0m	150m	Low land
150m	300m	Hill land
300m	1000m	High land
Above	1000m	Mountain

Source: Malaysian Institute of Engineering, 2010.

From the above classification, hilltop developments are settlements with altitude of more than 300m above sea level. Altitude alone may not be the major defining variable for hilltop settlements. Slope and gradient may be more significant in terms of planning and housing development, provision of infrastructure and settlement stability. The Lehigh Valley Planning Commission (2008), Steep Slopes, Guide and Model Regulations has classified slopes in percentage as follows

0 - 10% grade Gradual

10% - 15% Moderate

15% - grade Steep

(Source: SCAP-Steepslopes2010>02_21_CR.pdf): The Lehigh Valley Planning Commission (2008).

Table 2. Degree of Slope and Development Potentials

Degree of slope	Development Potentials
0% to 3%	Generally suitable for all development and uses.
3% to 8%	Suitable for medium density residential development, agriculture, industrial and institutional uses.
8% to 15%	Suitable for moderate to low density residential development, but great care should be exercised in the location of any commercial, industrial or institutional uses.
15% to 25%	Only suitable for low density residential, limited agriculture and recreational uses.
Over 25%	Only used for open space and certain recreational uses.

Source: Soil Surveys of Lehigh/Northampton Counties, Pennsylvania(USA)

In general terms, therefore, land with slope gradient of more than 12% is regarded as steep and not suitable for most developments such as housing. Many American municipal authorities ban developments of slopes above 10%, while the maximum permissible slope is 15% in other uses. For many areas in Jos, for example, slopes are more than 25% which, theoretically makes them unsuitable for residential developments (see, Dung-Gwom &Jugu, 2017).

2.4 Nature and Conditions of Housing on Hilltop Settlements

UN-HABITAT (2013) pointed out that, hilltop settlements are generally characterized by three major conditions; high population density, low standards of housing and the experience of filthiness. Furthermore, the quality of dwellings and materials used and the variety of tenure agreements practiced within hilltop settlements can vary significantly (Naidoo et al., 2018).

Hilltop settlements are usually built with substandard materials, boards and zinc sheeting as well as recycled and mixed materials which make the houses very vulnerable (Bustillos et al., 2012). Unger and Rely (2017) declared that houses on hilltop settlements are densely packed and poorly built with all kinds of materials. Marx and Charlton (2013) asserted that hilltop settlements are characterized by structure that are constructed to varying degree of permanence with a variety of materials. Hindson and McCarthy (2014) have argued that there is a common misconception that all hilltop settlements comprise no more than flimsy, unhealthy, dangerous shacks, where in fact settlements differ in terms of structure erected, their durability and the internal and external environment they create. As much as hilltop settlements

have some common characteristics, each hilltop settlement is a unique system of building, internal settlement patterns and form of tenure. Some of the housing challenges found on hilltop settlements include lack of: a) water supply, wells and pipe water, b) proper sewage, c) proper drainage, d) steep slope and gradient, e) maintenance of hilltop green areas, f) parking space, f) proper waste management g) inaccessibility h) poor sanitation, etc.

2.5 Factors Influencing Hilltop Settlement Development

The factors influencing hilltop settlement development include: affordability of land on hilltops, increasing urban poverty and inequality; insecure land tenure; and globalization (UN-Habitat, 2017). The private land market's marginalization of the poor (Turner, 2018) and the inability of the formal housing sectors to provide low-cost housing stock to the majority of urban dwellers in the locations they desire (Cities Alliance, 2008) compel the low-income households to turn to an informal housing market where housing supply is weak and demand is ever high (Gunter, 2014), resulting in hilltop settlements.

Wahab and Agbola (2017) identified additional causal factors to include: lack of development (master) plans for rural and urban settlements; politics; corruption; imperfect land market; ever-increasing land and housing prices and service costs; over-commercialization of housing development process; lack of access to credit; as well as neglected and undeveloped government acquisitions.

Other forces identified in the literature are; growing affordability problems within the urban populations, which have adversely affected people's ability to house themselves (Dovey, 2012); very high rent/lease charged for building and land spaces for commercial purposes (Oduwaye & Olayide, 2010); lack of detailed regulatory urban plans and cumbersome procedures to obtain building permits (UN-Habitat, 2013); weak, ineffective, non-proactive planning policy; planners' lack of institutional capacity and resources to effectively plan and manage physical development at the local level (UN-Habitat, 2013); weak enforcement of planning and building regulations; non-adoption of and total disregard for inclusive and people-centred urban planning and development; inadequate planning personnel to control and police developments (Wahab, 2017) and lack of spatial data infrastructure (cadastral). Other causes of hilltop settlement developments on the Jos Plateau, includes the reoccurring crisis in the state and city which have led to the ethno-religious segregation within the city.

2.6 Environmental Challenges of Hilltop Housing Settlement

The environmental challenges of hilltop settlements are associated with unplanned use of land, contributing to urban sprawl and over-stretched infrastructure (Huchzermeyer, 2011). Inadequate access to clean water, good roads and drains, public transport, and reliable electricity. The situation also adversely affects the quality of life in the "formal" areas of the city, where urban run-off, downstream pollution from garbage and sewer discharged directly in rivers create serious environmental threats (Ikejiofor, 2016). Obtaining land for the construction of communal infrastructure (such as roads, drainage, water management facilities and public sanitation facilities) is usually a challenge (Durand-Lasserve, 2016). While there is strong social cohesion in the communities, public or green spaces for social

interaction, networking and recreation are lacking owning to poor or lack of planning and their topography.

In addition to the infrastructure deficit, some of these settlements are directly exposed to environmental hazards associated with landslides, flooding, poor drainage, environmental pollution (UN-Habitat, 2015).

2.7 Planning Challenges of Hilltop Settlements

Buildable lands available in hilltops are limited due to topographical features of the hills. As a consequence of this, hilltops in the suburbs or within or adjacent to the cities are used for development purpose due to its lower price compared to other sites on flat terrain, weak land policies, improper development plan proposals and techno-legal regime, and weak economic background of green areas. There is deterioration in the quality of living environment in these settlements due to unsuitable and unsafe building stock for habitation, insufficient infrastructure, narrow roads, inadequate open spaces and reduction in green areas, which are the outcomes of wrong planning and lack of effective building regulations and inappropriate planning and design solutions (Kumar, 2015).

2.7.1 Challenges of Hilltop Settlements; A Global Perspective

This section presents an overview of the planning challenges of hilltop settlements in Brazil, India and Italy.

a) Hilltop Settlements in Brazil

Brazil's urban growth rate increased during the 1930s and 1940s and reached its highest value between the 1950s and the 1970s. The growing number of inhabitants resulted in urban sprawl and the densification of inner-urban area (Bähr & Lara, 2011). Since then, high density neighbourhoods and apartment houses became popular (Aragão & Maennig, 2013), which was the starting point of Brazilian Gated Communities, the so called *condominios fechados*, e.g. BarradaTijucain Rio de Janeiro (Herzog, 2013). The rapid increase of metropolitan population also led to a growth of informal settlements, many of the main vacant are as of the centre (Athayde, 2011; Coy, 2006; Coy & Pöhler, 2002). In Rio de Janeiro much of this took place on the environmentally fragile and risk-prone slopes of the Atlantic Forest (Mata Atlântica). Poor migrants from other regions constituted the largest share of population growth and the main reason for the still growing favelas, despite the often-precarious living conditions with very poor infrastructure (Herzog, 2013). Informal settlements are often constructed without legal supply of basic infrastructure (Lara, 2011) like electricity, water or sanitation. Particularly, the lack of properly planned water run-off and sanitation which potentially adds to the risk level, as it may exacerbate slope destabilization. Buildings themselves are constructed in an engineered way, casting doubts on their foundation and capacity to withstand hazards like intense rainfalls and landslides.

Informal settlements were already considered a societal problem for Rio de Janeiro in the 1920s and 1930s when they continuously grew (Freire-Medeiros, 2009). often-unaffordable prices and a lack of adequate social housing policies forced many of the poor migrants to settle in marginal areas (Perlman, 2010). Such less-favoured and risky areas comprised the steep slopes of the massifs (Freire-Medeiros,

2013; Romero Jacobetal, 2015). The growing problem of slum expansion was increasingly perceived and institutionalized when the term favela became a category for informal settlements.

b) Hilltop Settlements in India

Shimla is one of the 80 hill stations which were established on preferred locations during British rule in India. It is the summer capital of pre independent India, planned and developed for a maximum population of 25,000 in a picturesque hill setting. Presently, Shimla is capital of the state of Himachal Pradesh, one of the most preferred tourist destinations in the country and the most important administrative and educational centre in the region. It houses a population of 169,000, as per 2011 census, which is much more than its planned capacity. As a result, to meet the demand of residential, commercial, educational, work and recreational facilities for this ever increasing population; Shimla once famous for its natural settings, beautiful buildings and marvellous townscape; has undergone tremendous change and has numerous issues and problems of development. It is one of the very few examples of tremendous urban development in environmentally sensitive and picturesque hill settings. but today the situation has so much worsened that the population of the city is around 3 lakhs. The proportion of slum population has been constantly increasing (A. Kumar. Cities 49, 149-158, 2015.)

c) Hilltop Settlements in Italy

The city of Naples, on the basis of a plant radio centric, has expanded over the years to oil spot: the small scale of the urban coastal area has forced the city, on one side, to gradually embrace the surrounding hills, now the site of major districts with high residential as Capodimonte, Vomero and, secondly, to invade the valley of Fuorigrotta-Coroglio to west, the alluvial plain of Sebeto up the slopes of Vesuvius, the north side of Piscinola-Miano and, finally, to spread beyond the municipal boundaries by uniting the continuous band of neighbouring countries.

Today, this endemic absence of directionality in the development, of course with the political-economic and ethical-cultural factors, is among the main causes of the weakness of the urban structure of the Campania and unformed growth of the conurbation of the city of Naples which covers, now, the whole province of Naples.

The Province, in fact, without a cohesive pattern of development continues to grow in an undifferentiated way in every direction, presenting itself as a high concentration without development. Despite the promotion of the sustainable development of urban and extra-urban territory through the minimum soil consumption being one of the main goals of the Campania Regional Law on Territory Government (Law 16/2004), the intense urbanization process, frequently chaotic and unplanned developments which has involved for a long time the regional territory and, above all, the urban area of Naples seems to contradict this attempt (Bencardino, 2012).

The hilltop Settlements in these case study areas show the failure of physical planning intervention to provide decent habitable areas for the urban poor who had to embark on self-help and communal effort to provide most basic shelter and urban services for themselves.

2.7.2 Case Study of Jos

The city of Jos is the largest settlement in Plateau State. Its origin is closely associated with commercial exploitation of tin ore (cassetterite) on the Jos Plateau and the construction of a railway line linking it with Port Harcourt and Lagos, thus opening the area into the orbit of the world economy. The tin mining led to the influx of migrants, mostly Hausas, lbos, Yorubas and Europeans who constituted over half of the population of the town, making it highly cosmopolitan. Initially, the indigenous people were hostile to foreign mining interest and did not join the mines nor did they moved into the mining camps to settle. This led the colonial masters adopting different administrative systems for the 'natives' and 'settlers' (or non-natives) in the mining camps and in the towns. This laid the seeds for segregation and friction between the 'natives' and the 'settlers'. Also due to the number of crises that erupted in Jos metropolis in the last two decades, there has been a practice of residential separation alongside religious inclination and eventually isolating the metropolis into mainly Christian and Muslim neighbourhoods (Dung-Gwom & Rikko, 2009). This is also one of the reasons that has led to the development of settlement on steep slopes and hilltops due to high demand for housing land. The general spatial pattern was the outward movement of Christians from the inner city to the periphery and the movement of Muslim faiths into the inner city neighbourhoods (see, Aliyu, 2011; Dung-Gwom & Rikko, 2009).

Jos, in the last two decades has expanded rapidly in all directions and unto steep slopes and hilltops, leading to recent informal settlements on steep slopes, hilltops and river valleys mainly by the urban poor. These Hilltop settlements face various and serious challenges such as; rugged topography which imposes high cost for the provision of infrastructure, lack of planning and development control, substandard housing, poor access, poor waste disposal systems and poor linkages with other parts of the city. The unique physical and ecological characteristics of hilltop settlements desire environmentally-sensitive planning and special intervention by the relevant planning authorities and the government to make them sustainable. The Doxiades Greater Jos Master Plan (1975 to 2000), had designated hilly area as country parks and green areas, however, due to the pressure for housing development arising from increasing urbanization and weak urban planning and development control from the 1990s onwards, uncontrolled slums started developing on hilltops. The Jos crises which stared in 2001had further exacerbated the process of rapid developments on hilltops and steep slopes in Jenta, Kabong, Azurfa and Zinariya areas. The latter two area being close to the University of Jos have sprung up to provide affordable housing to the rapidly growing staff and students' population of the University and spill over population from the nearby high density areas of Anguwan Rogo and Anguwa Rimi.

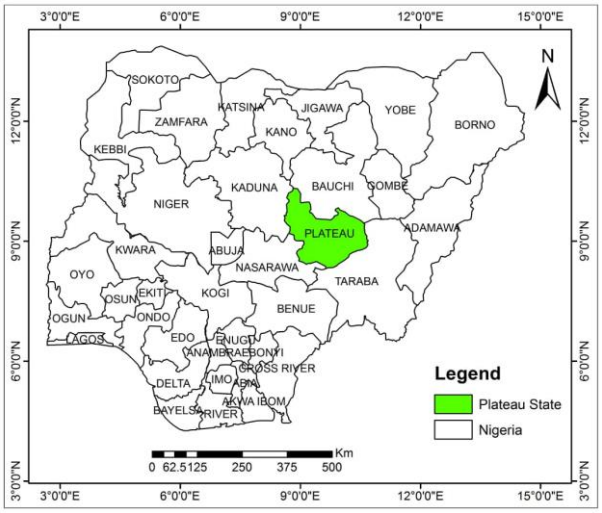

Figure 1. Nigeria Showing Plateau State

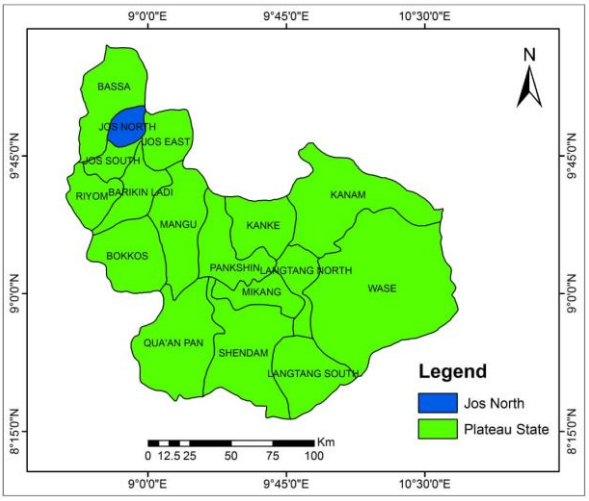

Figure 2. Plateau Showing Jos North

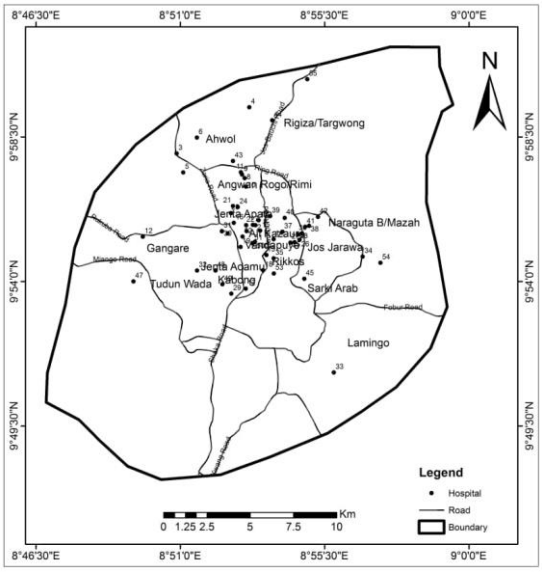

Figure 3. Map of Jos North

3. Research Methodology

A combination of the qualitative and quantitative approaches called the pragmatic approach was adopted for this study in order to collect data required for the achievement of the objectives of the study. Questionnaire was employed to collect information on the socio-economic and demographic characteristics of residents of sampled hilltop settlements in Jos; existing housing types and conditions; existing infrastructural facilities and services and the planning and environmental status of the areas. However, to improve study knowledge and develop theoretical and empirical literature the study used different published books, review internet websites, and journals, previous research papers regarding the challenges of hilltop settlement and housing problems in Jos North LGA and the world at large. This study used purposive sampling technique to choose its sampled hilltop settlements, choosing those close to the university of Jos that have grown very rapidly in the last 20 years due to several factors, a) the communal crises of 2001, 2008, 2010 etc. and the resultant residential mobility and relocations that have occurred; b) their nearness to the University of Jos and high demand for housing by both staff and students of the university; c) rapid increase in the urban population of Jos due to increasing insecurity and population displacements in Nigeria and especially in the northern parts of the country in the last 20 years, and d) lack of available and to affordable land within the city centre for housing development. Taro Yamane (1967) formula which is a simplified formula for proportion has become popular with researchers for these reasons. Denoting by n the sample size, Taro Yamane formula is given by n=*N/1+N*d^2* where *N* is the population size and *d* is the margin of error. Bearing in mind the estimated population of the sampled hilltop settlements with a total household population of 3258 amounting to 400 questionnaires that were used for the study.

Table 3. Distribution of Questionnaire

Sampled hilltop Neighbourhoods	Estimated household size (2021)	Percentage of household	Sample (no. of questionnaires)
Azurfa	1209	37.10	194
Zinariya	2049	62.89	206
TOTAL	3258	100%	400

Source: Authors Field Work, 2021.

3.1 Research Design

Research design is a comprehensive plan for data collection in an empirical research project. It is a blueprint for empirical research aimed at answering specific research questions or testing specific hypotheses, and must specify at least three processes: (1) the data collection process, (2) the instrument development process, and the sampling process (Bhattacherjee, 2012). A combination of the qualitative and quantitative approaches called the pragmatic approach was adopted for this study in order to collect data that is required for the achievement of the objectives of the study; physical planning implications of housing on hilltop settlements in Jos North Local Government Area of Plateau State.

Qualitative approach was employed to map out and describe the characteristics of hilltop areas, map out the spatial extend of the hilltop areas, show locations of existing physical infrastructure available in terms of spatial spread and distribution in space. While the quantitative approach was used to collect the socio-demographic characteristics of the respondents, their satisfactions with the quality of the physical environment, what they desire to be provided, how it will be provided and the physical planning strategies to control development on the hilltop areas of Jos North for sustainable development.

3.2 Research Approach

A Deductive approach is an opposite method to inductive and applied approach, whereas, when a researcher bases his study on existing theories establishes a logical relationship between concepts by developing hypothesis and then concrete on empirical evidence (Neuman, 1997); afterwards the assumed hypothesis is tested, enabling scientists to verify whether the theory is in consistence with the reality. Having said that, this study was conducted using a deductive approach, whereas, the research findings were compared to the existing literature and used to draw conclusions and suggestions for further research.

3.3 Sources of Data

The study by using standardized questionnaires collected primary data from the hilltop settlers of the two case study areas in Jos North (Zinariya and Azurfa) other sources of primary data such as semi structured interview, reconnaissance survey and satellite imagery were also used as data collection instruments. However, to improve study knowledge and develop theoretical and empirical literature the study used different published books, reviewed internet websites, and journals, previous research papers regarding the challenges of hilltop settlements and housing problems in the study area and around the world. The sources of data are basically primary and secondary sources.

3.4 Sampling Design

In statistics, the target population is the specific population about which information is desired (Ngechu, 2004). Mugenda (2007) explain that the target population should have some observable characteristics, from which the researcher intends to generalize findings of the study.

The target populations of this study were those people living around hilltop area of Jos North, particularly around the case study which is hilltop settlements around University of Jos (Zinariya and Azurfa). According to the data obtained from the reconnaissance survey around 3258 people are living on the hilltop settlement part of the case study. To address the research objectives and research questions, this study used 400 people as the target population of the study which was gotten through the Yamane's, (1967) sample size determination formula with a confidence level 95% as described.

3.5 Sampling Technique

The study made use of the purposive sampling technique, the main goal of purposive sampling is to focus on particular characteristics of a population that are of interest, which will best enable you to answer your research questions. This study used purposive sampling techniques to choose its sample hilltop settlements, choosing those close to the university of Jos and have grown very rapidly in the last 20 years due to several factors, a) the communal crises of 2001, 2008, 2010 etc. and the resultant residential mobility and relocations; b) their nearness to the university of Jos and demand of staff/students especially, c) rapid increase in the urban population of Jos due to increasing insecurity and population displacements in Nigeria and especially in the northern parts of the country in the last 20 years, and d) lack of availability of affordable land within the city centre.

3.6 Data Measurement

The data obtained were measured from Five point Likert scale being one of the most reliable measurement scales and very popular in most of current studies, this scale was applied in this study. Interval with five-point scale is calculated using Best (1977) formula: (5-1)/5=0.80. To calculate the mean value of the respondent's opinion, the study used itemized rating scale to construct a range. This range was used to measure the perception level of the respondents towards each variable.

Therefore, the study used Best (1977) rating formula to interpret the score value which were obtained from the primary data as follows:

4.22-5.00 are considered as strongly agree

3.42-4.21 are considered as agree

2.62- 3.41 are considered as Average/moderate

1.81- 2.61 are considered as disagree

1.00-1.80 are considered as strongly disagree

3.7 Data Analysis

Initial and final data retrieved were screened using descriptive statistic indexes like frequency distribution, percentage, mean and standard deviation. After information was collected from different sources, mainly the information obtained through questionnaire were scaled, once the information was scaled then the researcher organized in appropriate categories related to respondent's view in general and in terms of the research variables in particular. Measures were taken to insure the validity of the questions for this research. This study used content validity to check the validity of the questionnaires. This study used Cronbach's coefficient alpha in order to measure the reliability of the scales used. Based on the SPSS result for the whole questionnaires the Cronbach's coefficient alpha is equal to .865, which means the questionnaires were consistent and reliable to carry out this study.

4. Data Presentation, Analysis and Discussion

4.1 Socio-Economic and Demographic Characteristics of Respondents

the Sex distribution of respondents revealed that 50.6% of the sampled population were male using a judgement/purposive sampling method while 49.4% were female. This indicates that the percentage of male population is greater than female in the study area which tallies with the national distribution ratio of male and female in Nigeria (World Bank, 2020).

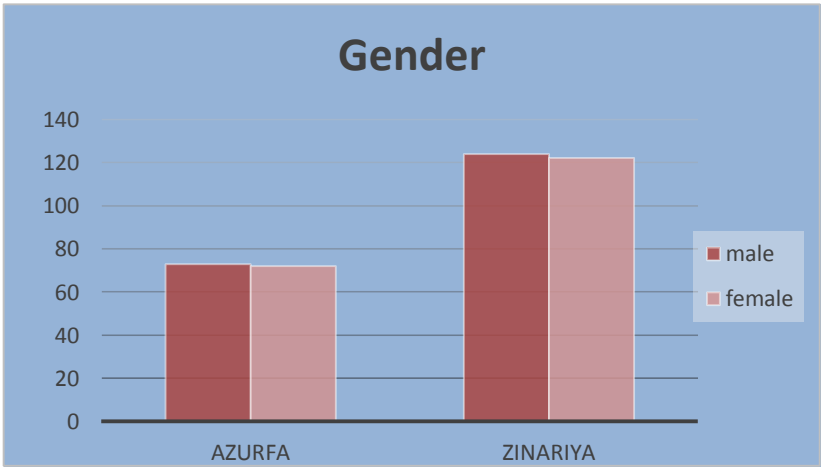

Figure 4. Gender Distribution

Source: Authors Field Work, 2021.

The marital status of the households shows that for both hilltop settlements, 257(65.7%) were married, 52(13.3%) were single, 47(12.0%) were either divorced or separated and the remaining 35(9.0%) of the

respondents were widowed. The result revealed that the majority of respondents were married households and followed by single households.

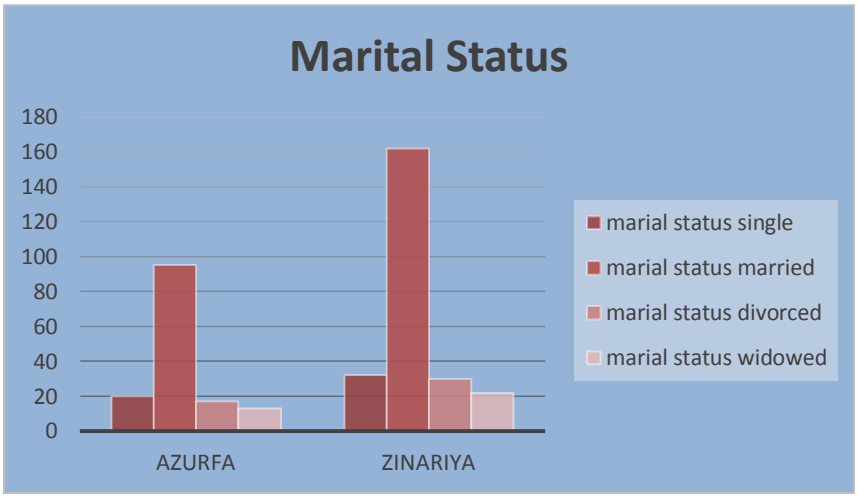

Figure 5. Marital Status

Source: Authors Field Work, 2021.

Out of the total respondents, 302(77.2%) were exposed to education at one stage or the other while 89(22.8%) didn't receive any form of formal education at all. These shows that one third of the respondents were semi-literate. A few number of residents (5.1%) were degree holders.

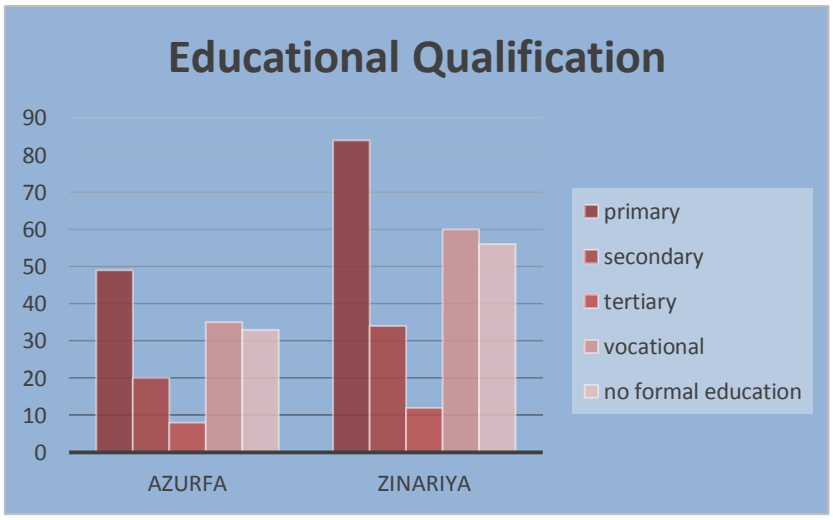

Figure 6. Level of Education

Source: Authors Field Work, 2021.

Related to respondent's age, 161 (41.2%) of respondents were between 18- 30 years, 201 (51.4%) of respondents were between 31-50 years and the remaining 29 (7.4%) of respondents were above 51 years.

Majority of the respondents living on the hilltop areas of Azurfa and Zinariya were between the ages of 31-50 years indicating that these households were in the productive age group.

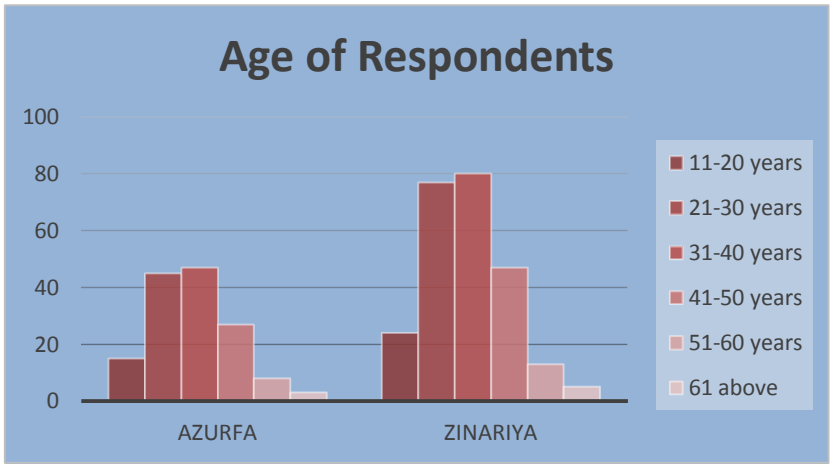

Figure 7. Age of Respondents

Source: Authors Field Work, 2021.

The occupation profile of the respondents influences locational choices for residence by residents of the sampled hilltop neighborhood taking into consideration social status; affordability and availability. Figure 7 show that 14.3% of the sampled population were farmers, 9.2% were public servants, 40.2% were into trading, 8.4% and were artisans. One-fourth of the total population were unemployed reflecting the high rate of unemployment in Nigeria almost tallying with the national figure which is at 33.3%.

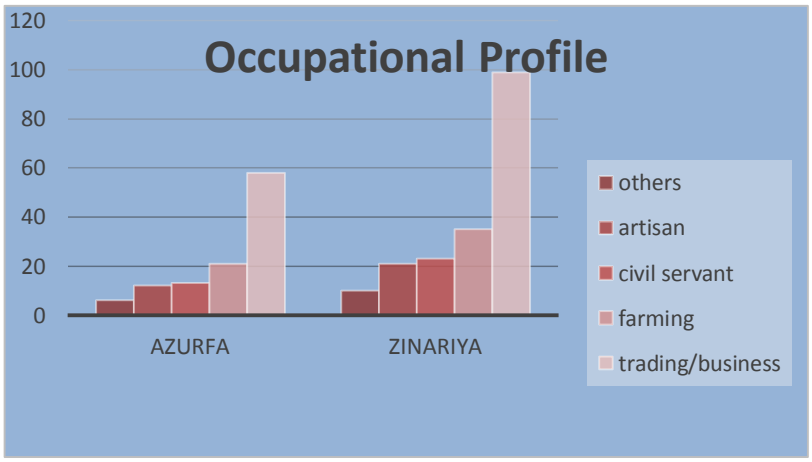

Figure 8. Occupational Profile of Respondents

Source: Authors Field Work, 2021.

Income variable of respondents per month as presented in Figure 6 reveals that 32.7%, earn N20, 000 or less per month which are the majority; followed by 22.8% who earn between N20, 000-N40, 000 monthly

and 16.9% who earn between N40,000-N60,000. Similarly, 27.6% earn above N60, 000 per month. The income level is an index of measuring the poverty line of a country. Given the national average family of 6 persons and using the world Bank's new international poverty line of spending not less than $1.90 per person per day (based the current official exchange rate of the 500 Naira to 1 dollar), this indicates that most residents of hilltop area live below the international poverty level.

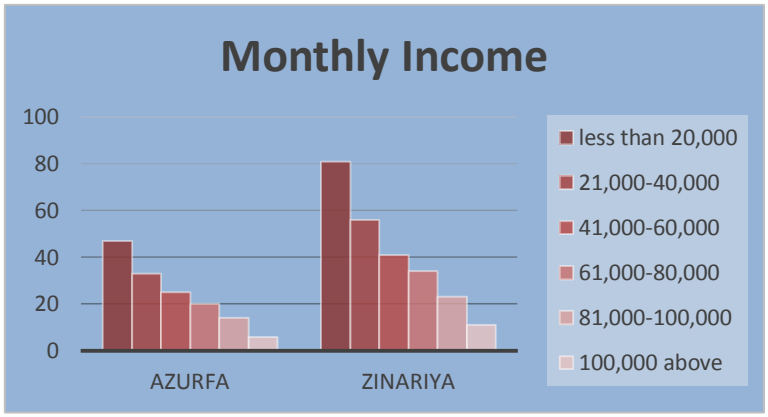

Figure 9. Monthly Income of Respondents

Source: Authors Field Work, 2021.

19.2% of the hilltop dwellers have an average household size of 3 persons, 33% of the households have an average household size of 8 persons, followed by 30% with a household size of 13 persons, 12.5% with 18 persons, while 4.1% have a household size of more than 21 persons. The average household size in Nigeria is 6 persons per household. The situation in hilltop settlements in Jos is not quite different from the national average. Polygamy and religious factors account for the large household sizes that prevail in some families in the areas. Most of the population in these areas are Muslims who have more than one wife.

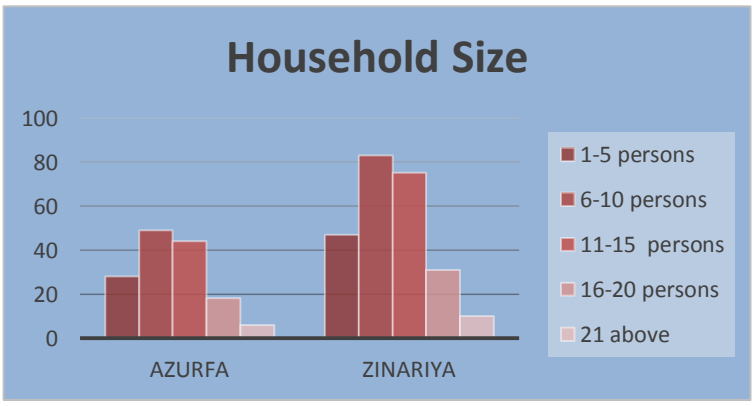

Figure 10. Household Sizes

Source: Authors Field Work, 2021.

70.3% of the sampled population have lived in the area for the period of 1-10years, while 27.4% have lived in the area for the period of 11-20 years while 2.3% of the population have lived there for 21-30years. This indicates that these hilltop settlements are relatively new and upcoming settlements. Zinariya settlement has grown rapidly in the last 37 years following the de-gazetting of the Naraguta Forest Reserve in 1986 into a residential area in the Jos metropolis. Given their close proximity to the University of Jos, the areas have grown very rapidly providing residential accommodation to students and staff of the university. These are around Anguwan Rogo and Anguwan Rimi to the west of the University of Jos.

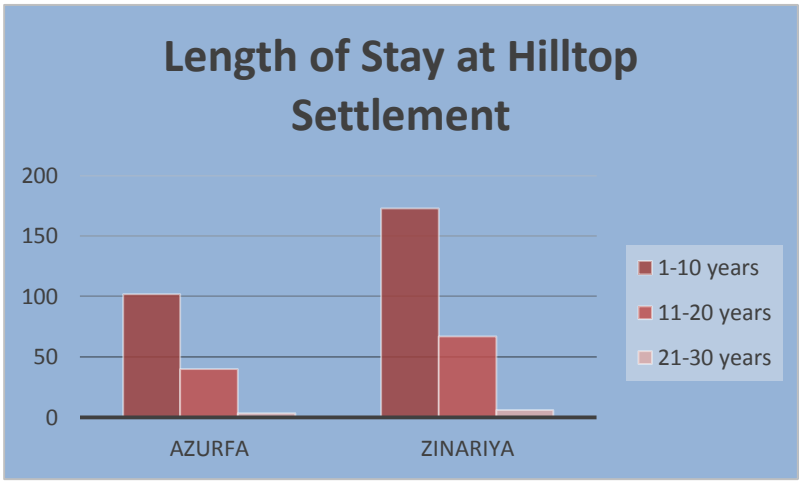

Figure 11. Length of Stay at the Hilltop

Source: Authors Field Work, 2021.

4.2 Nature and Housing Conditions of Sampled Hilltop Settlement

Table 4. Housing Problems of Sampled Hilltop Settlements

	Azurfa		Zinariya	
Problems	frequency	Percentage	Frequency	Percentage%
Overcrowded rooms of More than 2 per persons per Room (According to Nigeria National Building Code)	101	25.4	172	25.5
Substandard size of sleeping rooms	81	20.4	137	20.3
Inadequate toilet facility	87	21.9	147	21.8
Inadequate kitchen facility	106	26.7	180	26.7

Poor condition of buildings	22	5.5	38	5.6
Total	397	100	674	100

Source: Authors Field Work, 2021.

Majority of the residents of the households have above 5 persons (36.6%) per habitable room followed by 33.2% of households having 3-5 persons per habitable room, 15.6% with 2-3 persons while 14.6% have 1-2 persons per habitable room. This situation is caused by the Polygamous setting and religious factors which accounts for the large household sizes that prevail in some families in these areas. It was observed that the sizes of the sleeping rooms were inadequate when compared to the average of 2 persons per habitable room as prescribed by (Nigeria National Building Code), such condition affects air quality and ventilation of these hilltop settlements.

Although most of the houses found in these settlements make use of water system toilets, they predominately make use of shared water system toilet as there are not adequate number of toilet to cater for these households. This can be linked to their socio-economic status and lack of building and design plans. Others who don't have water system (toilets) make use of pit latrines or public toilets found at various public places such as markets or motor parks. The adequacy of toilet facility in the sampled neighbourhood were measured using criteria such as its convenience, number of people using it, its maintenance among others. The study therefore discovered that toilet facilities were not adequate in the sampled neighbourhoods. Pit latrines are still being used in spite of the fact that they were officially banned in the metropolis as far back as 1975.

A large proportion of the buildings examined have shown that their kitchen facilities are substandard, inadequate or inconveniently located. Many of the kitchens are just small enclosures, some of which are made of rusted corrugated iron sheets or planks at the backyard of these buildings. The use of firewood represents 22.3% and charcoal 37.1% for cooking is prevalent; hence many of the buildings have their kitchens located in the backyard, except for the few ones that used kerosene stoves 16.1%, Gas cookers 15.8% and electric cookers 8.7%.

The quality of materials and standard of some buildings in these hilltop settlements are very poor as they were built with substandard materials such as blocks less than the standard 6" (6" x 9" x 18") and 9" (9" x 9" x 18"), had no structural design plan, nor approval from the planning authority such as JMDB (Jos Metropolitan Development Board). With these kind of substandard buildings, there are impending risk of personal and community safety due to the risk of building collapse (see, Plate 1 and Plate 2)

Plate 1. Substandard Building at Zinariya

Plate 2. Substandard Building at Azurfa

Source: Author's Field Work, 2021

4.3 Environmental Condition of Hilltop Settlement

Table 5. Environmental Challenges at Sampled Hilltop Settlements

	Azurfa		Zinariya	
Problems	frequency	Percentage	Frequency	Percentage%
Poor access	64	19.2	108	19
Difficult terrain	62	18.6	106	18.7
Lack of public Utilities	98	29.3	166	29.3
Poor Sanitation	110	32.9	187	33
Total	334	100	567	100

Source: Author's Field Work, 2021.

The study also looked into the environmental condition of the study areas such as; accessibility, water supply, methods of waste disposal etc. and discovered that the sampled hilltop neighborhoods were faced with the following environmental problems: Lack of accessibility was observed in all hilltop settlements areas, making most residents rely on footpaths and stair cases constructed by the residents for circulation due to inorganic layout. presence of a few substandard access roads as the width of most access roads found in these neighbourhoods were between 3.5-4m with no setbacks, non-aligned streets structure, and eroded roads as a result of absence of drainages. Residents dispose of waste indiscriminately due to absence of proper waste collection points, as approximately 33.754 tons of solid waste were disposed of in these settlements weekly. It took up to a month or even longer for the Plateau State Environmental

Protection and Sanitation Agency (PEPSA) to evacuate solid waste that have accumulated at the few collection points in the neighbourhood. Very poor sewage disposal system existed as these were disposed directly into the available public drainages in the area constituting poor aesthetics and health hazards in the settlements. There were no water pipelines connected to these settlements and the residents had to rely on shallow wells in the rainy season and water vendors in the dry season for their water supply, further heightening public health problems and communicable diseases in the neighbourhood. Educational and health facilities and services were not within easy reach of the residents of these hilltop settlements, as some children had to travel for over a kilometre to an elementary school. These were not supposed to exceed half a kilometre radius. Residents had to commute longer distances to access basic services and facilities in these hilltop settlements.

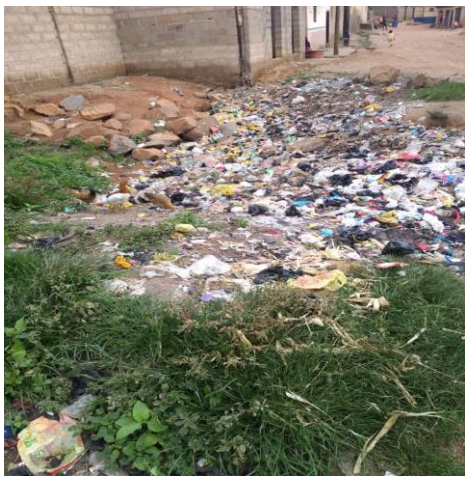

Plate 3. Poor Environmental Sanitation at Zinariya Plate 4. Indiscriminate Refuse Disposal at Zinariya

Source: Author's Field Work, 2021

Plate 5. Difficult Terrain and Poor Accessibility at Azurfa

Source: Author's Field Work, 2021.

4.4 Factors Influencing Hilltop Settlement Development

Table 6. Reasons for Hilltop Settlement Development

	Azurfa		Zinariya	
Problems	frequency	Percentage	frequency	Percentage%
Affordable cost of land	40	28.6	67	28.3
Occupied by same ethno-religious	35	25.5	60	24.9
Group				
Lack of Alternative Sites Housing	27	19.3	46	19.4
Jos Crisis (Displacement)	20	14.3	33	14
Availability of land	18	12.3	31	13.4
Total	140	100	237	100

Source: Author's Field Work, 2021

Affordability of land for development was the main reason driving people to build and settle at Hilltop settlements. This factor was cited by 28% of the respondents which confirms the findings of Dung-Gwom, (2008) that the major driver of hilltop settlements in Jos was the affordability of land which attracted more than a quarter of the residents especially those at Zinariya hilltop settlements as a plot of land was sold between 50,000-150,000 some few years back. 14% said they moved to these hilltop neighborhoods due to the Jos Crises (of 2002, 2008 and 2010 respectively). 25% cited security reasons, (living with people of the same ethno-religious provided a sense of security and solidarity), dwellers of Azurfa hilltop settlement cited this as one of the major reason for building on hilltop, as they would rather reside on hilltop with people they share same ethno-religious group with than build on flat land close to people they don't share same ethno-religious group with. while lack of housing alternatives was what attracted about 19% of the respondents to these residential areas.

Table 7. Possession of Land Documents and of Building Plans Approval (Building Permit)

	Azurfa		Zinariya	
Possession of Land Documents	Frequency	Percentage	Frequency	Percentage
Statutory R of O	16	11.1	27	10.9
Statutory C of O	14	9.7	25	10.1
Sales Agreement	114	79.2	195	79
Total	144	100	247	100
Possession of Building Plan Appro	frequency	percentage	Frequency	Percentage
No	111	76.6	188	76.4
Yes	34	23.4	58	23.6

Total	145	100	246	100

Source. Author's Field Work, 2021.

In terms of land rights/titles held, the study revealed that 79% of property owners had sales agreements. Similarly, 10% had statutory titles/certificate of occupancy granted by the state government, while 11% had customary certificates of occupancy granted by the local government authority (the Jos North Local Government authority).

Only a quarter of developments in these areas had complied with the formal system of land administration in the city. On possession of approved building plans (building permits/planning permission) information gathered showed that 76.5% did not possess approved building plans while only 23.5% had approved building plans. This result shows that about three quarters of all developments were outside the formal land/planning permission system.

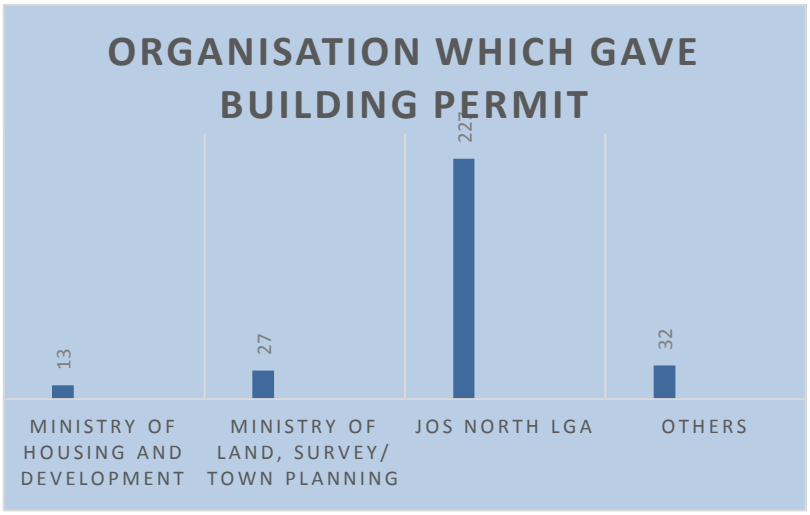

Figure 12. Organizations Which Gave Building Permits to Hilltop Developers

Source: Authors Field Work, 2021.

4.5 Physical Planning Implications Hilltop Settlements

The obvious implications of these hilltop settlements on physical planning are as a result of the failure of urban planning authorities such as (Jos Metropolitan Development Board, Ministry of Lands, Survey and Town Planning and Ministry of Urban Development) to regulate and control developments in these areas. Aluko (2011) has asserted that in spite of the existence of local planning authorities in every Nigerian city whose portfolio includes development control of urban land use, many buildings have been and are being constructed without approved layouts and building plans (planning or development permits). Illegal developments and structures spring up arbitrarily on any available vacant land, open spaces.

Due to the fact that hilltop settlements are unplanned, they lack basic social amenities such as good roads and pipe borne water and other communal facilities such as schools and health facilities. The rugged topography of these settlements makes it difficult to develop infrastructures such as good access roads, and other social facilities such as health and educational facilities. Residents of these settlements have to travel a far distance to access basic social amenities such as water, etc. Another notable problem as a result of the terrain of these hilltop settlements is the difficulty and high cost of transporting building materials to construction sites. The resultant effect of lack of planning and development control is that such areas are fast becoming slums and posing not only health and environmental hazards but fast becoming hotspots for many social ills and insecurity in city. The proximity of these areas to the University of Jos poses further grave challenges to the safety and security to the staff and students of the university as any conflict trigger in the city quickly reverberates into violence and the destruction of live and property as had been witnessed in the past and even in the no not too long attacks and killings at Yelwa Zamgam and Anguwan Rogo in 2021.

Table 8. Physical Planning Problems of Sampled Hilltop Settlements

	Azurfa		Zinariya	
Problems	frequency	percentage	Frequency	Percentage%
Haphazard Developments	29	6.5	50	6.6
Absence of Basic Social Amenities	80	18	135	17.9
Difficulty in Development of Infrastruct Facilities/Services	74	16.7	127	16.8
Difficulty and High Cost of Transportati of Building Materials	111	25	190	25.2
Poor Environmental Sanitation	110	24.8	187	24.7
Development of Slums	39	9	66	8.8
Total	443	100	755	100

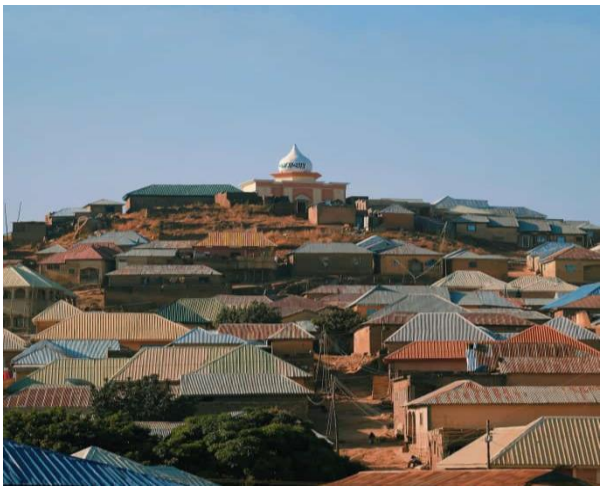

Plate 6. Haphazard Development at Zinarya

Plate 7. Unplanned Development at Azurfa

Source: Authors Field Work, 2021.

5.1 Summary of Findings on the Type and Characteristics of Hilltop Development

In the course of the study, it was discovered that there was imbalance and unsustainable development on sampled hilltop areas, as development were found to be unplanned and haphazard, which in turn had affected the efficient circulation, functionality, aesthetics and infrastructural provisions in which residents have been forced to adjust to and to live without. This was linked to the very weak development management and control on hilltop settlements by the relevant planning authorities (The Jos Metropolitan Development Board, JMDB; the Ministry of Lands, Survey and Town Planning, MLS&TP; Ministry for Urban Development, and to a lesser extent, the Jos North Local Government Authority).

The predominance of low income is reflected on the poor quality of houses and the environment. This explains why there were so many substandard houses in the neighbourhoods. Majority of which, are

multi dwelling units accommodating more than two families with limited and often poor sanitary facilities.

In terms of infrastructure and service provision, there were glaring inadequacies. The survey revealed that only one seventh (15%) of the households were connected to the public water supply, with over 80% connected to the municipal electricity supply grid provided by the Jos DISCO (electricity distribution Company). The non-availability of amenities such as pipe borne water in these areas puts further pressure on the surrounding areas where these amenities are available.

Facilities such as schools, health and recreational centres, were grossly inadequate in terms of their location, spatial distribution and size. For example, a government primary school in Zinariya was situated at a location where some pupils had to cover a distance of more than a kilometre as against the standard of half a kilometre. In the areas sampled, there were no organized open spaces for recreation; thus indirectly affecting the comfort, health and convenience of the residents.

Environmental factors such as solid and liquid waste disposal was a major challenge. The survey found out that 65% of residents disposed their solid waste indiscriminately while 60% of liquid waste was disposed directly through broken and uncompleted pipes not connected to any suck-away. Where suck away pits were available, they were constructed above the ground level due to the rugged terrain, posing serious health hazards especially during the rains when they overflow into the streams and shallow wells in the areas.

The research also discovered gross violations of the provisions of 1975 Doxiades Greater Jos Master Plan, which zoned the hilly areas as urban green lands, country parks and nature reserves. There has been very little or no attempt to manage and control these hilltop developments by the relevant planning authorities through the production and implementation of new policies and frameworks to guide such hilltop developments.

5.2 Conclusion

The paper has analysed the physio-social characteristics of hilltop settlements, with particular emphasis on Azurfa and Zinariya areas of Jos metropolis. The findings revealed that these areas are developing and growing in a completely unplanned and haphazard manner as three-quarter (76.5%) of house owners and developers do not have approved building plan from the relevant planning authority (Jos Metropolitan Development Board). Attempts were made to plan the Zinariya area into a low density area, after the de-gazetting of the Naraguta Forest Reserve in 1985. However, the Jos crisis of 2001 had totally changed the plan and development outcome of the area as rich-high income people sold out the land/plots which was subsequently carved into small plots and sold to low income people. The green areas were encroached upon and also sold and 'illegally' occupied by low income earners. There has been no review of the master plan of Jos to incorporate these changes and to ensure proper integration of these area into the city system.

Rugged topography/terrain and steep slopes pose great challenges to housing development, provision of infrastructures, road design and construction see for example plate 5, 6 and 7. Exorbitant cost of

providing and extending public facilities, utilities and services to these areas also accounts for their gross inadequacy or none availability. Due to the high level of poverty and the fact that these areas are mostly inhibited by low income earners, the residents are unable to provide these facilities and services on their own with over 70% of the residents earning less than 60,000 Naira a month ($120) indicating that a family of 6 persons live on $4 per day which is far below the poverty line recommended by the World Bank's international poverty line (2017) of $1.90 per person per day. Quality of housing development is generally poor, lacking in design, adequacy of space, orientation and ventilation exhibiting the weak or non-existence of the presence of development control in the hilltop settlements. Many of these kind of settlements are uprising in the city and fast turning into slums and urban jungles. Unless innovative site/terrain specific and sensitive policies are implemented, the physical and social dimensions of these areas would deteriorate further in the future. There is a need to incorporate new and visionary approaches to urban growth management in the city as well as in the suburbs and hilltops settlements, which are dichotomizing not only socially and culturally but also morphologically. The following recommendations have been made to address the existing challenges, for these hilltop settlements to meet the goals of the Sustainable Development Goals (SDGs, 2015-2030) and the New Urban Agenda (2030).

5.3 Recommendations

5.3.1 Recommendations for Government (State and Local Government)

a. Rehabilitation and renovation as an urban renewal strategy should be applied to these existing hilltop settlements so as to serve as a process of neighbourhood revitalization by removing worst structures, repairing and constructing streets with additional parks and public utilities in accordance to the standard of development area densities and land use structure for hilltop settlements.

b. Local government should establish integrated urban development plans for these areas to bring infrastructure and accessibility with other local policies and objectives.

c. Government should provide affordable land and low cost housing for urban dwellers as it has been seen through the research analysis that affordability is one of the major pull factor to these hilltop settlements.

d. Filtration; a strategy for urban renewal which is in form of peripheral development around metro cities such as creating expanded or satellite towns can be implemented in Jos as this could help decongest the city thereby reducing developments on hilltops and also pave way for integrated communities to be created just as it was in the 1980s, 1990s and early 2000 through inclusiveness of all ethnic, religious and social class, to avoid segregation of neighbourhoods along ethno religious lines just as it can be seen currently in the city.

5.3.2 Recommendations for the Planning Agencies

a. Building regulations for hilltop settlements should be formulated around the basic premise of topography, slope stability, existing vegetation and visual significance.

b. For the improvement of the quality of housing in these settlements, standard for housing should be strictly adhered to, as it prescribes minimum conditions under which a building or part of it may be lawfully occupied as a dwelling, and this should be monitored by development control agencies.

c. Preparation of neighbourhood plans should be the priority of the planning and development control agencies to ensure monitoring and control of development and avoid further unlawful developments on hilltops.

d. Public participation in plan preparation should be encouraged to enable the residents understand the dynamics of physical development. This should be done in close consultation with the local government authorities, the local people and other relevant stakeholders.

5.3.3 Recommendations for Developers and Dwellers of Hilltop Settlements

a. The use of incinerators, septic tanks, suck away pits and the use of water closets as contained in the Environmental Sanitation Programme instituted by the federal government in 1984 is a good measure which could help tremendously to improve housing and environmental quality in hilltop settlements.

b. Developers of housing on hilltops settlements should adhere strictly to planning standards in the course of construction, as these areas are delicate and fragile due to the nature of their terrain. Appropriate planning, space health and space standards should be formulated and adopted for such areas.

c. Developers should ensure the use of quality materials during construction to avoid penetrating damps and efflorescence on building walls after few years so as to avert building collapse.

d. Dwellers of hilltop settlements and developers should ensure they have/get Certificate of Occupancy or Right of Occupancy, building plans and building permits, should in case the government decides to embark on an urban renewal programme which involves demolition of hilltop settlements, so that they can get compensated and not lose out in such scenario.

e. Provision of land/sites for public services such as schools, motor parks, health and other community services to cater the populace.

f. Security of tenure and access to private/public sector finances/loans should be available for building construction and services.

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