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CHARACTERISTICS AND PLANNING CHALLENGES OF HILLTOP SETTLEMENTS IN JOS METROPOLIS, NIGERIA

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HIGHLIGHTS

- Uncontrolled urbanization in the developing countries is leading to unprecedented urban expansion and putting intense demand on land for housing development.
- Jos, a city in central Nigeria, has witnessed very rapid urban growth leading to recent informal settlements on steep slopes, hilltops and river valleys mainly by the urban poor.
- Hilltop settlements face various challenges; rugged topography which imposes high cost for the provision of infrastructure, lack of planning and development control, 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 planning authorities and government to make them sustainable.

ABSTRACT

Jos Metropolis is witnessing rapid urban growth, which in turn puts pressure on development space. From a small mining town of less than 10,000 in 1920, it is now a buzzing state capital of over 1 million people. Hills and valleys that were earmarked in the 1975 and 2009 Master Plans as urban green, parks and conservation corridors are being swamped by low and medium income groups for housing developments resulting into unplanned spatial growth characterized of poor access and lack of basic infrastructure. Settlements on steep slopes and hilltops pose unique planning challenges arising from their topography, costs of construction and extension of social services and public facilities; poor drainage, irregular developments and propensity to environmental hazards. This paper analyzes physical and social characteristics of five sampled hilltop settlements in Jos metropolis. It is recommended that such settlements need special attention not only in terms of their planning but even more so in terms of their management, provision of basic services and infrastructure, integration with other parts of the city. Governments and the planning authorities should provide land for development for the urban poor at desirable locations at subsidized rate as a strategy of prohibiting housing developments on very steep slopes and difficult terrain.

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1. INTRODUCTION

Urban settlements are so basic to the idea of human progress that even the word civilization has its roots in the Latin word 'civitas' meaning 'the public-collective, 'citizens' and later 'city constitution' or simply 'city' (Wikipedia). No wonder, **the World Cities Report, 2016** states that millions of people flock into cities in the developed and less developed countries annually in search of personal and family opportunities and progress (UN-Habitat 2016). The Report among others demonstrates that current rate of urbanization is unsustainable and exacerbates the issues of inequality, informality and

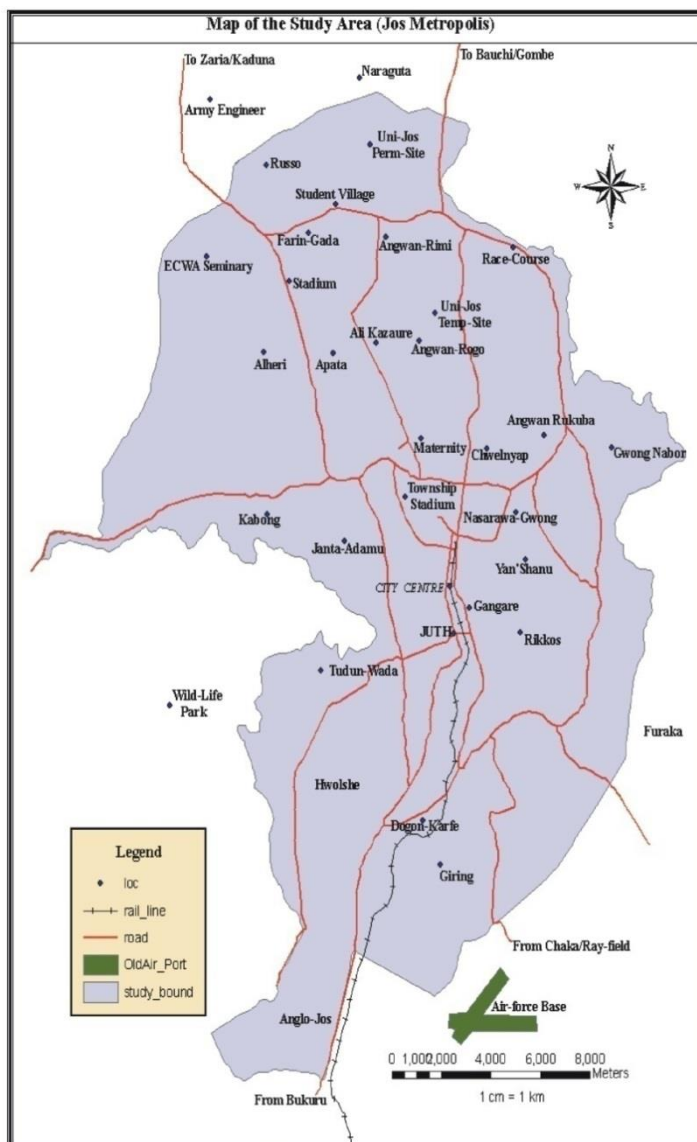


Figure 1: Study area, Jos Metropolis.

unsustainable forms of urban expansion. During the early years of the Iron Age, it was not on the hills but rather at the river valleys that people settled. It was only as time passed by that settlements on hilltops started to appear. Beach (1988) holds the view that hilltop settlements emerged towards the end of the early Iron Age. In Africa, hilltop settlements emerged in different parts of the continent. Ehret (2002) argued that developments on Mount Kilimanjaro, Mount Kenya, the Para Mountains and the Usambara Range emerged since 11th century A.D. In Malaysia, there had been tremendous increases in physical developments on hilltop areas due to depleting flat land and the beautiful scenery, and the desire for fresh air and exclusiveness that such areas present.

In Nigeria, human settlements emerged in four major ecological zones; the Northern plains with cities and towns such as Kano, Zaria, Bauchi, Kaduna, Daura, etc based on pre-colonial city states and many like Kano flourished due to the trans-Saharan trade. The second ecological unit is the Jos Plateau, which lies at about 1300m above sea level. Settlements developed on hilltops for security and defensive purposes and later due to the presence of mineral resources, which were exploited during the colonial period from 1903, which attracted thousands of people from within and outside the country to the minefields (Freund, 1981; Alexander, 1985). The

plains and hills of Yoruba land in the South West had such towns like Idanre, Ibadan Abeokuta. Lastly, were the high plains of the east with settlements such as Enugu and Igbinike.

The pace and influx of people into the cities in Nigeria has geometrically overwhelmed city development thereby putting pressures on development space (Agbola, 2005, UN-Habitat, 2005a; Bloch, et al 2015). This has in turn provoked the scramble for land at the urban periphery and on hilltop areas by all groups of people (Ikejiofor, 1998; Jiriko, 2008, Okoye, 2013). In Jos, rapid population growth and uncontrolled urban expansion has increased demand for land for all purposes and especially for housing development. By 1913, Jos had a population of 3000 (Bingel, 1978). This increased to 10,000 by 1920. Further increase in the population of the city was a direct result of the construction of railway line to Jos in 1937 which facilitated ease of movement of people from different parts of Nigeria to Jos (Bingel, 1978). According to the 1963 census, Jos had a population of 26,898. By 1973, the population had grown to 133,000 (Doxiadis Master Plan, 1975) with an annual growth rate of 6.1%. The 1991 the population census recorded the population at about 650,000 (NPC 1998) while the 2006 census put the population of Jos at 950,000.

Current estimates put the population of Jos at between 1.2m and 1.4m (see, Dung-Gwom and Rikko 2009). This 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 and Oladosu, 2004; Dung-Gwom 2007, 2008). The Urban authorities have failed to provide serviced lands on desirable sites to the teeming population who have had to fend for themselves for residential land through the open market to provide shelter for themselves 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. The focus of this paper is to examine the physical characteristics and planning challenges posed by topography on the emerging hilltop settlements in the Jos metropolis (see Fig 1, which shows the study area). Hilltop settlements here refer to human settlements in steep slopes that gradually creep to the crest of the hills.

2. REVIEW OF RELEVANT LITERATURE

Modern theories on urban growth and land use structure derive their epistemology from the Chicago School of Social Ecology of the 1920s and principally from the work of scholars such as William Burgess (1929), Homer Holt (1939), Harris and Ullman (1945). Rapid urbanization of the later half the 20th and 21st centuries have imposed on cities in the western world and less developing countries (Basussi, et al 2010; Rossi-Hansbery & Wright, 2007; Cheng, Masser & Ottens, 2003). Advances in techniques for spatial analysis, modelling and GIS have also enabled scholars to measure, analyze and monitor urban forms and growth changes more precisely.

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. 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 note the share pace and scale or urban sprawl in both western and nonwestern 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.

The spatial pattern and structure of Jos exhibit the features of classical models of urban form. The Sector Theory propounded by Holt (1939) explains its colonial past, with zones of different residential qualities and income. The white colonialists lived in well-drained and planned areas (so called

European Reservation Areas, ERAs), the present day Tudun Wada Government Residential Area (Plotnicov, 1976; Urquhart, 1977). After independence in 1960, such areas were taken over by the black bureaucrats and elites and turned them into 'Government Residential Areas' (GRAs) for exclusive occupation by them. The 'natives' were segregated into the 'native town/areas' to be administered by the Native Authorities under customary norms and custom which were unplanned and lacked basic facilities and services (Urquhart, 1977).

Jos, in many ways, however, reflects the multi-nuclear model postulated by Harris and Ullman (1945). It has grown from a series of mining and labour camps, which sprung up during the scuffle for tin ores (cassiterite) on the Jos Plateau in the early 20th century (Freund, 1981; Olaniyan, 1986). The steep relief of Jos imposed constraints for even expansion, and the city grew as a series of 'cities' within the city' attempts at master planning in the mid-1970s tried to link the various spatial elements while preserving the hills and steep valleys and gorges as urban greens, country parks or natural corridors. The Doxiadis Greater Jos Master Plan, 1975 adopted a lineal North-South form due to the natural and man-made constraints to the East and West. From the 1980s however, due to rapid population growth and the Jos crisis from 2001, accelerated the processes of population growth and dispersal from the inner city to the peripheral areas. Expansion onto steep hills and hazardous lands along the Delimi River and its tributaries became the new form (For discussion of the 'Jos Crisis' see Dung-Gwom & Rikko, 2010; Higazi, 2011; Best & Rakodi, 2011; Krause, 2012; Lohor, et al. 2013 and 2015, on the causes and effects of the violent crises on spatial restructuring and housing).

Recent theories of urbanization and urban growth have empathized interaction between processes, policy frameworks, behaviors, attitudes and actions of various actors the outcomes/outputs resulting in patterns and structure of cities. These processes, policies, decisions and outcomes vary from one city to the other. This gives credence to local-evident approaches in the analysis of urban growth, form and patterns. There is, however, limited academic studies of the impacts of urbanization and urban growth on hilltop settlements. More particularly, on the relationships between urbanization on physical relief, population density, settlement patterns, housing form and infrastructure. The review of literature has therefore focused on the planning principles, design concepts of steep slope/hilltop developments and the environmental challenges that they face. A lot of such literature exist online for such areas, and particularly in the United States, which the authors had found very useful, for example, development guides and regulations for steep slope developments for the city of Carlsbad (1998), Nanaimo (2005), Lehigh Valley (2008) and for the country of Maritius (2016).

2.1 Concept of hilltop Developments.

According to Olshansky, (1996) hillsides pose unique problems for construction and maintenance of buildings. Where vegetation has been removed significant issues can arise such as increased erosion, landslides, and sedimentation. It is also more difficult to control fires on sloped land, and is difficult for emergency vehicles to access development on steep hillsides (see, 'Overview of Hillside Development Terms and Concepts'. 2002. City of Glendora California Planning and Redevelopment Department - <http://www.ci.glendora.ca.us>). What constitute hillsides? The literature uses other terms such as steep slopes, mountainside, steep ridges, ridge tops, hilltops, etc. There is no single definition of steep slopes, hillside developments or hilltop. The Malaysian Institute of Engineers in 2000 proposed a classification system based on altitude of the topography before development as follows:

0m	-	150m	-	Low Land
150m	-	300m	-	hill Land
300m	-	1000m	-	high Land
Above	-	1000m-		Mountain

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.

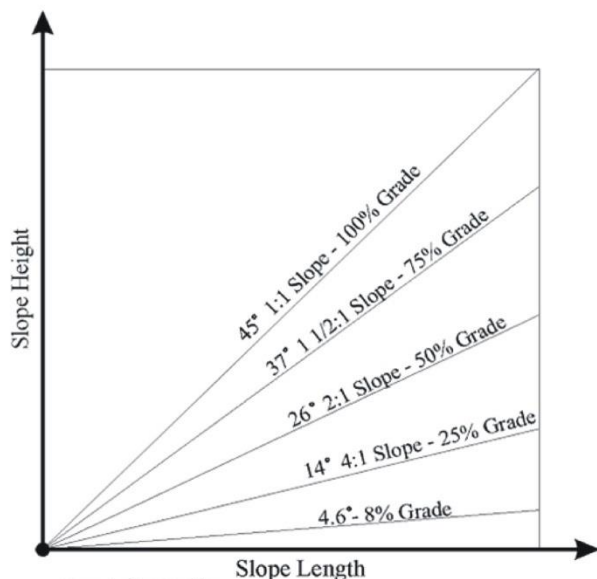


Figure 2: Graphical representation of slopes of the land based on gradient (grade).

The Lehigh Valley Planning Commission (2008), Steep Slopes, Guide and Model Regulations has classified slopes in percentage as follows (Source: SCAP-Steepslopes2010>02_21_CR.pdf):

0 - 10% grade	Gradual
10% - 15%	Moderate
15%+ grade	Steep

Obateru (2005) has classified the physical features of urban land based on gradient slightly differently as follows:

0 - 2°	Flat Land
2 - 6°	Gentle slopes
6 - 12°	Moderate slopes
Over 12°	Steep Slopes

A steep slope is defined as land with gradient of over 150 and grade of over 25%. Land with slopes of 100 to 250 are only suitable for medium and low density housing development. Lehigh Valley Planning Commission (2008) has classified land potentials for various uses based on its gradient/slope in Table 1

Table 1: Degree of Slope and Development Potentials

Degree of slope	Development Potential
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 agricultural and recreational uses.
Over 25%	Only used for open space and certain recreational uses.

Source: Soil Surveys of Lehigh/Northampton Counties, Pennsylvania

In general terms, therefore, land with slope grade of more than 12% is regarded as steep and not suitable for most developments such as housing. In many American municipal authorities ban developments of slopes of 10%, while the maximum permissible slope is 15% in others. For most of the sampled areas in Jos, the slopes were more than 25%.

2.2 Characteristics of Hilltop Developments

Developments on hilly topography are characterized by undulating terrains and located at high altitude. Due to the rugged nature of hilltop settlements, developments are mostly scattered and well-spaced. The development pattern is often very irregular with narrow routes and circulation networks occasioned by the physical constraints. Similarly, the population of hilltop areas is small. Highland

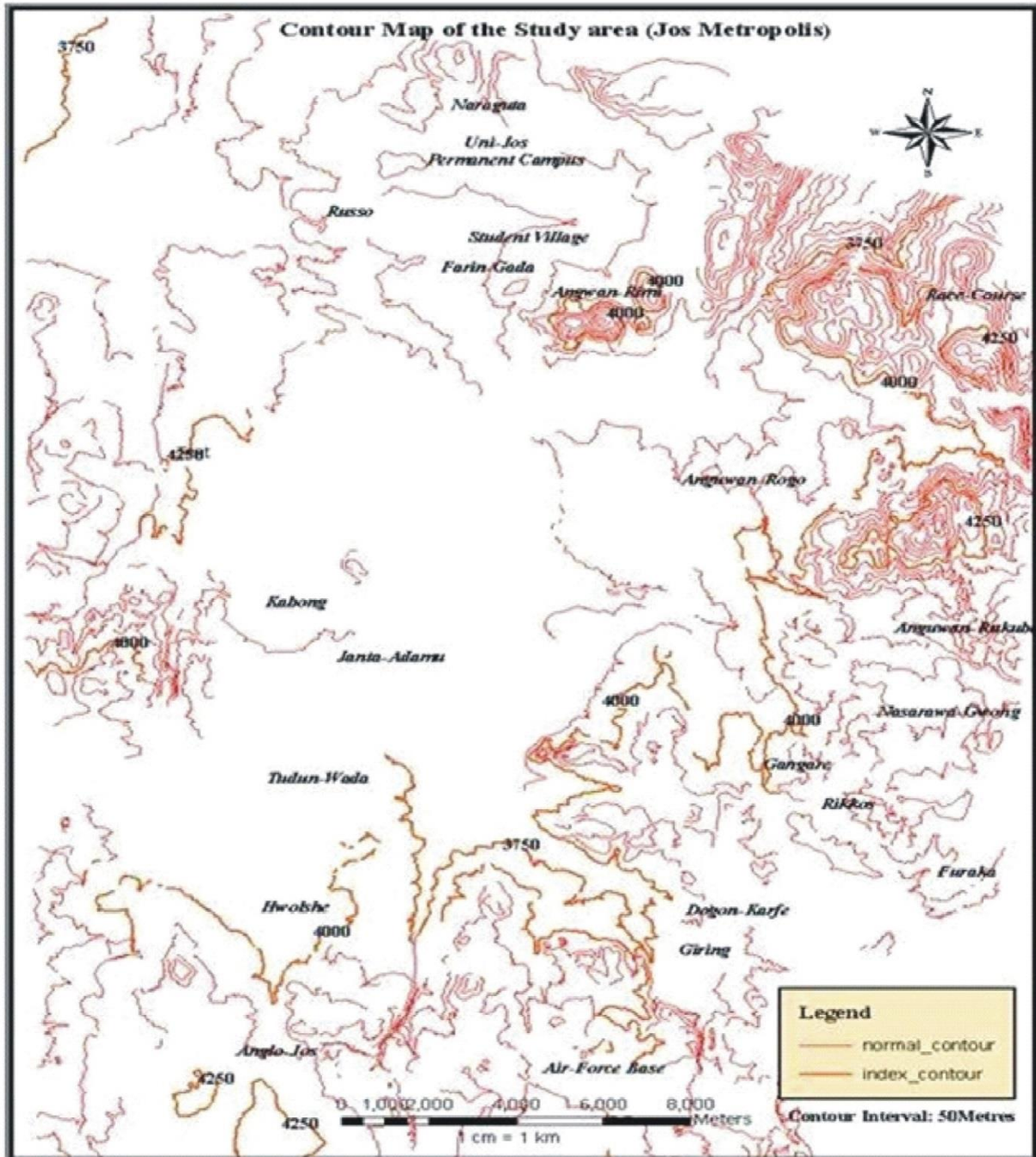


Figure 3: Relief Map of Jos.

areas tend to be healthier due to their clement climate, pleasant micro-weather. These settlements in the prehistoric era were often more secure than those located on the plains.

Jos town is located on the Jos Plateau, which is the geographical centre and hydrological hub of the country. The geology of the Jos Plateau consists of three types of rocks. The Older Granites which dates back to the Cambrian era and consists of precambrian basement complex rocks. The Younger Granites which are intrusion on the older granites and form the inselbergs and hilly areas. There are also volcanic rock formations from the Jurassic era. (See, Alford, et al 1979). These rocks formations have left a landscape of a degraded plateau with mountain ranges, inselbergs and weathered areas forming incisive valleys. The tin ore, which has been mined commercially on the Jos Plateau since the beginning of the 20th century, are found in the younger granites. Jos, located on the northern fringes of the Plateau, was initially constrained in its expansion due to the steep and rugged hills to the east and west of the city (See Fig 2). Exploding population and high demand for land for housing, however, have turned such constraints into opportunities.

2.3 Planning Principles of Hilltop Developments

A number of policies and guidelines for sustainable development on steep slopes exist. These guidelines concentrate on major urban elements such as streets, building and green open spaces that impact positively on steep slopes (Monkhouse, 1994). These elements include appearance of buildings, extent of elevation, maximum height of buildings, slope of the hill, etc. Some basic standards and norms for urban development have been proposed to provide a basis for decision making. Rao (2001) has suggested the distribution of land used in hilltop settlements in terms of densities and use structure as shown in Tables 2 and 3:

Table 2: Developed Area Densities

Settlement Type	Person per hectare	
	Plain area	Hill Areas
Small Towns	75 – 125	45 – 75
Medium Towns	100 – 150	60 – 90
Large Towns	100 – 150	60 – 90
Metro cities	125 - 175	-

Source: Roa, 2001

Table 3: Proposed Land Use Structure in Hill Towns

Land use	Percentage of Developed Area		
	Small Town	Medium Town	Large Town
Residential	50 – 55	8 – 52	45 – 50
Commercial	2 – 3	2 – 3	4 – 5
Industrial	3 – 4	4 – 5	5 – 7
Public	8 – 10	8 – 10	12 – 15

Source: Roa, 2001

The suggested norms are only indicative and can be suitably modified depending on local conditions.

2.4 Hazards of Hilltop settlements

Despite the many advantages of hilltop areas, there are hazards usually associated with developments on steep slopes. Monkhouse (1974) identified some of the hazards to include volcanic activities, earthquakes and various types of weathering and sedimentary rock movement. Volcanic activities are generally found around the coastal edges of the world's highest mountains e.g. the Pacific coast of the Himalayas in Asia (Japan). Some volcanoes are dormant but could erupt over time. Devastating effects of active volcanoes on hill settlements lead to fatalities, which are common in places like Afghanistan, Pakistan, Italy and in Latin America.

In Nigeria, recent events in Nkpume Atulugbo in Mgbo Abakaliki in Eastern Nigeria and the Wusa Peak (Kwoi area) in Central Nigeria (Adinnu, 2005) have shown that volcanic activities may not be extinct. Volcanic eruptions do not just destroy buildings and infrastructure, but often results in loss of human lives.

Another hazard of hilltop areas are earthquakes. Earthquakes occur due to tectonic forces movements below the earth crust, which manifest in the shaking of earth surface and the triggering of forceful waves which have devastative effects (Strahler and Strahler, 2006) or as inclusive of the internal push that reaches the surface in the form tremors. When earthquake occurs, the vibration of the coastal areas disposes it to sliding, crumpling, slumping and rock falls. These are dangerous and may cause flooding, blockage of stream channels and exposure of ground water to pollution from surface flows.

The case of favelas (slums) in Brazil is an example of settlements on steep slopes and the risks and calamities they face arising from natural hazards. Favelas have emerged out of the need for the poor and low income to obtain shelter, often on any vacant land on the edges of city and in many Brazilian, like Rio de Janeiro, on very steep slopes. The development of Rio's favelas is linked to the end of slavery in the late 19th century. Large number of families seeking housing and employment led to informal occupations of areas that had little value, difficult to access and lacked urban infrastructure. The favelas developed on the central hills of providence and Santo Antinro in 1893 then to Morrodos Telegrafos and Manqueira in 1990. These favelas grew rapidly near businesses and upscale residential areas that housed the city's elites. It was only the beginning of the 20th century that these favelas were identified as a problem as the hills provoked fear and curiosity. During heavy rainfall, the favelas suffer from mudslides, rock falls and floods leading to large scale destruction of property and loss of human lives. The environment becomes quite unhealthy and repulsive for decent living. The floods and mudslides of January 2011 in Rio de Janeiro, for example, led to the death of 903 people, making it one of the worst weather natural disaster in Brazilian history. In response, the government in Brazil commenced the provision of housing to low income earners in safer locations as well as improving living conditions in existing favelas while prohibiting the construction of new favelas on precarious sites (See, for example, Landslides Risks Reduction Measures by the Government of Rio de Janeiro City Government, in Improving the Assessment of Disaster Risks to Strengthen Financial Resilience.

3. METHODOLOGY

The study used both desktop research to obtain data from the internet and field survey through the administration of a questionnaire and field observations. A questionnaire was employed to collect information on the socio-economic and demographic characteristics of residents of sampled hill settlements in Jos; existing housing types and conditions; existing infrastructural facilities and services and the planning and environmental status of the areas. Fifteen (15) hilltop settlements were identified and mapped out based on height and elevation. Out of the fifteen (15) hilltop areas, ten (10) are located in Jos North Local Government Area (LGA) while five (5) are in Jos South LGA. A sample

size of 30% which represented five (5) settlements was then taken as shown in Table 4. Based on Krejcie and Morgan (1970) suggestion that a sample size of 20% is adequate for a population of between 1000-5000, while 10% for a population of 5001 – 10,000 and for a population of over 10,000 a sample size of 5% is adequate; and bearing in mind the estimated population of the sampled hilltop settlements, a sample size of 20% households amounting to 750 was used for the study. Questionnaires were distributed proportionately to the population of the five hilltop areas as shown in table 5: detailed field survey and questionnaire administration was done in 2013.

Table 4: Hilltop Settlements by Local Government and Sample Size

S/N	LGA	Settlements	Sampled Settlements
1	Jos North	JentaAdamu, GadaBiyaAngwanRogo, AngwanRimi, Kabong, Rikkos, AngwanRukuba, Kotton-Rikkos, JentaMangoro	Jenta-Adamu, Kabong, KotonRikkos, AngwanRukuba
2	Jos South	Tudun-Wada, Zaramaganda, SabonGari, Giring, Hwolshe	Tudun-Wada,

Source: Authors Field Work 2013

Table 5: Distribution of Questionnaire

S/N	Name	Estimated Population	Sample
1	Kabong	899	180
2	AngwanRukuba	767	153
3	KotonRikkos	1045	209
4	JentaAdamu	707	140
5	GadaBiyu	536	107
	TOTAL	3954	790

Source: Authors field work 2013

For the selection of target population, systematic sampling was employed where every 5th household was selected. Data collected was compiled and analyzed using simple frequencies and presented in tables and graphs.

4. DATA ANALYSIS

This section presents data collected in terms of the socio-economic characteristics of the residents; land, housing issues, facilities and infrastructural characteristics of hill settlements in Jos. The last section discusses the findings of the study.

4.1 Socio Economic characteristic of Residents

The Sex distribution of respondents revealed that 54% of the sampled population were males while 46% were female. This indicates that the percentage of male population is greater than female except

for Kabong where the females was 53% as against 47% for male. In Jos, as in other cities in Nigeria, male adults are the predominant heads of households. Due to demographic changes and changes in educational status, there is an increasing proportion of female being heads of households.

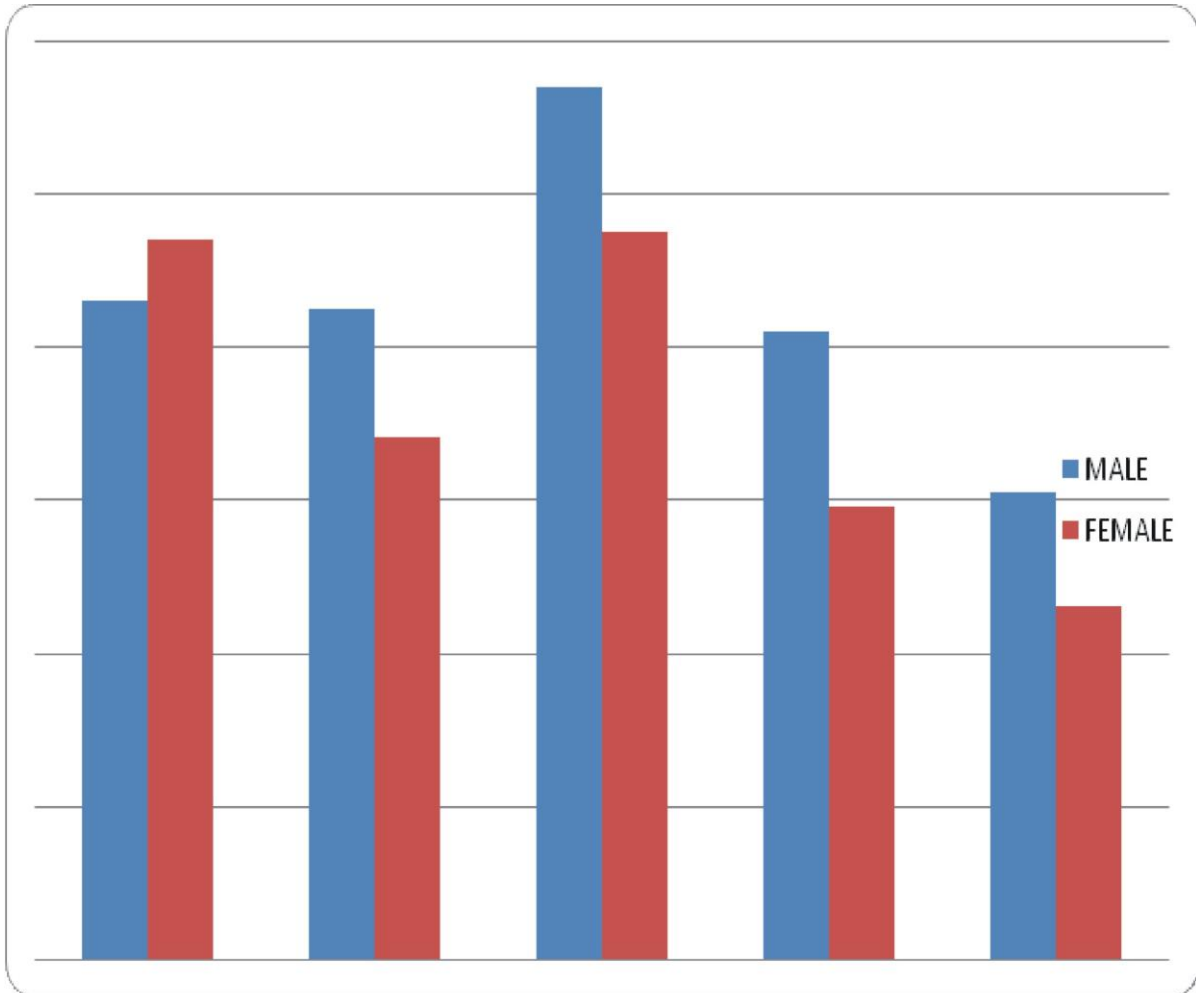


Figure 4: Sex of Heads of Household.

The sample survey revealed that 35% of respondents were 60years or above, 34% were within the age cohort of 42 – 60years, while 18% were between the ages of 21-40 years. The economically active group, from 18-60years constituted 65% of the populations. This reveals the youth bulge in the population and the fact most urban dwellers are young, who have moved into the city in search of work. 59% were married, 11% were widowers, 10% were widows, and 9% were single. The high rate of widows/widowers may be attributed to the Jos crises, which had caused the death of spouses. Table 6 show that 44% of the households had an average household size of size 4-9 persons, followed by 29% with a household size of 10 – 14 persons, 12% with 15 to 19 persons while 7% had a household size of more than 20 persons. The average household size in Nigeria is 8 person. 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. Muslim and traditional religious believers marry more than one wife.

Table 6: House Hold Size

SIZE	FREQ/PERCENTAGES											
	KABONG		A/RUKUBA		K/RIKKOS		J/ADAMU		G/BIYU		TOTAL	
	FREQ	%	FREQ	%	FREQ	%	FREQ	%	FREQ	%	FREQ	%
< 4	26	14	13	8	6	3	12	9	4	4	61	8
4-9	85	48	57	37	101	48	61	43	41	38	345	44
10-14	39	22	63	41	82	39	36	26	12	11	232	29
15-19	17	9	8	6	12	6	21	14	35	35	93	12
Above 20	13	7	12	8	8	4	11	8	15	15	59	7
Total	180	100	153	100	209	100	141	100	107	100	790	100

Educational status of sampled population showed that 31% (the majority) had vocational/technical education, followed by those with primary education (16%), while those with university education accounted for 9%.

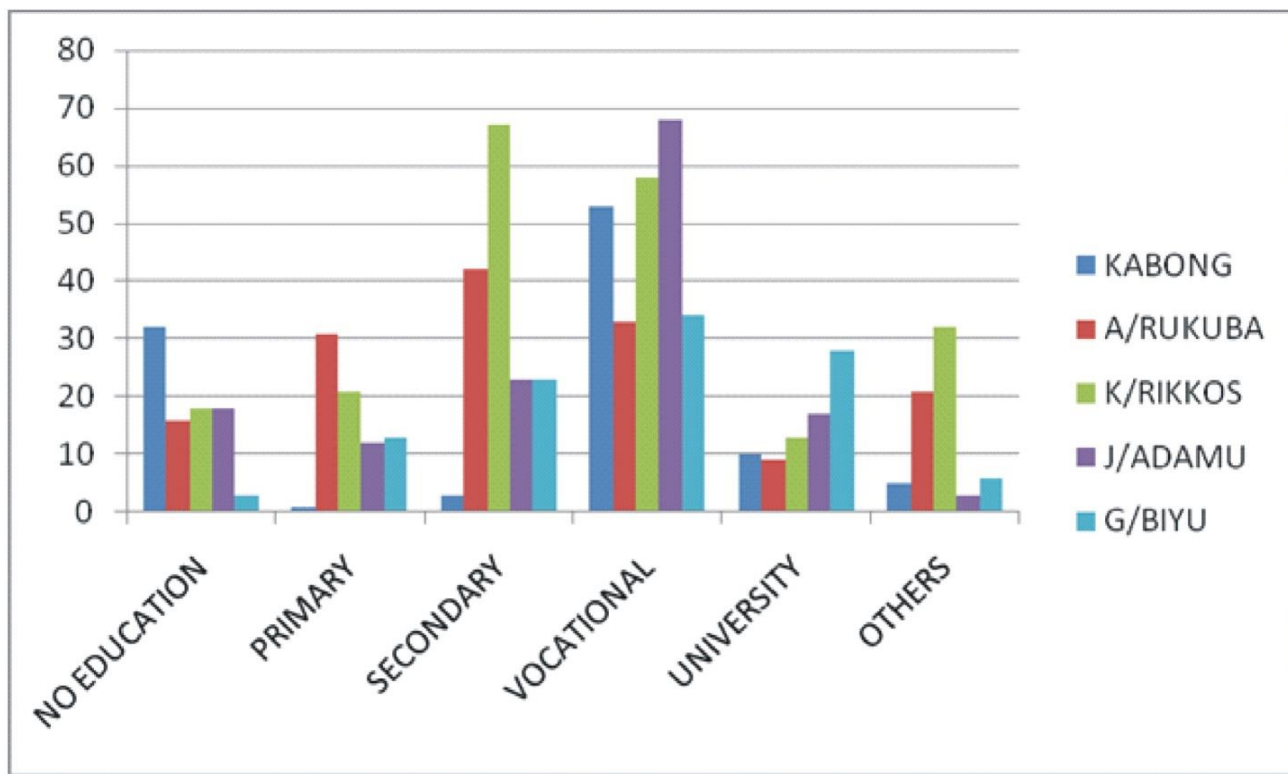


Figure 5: Level of education.

Income variable of respondents per month as presented in Table 7, which reveals that 25%, which was the majority, earned N10, 000 or less per month; followed by 22% who earned between N10, 000 - N15, 000 monthly. Similarly, 5% earned above N30, 000 per month. These translates into 25% earning about \$33; 22% between \$33 to \$50, and 5% earning about \$100 per month (based the current official exchange rate of the 300 Naira to one dollar). Given the average family size of 8 persons, these

rates indicate that most residents of hilltop areas were below the poverty level (of \$2 per person per day).

Table 7: Income levels

INCOME (₦)	UNITS /PERCENTAGES											
	KABONG		A/RUKUBA		K/RIKKOS		J/ADAMU		G/BIYU		TOTAL	
	FREQ	%	FREQ	%	FREQ	%	FREQ	%	FREQ	%	FREQ	%
< 10,000	43	22	53	35	37	18	31	22	32	30	196	25
10,000-15,000	38	22	21	14	63	30	26	18	25	23	173	22
15,000-20,000	32	18	18	12	48	23	27	19	17	16	142	18
20,000-25,000	31	17	26	17	20	10	23	16	16	15	116	15
25,000-30,000	26	14	30	19	26	12	28	21	10	9	140	15
>30,000	11	6	5	3	15	7	6	4	7	7	44	5
Total	180	100	153	100	209	100	141	100	107	100	790	100

Reasons for choice to live in hilltop settlements ranged from security, nearness to place of work; and low and affordable house rents. Since 2001 Jos crisis and later violent conflicts in the city, people had realigned residential locations to safer and more secure neighborhoods, which have become spatially segregated based on ethnicity and religious belief. Social/religious solidarity and the need for security have become the defining factors for residential preference in Jos (see Dung-Gwom & Rikko 2010; Best and Rakodi, 2011; Lohor et al, 2013, 2015; Pidan, 2010).

4.2 Land and housing characteristics

This section discusses land related factors such as land use, tenure as well as housing morphology. Data obtained from the field survey revealed that residential land use was the dominant land use accounting for 48% of the land, followed by transportation uses 18% and vacant land 12%. Other land uses such as religious and industrial (5%), commercial (9%) and educational uses (6%).

Table 8: Existing Land Uses

LAND USE	HECTARES /PERCENTAGES											
	KABONG		A/RUKUBA		K/RIKKOS		J/ADAMU		G/BIYU		TOTAL	
	Ha	%	Ha	%	Ha	%	Ha	%	Ha	%	Ha	%
Residential	4.12	51	4.01	52	5.69	60	2.59	40	2.49	30	18.9	48
Commercial	0.56	7	0.41	5	0.12	1	1.01	15	1.34	17	3.44	9
Industrial	0.33	4	0.54	7	0.23	2	0.37	6	0.53	7	1.98	5
Vacant	0.92	11	1.21	16	1.43	15	0.53	8	0.56	8	4.65	12
Transport	0.34	4	0.56	7	0.66	7	0.56	9	0.41	6	2.53	18
Govt.	0.42	5	0.12	2	0.39	4	0.15	2	0.20	3	1.28	3
Education	0.16	2	0.28	4	0.63	7	0.80	12	0.65	9	2.52	6
Religion	0.36	5	0.32	4	0.23	2	0.28	4	0.95	12	2.14	5
Health	0.84	10	0.24	3	0.16	2	0.23	4	0.31	4	1.78	10
Total	8.05	100	7.67	100	9.54	100	6.34	100	7.40	100	39.08	100

Property owners/developers had acquired lands through various channels; 48% through purchase, followed by 29% through inheritance and 9% through leasehold arrangements. This show that about half of the property owners in these areas had obtained land from the open market. In terms of land rights/titles held, the survey revealed that 27% of property owners had sales agreements. Similarly, 26% had statutory titles /Certificate of occupancy granted by the state government while 21% had customary certificate of occupancy granted by the local government authority. 26% had rights to land through family inheritance.

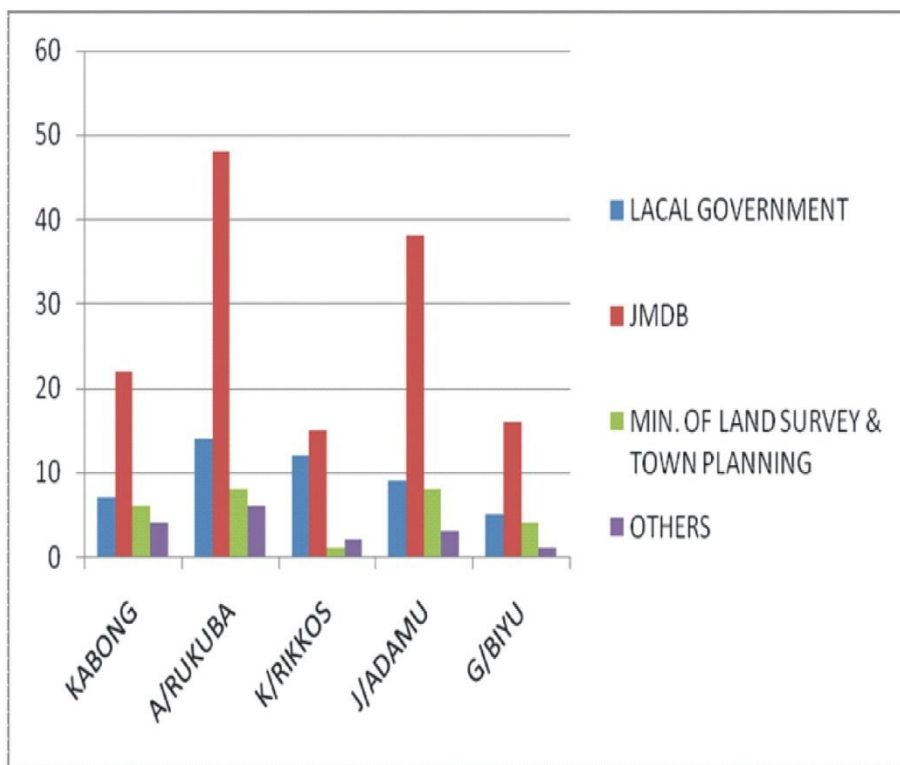


Figure 6: Possession of approved Building Plan.

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 71% did not possessed approved building plans while only 29% had. This result show that about three quarters of all developments were outside the formal land/planning permission system, (see Figure 3). Based on the 1978 Land Use Act, local government are not authorized to grant land titles in areas gazetted as ‘urban areas’ which Jos (the state capital) is one in the state. Dung-Gwom

(1991) had similarly found that most property developers in informal settlements (‘isolated plots as against laid out plots in publicly planned estates/layouts) did not comply with formal procedures and requirements for development.

Information from Ministry of Land, Survey and Town Planning reveals that there exist three plot densities namely; high density (30 x 15m); medium density (30m x 30m or 0.09ha) and low density (30mx 40m). Field survey however reveals that locals sell plots below the accepted standard i.e., 15m x 15m. This has increased the density of development in hilltop settlements and exerting further pressure on already inadequate facilities and utilities within such areas. Physical measurements revealed that about two thirds of plots were 15m x15m (225m²) followed by a third greater than this. The study observed a few large plots of about 50m x 50m (2,500m²) by the rich often fenced with cement blocks. Non-adherence to planning rules and design standards explains the high rate of congestion on these hilltop settlements.

Table 9 reveals that majority of house types on hilltop settlements were compounds (40%) followed by rooming housing (21%), room and parlour (19%) and detached bungalows 17%. Family compounds and housing for low income families predominates the housing structure.

Table 9: Housing Type

TYPE	UNITS/PERCENTAGES											
	KABONG		A/RUKUBA		K/RIKKOS		J/ADAMU		G/BIYU		TOTAL	
	FREQ	%	FREQ	%	FREQ	%	FREQ	%	FREQ	%	FREQ	%
Compound	89	49	53	35	83	40	43	30	49	46	317	40
Detached	35	19	27	18	21	10	25	9	23	21	131	17
Room & Palour	9	5	42	26	67	32	16	11	13	12	147	19
Single Room	42	23	27	18	33	26	47	33	15	14	167	21
Others	5	4	4	3	5	2	10	7	7	7	31	3
Total	180	100	153	100	209	100	141	100	107	100	790	100

4.3 Challenges of Hilltop Settlements

Table 10 presents challenges faced by residents of hill top settlements in Jos. Poor accessibility was the major challenge (experienced by 28% of the households), followed by the difficulty of the terrain which exerted high construction cost and lack of public facilities (schools, health, recreational facilities). Challenges related to sanitation, was surprisingly expressed by only 15 % of the households. This could be due to low importance accorded to the quality of the environment and on personal hygiene by the urban poor.

Table 10: Challenges of Hilltop Settlements

PROBLEM	UNITS/PERCENTAGES											
	KABONG		A/RUKUBA		K/RIKKOS		J/ADAMU		G/BIYU		TOTAL	
	FREQ	%	FREQ	%	FREQ	%	FREQ	%	FREQ	%	FREQ	%
Poor Access	52	29	36	24	63	30	38	27	29	27	218	28
Difficult Terrain	67	37	39	26	34	16	43	31	31	29	214	27
Lack of Public Utilities	29	16	48	31	79	38	18	13	13	12	187	24
Sanitation	21	22	18	12	23	11	36	25	26	24	125	15
	11	6	12	7	10	5	6	4	8	8	47	6
TOTAL	180	100	153	100	209	100	141	100	107	100	790	100

Rating of environmental problems showed that 41% rated it as fairly severe, followed by 36% as severe, while 23% as most severe. These environmental problems included the un-kept surroundings, indiscriminate disposal of solid wastes, improper disposal of household sewage, unsightly neighbourhoods, and so on.

Table 11: Rating of Environmental Problems

RATING	UNITS/PERCENTAGES											
	KABONG		A/RUKUBA		K/RIKKOS		J/ADAMU		G/BIYU		TOTAL	
	FREQ	%	FREQ	%	FREQ	%	FREQ	%	FREQ	%	FREQ	%
Severe	68	38	47	31	108	52	37	26	28	26	288	36
Fairly Severe	75	42	80	52	66	32	48	34	53	50	322	41
Most Severe	37	20	26	27	35	26	56	40	26	24	180	23
TOTAL	180	100	153	100	209	100	141	100	107	100	790	100

Analysis on residents' preferences of basic facilities is presented in table 12. The need for access roads topped the list of preferences (35%) followed by potable water (24%), while electricity was third 18% and the desire for effective waste management expresses by 14% of the respondents.

Table 12: Resident's Preference of Basic Facilities

FACILITY	UNITS/PERCENTAGES											
	KABONG		A/RUKUBA		K/RIKKOS		J/ADAMU		G/BIYU		TOTAL	
	FREQ	%	FREQ	%	FREQ	%	FREQ	%	FREQ	%	FREQ	%
Water	41	23	53	35	42	20	33	23	19	18	188	24
Electricity	39	21	21	14	36	17	25	18	21	20	142	18
Roads	48	27	36	24	93	45	52	37	47	44	276	35
Solid Waste Collect.	32	18	29	19	27	13	13	1	13	12	114	14
Market	20	11	14	8	11	5	18	13	7	6	70	9
TOTAL	180	100	153	100	209	100	141	100	107	100	790	100

Solid waste disposal was a major environmental challenge. Table 13 show that there were no public waste dumps, and therefore no public waste collection systems in hill top settlements. Residents disposed of their solid waste through burning, indiscriminately and into the nearby streams. About 30% collected waste in garbage bins or polythene bags and employed the services of 'wheel barrow boys' at a fee to dispose of it. These end up in streams or any vacant site or along the narrow streets. The situation was more critical in Kabong and Koton Rikkos where a third of the solid waste were disposed of indiscriminately. Poor was disposal and management poses serious public health risks as solid waste dumps become breeding grounds for mosquitoes and other rodents. Given the steep slopes, such waste get washed down hill during the rains clocking drainages and polluting drinking water.

Table 13: Method of waste Disposal

METHOD	FREQUENCY/PERCENTAGES											
	KABONG		A/RUKUBA		K/RIKKOS		J/ADAMU		G/BIYU		TOTAL	
	FREQ	%	FREQ	%	FREQ	%	FREQ	%	FREQ	%	FREQ	%
Indiscriminately	53	30	42	28	63	30	24	17	13	12	195	24
Polythene Bags	14	8	27	19	34	16	13	10	13	12	101	13
Garbage Bin	28	15	25	15	23	11	27	19	21	20	124	16
Stream	33	18	28	18	17	8	54	38	39	36	171	22
Burning	52	29	31	20	72	35	23	16	21	20	199	25
TOTAL	180	100	153	100	209	100	141	100	107	100	790	100

5. DISCUSSION

Majority of residents of hilltop areas are low income earners as 60% earn below N25, 000 per month, 36% of whom have migrated to hilltop areas within the last 20 years. Also majority are married and within the active age group. They provide the semi-skilled and unskilled labour that drives the informal urban economy. The predominance of low income is reflected in the poor quality of houses and the environment. This explains why there are many substandard houses in the neighborhoods. The rapid growth of hilltop settlements in the past 20 years corresponds to the rise in Jos ethno-religious crises in the city, which became violent from 2001. This further explains why these areas are

developing along ethnic and religious lines. For example, Jenta Adamu, Gada Biyu and Angwan Rukuba are predominantly Christian, while Angwan Rogo, and parts of Rikkos are predominantly Muslim. Settlement patterns along ethno-religious has serious long-term implications on governance and peaceful development of the city (Best and Rakodi, 2011). This reinforces perception of the 'we' and the 'other' and legends of favoritism by the state government to particular ethnic/religious groups.



Figure 7: Housing developments on the Steep Slopes in Kabong. *Source: Photo by the Author*

On land and housing issues, it is apparent that residential land use is highest in all settlements with roads covering far less. What this implies is that there is no balanced and sustainable development on hilltop areas. General inaccessibility in these areas implies that infrastructure and services cannot be extended to these areas easily, but only at very prohibitive cost (see Figs. 4 & 5). Additionally, possession of statutory title to land indicates that majority of properties in these settlements are developed without statutory land titles. Only 29% of properties possess building plans approval as against 71% who do not. Most buildings have poor road setbacks, design and orientation and often of poor structural quality which characterizes the urban form. In areas such as Jenta Adamu, Kabong and Gada Biyu, houses are crammed together with no access, inadequately sunlight and ventilation. Majority of houses are compound type accommodating dozens of families with limited and often poorly built sanitary facilities. 31% of the households still use pit latrines, which had been banned in the metropolis since 1975; while majority resort to the bush (or any available open space, vacant lands and uncompleted buildings) for defecation. The high rate of non-availability of toilets explains the rampant rate of open defecation in hilltop areas. In terms of infrastructure and service provision,

there are glaring inadequacies. The survey revealed that only one fifth (21%) of the households were connected to public water supply, with a third (31%) connected to the municipal electricity supply from the Power Holding Company of Nigeria (PHCN), now managed through a private consignment, the Jos DISCO (distribution Company). The non-availability of pipe borne water and electricity in these areas puts pressure on the surrounding areas where these amenities are available through illegal extensions and connections, resulting in low voltage for power and leakages of water pipes.

Facilities such as schools, health and recreational centers, were grossly inadequate in terms of their location, spatial distribution and land reservation. For example, a school in Jenta Adamu was situated on an area of 0.02ha as against the recommended standard 0.045ha (Obateru, 2001). In all the areas sampled, there were no organized open spaces for recreation; thus implying the negative 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 of their solid waste indiscriminately while 60% of liquid waste was disposed directly into the streets, alleys or pen fields. Where soak away pits were available, they were constructed above the ground level due to the rugged terrain. When such soak away pits got filled up, sewage flowed freely thereby constituting public

health risk to other inhabitants and especially those that live downhill and on the flatter sites on the plains.

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. The management and control of hilltop developments had been very weak and ineffective, while no attempt has been



Figure 8: Poor Access and Indiscriminate Disposal of Solid Waste in Gadan Biyu. *Source: photo by the Author*

made by the relevant planning authorities to evolve new policy framework and regulations to guide developments on the hilltops.

6. CONCLUSION

The paper has analyzed the physico-social characteristics of hilltop settlements in Jos metropolis. The findings revealed that these areas are not properly integrated into the city system. Topography and steep slopes pose great challenges to housing development, road design and construction. The prohibitive cost of providing and extending public facilities, utilities and services to these areas may account for their gross inadequacy or no availability. Given the high level of poverty, the residents are

unable to provide these facilities and services on their own. The quality of housing development is generally poor, lacking in design, adequacy of space, orientation and ventilation exhibiting the weak or non-existence of development control in the hilltop settlements. Many are 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 will deteriorate further in the future. The cycle of violent ethno-religious conflicts alluded to by many researchers (for example Krause; Best and Rakodi (2011) is rather rash as the city has enjoyed relative peace in the last four years. To consolidate on this requires new and visionary approaches to urban growth management in the city as well as in the peri-urban and hilltops settlements, which are polarizing not only socially and culturally but also morphologically. The following recommendations are made to address the existing challenges if hill top settlements are to meet the goals of the Sustainable Development Goals (SDGs, 2015-2030) and the New Urban Agenda.

7. RECOMMENDATIONS

1. The provisions of the Doxiadis Greater Jos Master Plan (1975 to 2000) and the Fola Konsult (New) Greater Jos Master Plan (2009 to 2023) which zoned hilltop areas as green area, country parks and conservation corridors should be revisited to accommodate the realities of many of such areas. The state and local governments through the planning authorities should enforce the recommendations of the master plans in areas not under threat by providing land for housing to the poor at more desirable locations that pose little development challenges.
2. Environmental and housing conditions in hilltop settlements should be upgraded through elaborate and conscious policy initiatives of environmental improvements and rehabilitation and urban regeneration. The major focus should be to improve primary access roads, the provision of basic public services and infrastructure, water supply and waste collection. Grants of loans at low interest rates should be provided to the poor to improve their dwellings.
3. There is need to integrated hilltop settlements into the city system through truck services and construction of arterial roads.
4. Planning standards and regulations should be evolved for hilltop areas. This is against the practice where such standards and regulations are uniformly applied to both flat and hilly areas. Hilltop settlements needs relief sensitive planning frameworks to guide their developments, for example, on density, plot sizes, orientation, design that respect their geology, ecology and gradient. Slopes of over 250 should not be developed as these areas witness high run off during the rains and are most susceptible to erosion. Maximum building heights on hilltop areas should be limited to two storeys.

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