

# An Assessment of Causes and Drivers of Urban Sprawl as a Result of Land Use Land Cover Changes in Jos Town and its Environs. Plateau State, Nigeria Using Quantitative and Qualitative Techniques

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**Abstract:** This study intends to assess the driver/causes of urban sprawl as a result of land use land cover change in Jos town and its environs with the view to understand and assess the causes, driver and the factor responsible for urban sprawl as a result of land use land cover change in Jos town and its environs. As a result of land use land cover changes in Jos town and its environs, increase in urban Sprawl increases traffic problems, depletes local resources and destroys openspace particularly in the city center and peripheral areas which has translated into socio-economic and political problems, thereby imposing great challenges to urban planners, city administrator and the public settlement. The objectives of the study are: to assess the driver/causes of urban sprawl, to determine the factors responsible for urban sprawl. Next, quantitative techniques of Cross analysis change detection analysis using Arc GIS was used on the already classified land use and land cover change in Jos town and its environs to detect where waterbody, farmland, openspace, vegetation and rock outcrop converts to settlement land use and which types of land has been transformed to settlement land-use. A qualitative technique using field survey and administration of questionnaire was carried out through which specific general information was collected on sprawl areas in Jos, location sprawl drivers/causes and the factors responsible for sprawl development in Jos town and its environs. The questionnaire was designed to gauge information about the causes/driver and the factor responsible for urban sprawl development in Jos town and its environs specifically areas that show urban sprawl in the study area. The area of open space land in 1986 converted to developed settlement land in 2012. It was also used to determine areas that remained open space land and those land use areas that change from open space land to developed settlement land from 1986 to 2012. This was analyzed to show the pattern of urban sprawl in Jos town and its environs. What were settlement in 1986 and open space in 1986 and open space land that have changed to settlement in 2012. The rate of urban sprawl shows that there was a clear increase in the amount of developed settlement land over the given time period. In 1986 area in hectare is 7525 and in 2001 the area in hectare increased to 12565 area hectare of developed settlement land within the study area respectively. Percentage of respondents on the driver and causes of urban sprawl are: Proximity to the city 27.8%, presence of higher institution in an area 5.6%, 27.8% said cheap land for settlement development, 16.6% availability of social amenity and facility, 22.2% said religion crisis and ethno-religion crisis. 64.8% of the respondents agree that urban sprawl hinders the provision of more social amenity and 35.2% said urban sprawl has not hindered the provision of social amenities in their community. Finally, the analysis on the consequence of the spatial pattern of urban sprawl shows that, the study area needs social amenities to cope with the increase in settlement development, good town planning policies. Most sprawled areas in the study area lack infrastructural facilities to cope with the level of urban growth.

**Keyword:** urban Sprawl, drivers/causes, GIS and RS, land use land cover,

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## I. Introduction

### 1.1 Background

Urban sprawl is often difficult to gauge because it occurs slowly over time. Wilson, Hurd, Civco, Prisloe and Arnold (2003) argues that without a universal definition of sprawl it is extremely difficult to model urban sprawl. Certainly not all urban growth is considered as sprawl because what is sprawl to some may not be to others. "Creating an urban growth model instead of an urban sprawl model allows us to quantify the amount of

land that changes to urban uses and lets the user decide what he or she considers to be urban sprawl” (Wilson et al, 2003).

Urban sprawl is characterized by leapfrog land use patterns, strip commercial development along highways, and very low-density single-use development, all of which occur over a relatively short period of time (Ewing, 1997). It has also been defined in terms of associated causes: urban sprawl is generally believed to result from poorly planned, large-scale new residential, commercial and industrial development in areas not previously used for urban purposes (Zhang, 2001). However, there is no one overriding them in the recognition of urban sprawl: a spatial-temporal signature unique to the phenomenon. Over the past 50 years the process of urbanization, suburbanization, counter-urbanization, and re-urbanization, has allowed for urban expansion in to rural areas taking the form of low-density development, predominantly single family residential subdivisions and strip commercial development (Lee, Tian, Erickson and Kulikowski, 1998).

(Wheeler, 2000). Said “increase in population and changes in income of an average family, leads to the increase in urban sprawls”. Some view it as an opportunity to lead a better life in larger homes, away from the congested city life. However, for some, sprawls are a burden on the economy and environment of the country. Urbanization refers to migration of population from rural regions to towns and cities. Man has always moved to new places in search of better pastures. Hence, migration is not a new phenomenon. However, recent studies have shown a steep rise in urbanization in the late 19th and early 20th century and this sudden increase in urbanization can be attributed to Industrial Revolution, which provided better economic opportunities in the cities, due to setting up of factories and industries. As the cities and towns reap most of the benefits of innovations in the fields of science and technology, urbanization still continues to take place in them. As a result of this, the cities and its suburbs spill over to the rural areas along their boundaries, and this spread is termed as urban sprawl. (Wilson et al, 2003) named the causes of urban sprawl as: Cheaper land and housing costs in the suburbs as compared to urban centres has lured many to settle in these areas, there has been an increase in public spending for the development of infrastructure like roads, water and electricity in the suburbs than in existing urban centres, thus adding benefits to life in sprawls, there has been an increase in commercial lending practices that favour suburban development, sprawls are characterized by low density populations and less traffic congestion. Therefore, even in the absence of any federal policy that would encourage growth of sprawls, these centres have proliferated due to the willingness of a growing number of people to live in sprawl areas, where they find life calmer and more peaceful than in the cities, higher property and business taxes in the cities have pushed businesses to the suburbs where taxes are generally low.

### **1.2 Statement of the problem**

Urban development has led to increase in employment opportunities, housing stock, social services and expanding infrastructure, such development is occurring in a haphazard manner largely dominated by the urban informality in most of the sectors. This has greatly contributed to the unsustainable utilization of natural resources within the metro area resulting in environmental degradation through solid waste accumulation, wetland encroachment and destruction, water pollution and land use/cover change that is reducing the ecological services from the natural environment of the metro area (Wilson et al. 2005).

The resultant living environment of the urban poor in the city is deplorable with poor sanitation, inadequate housing, poorly managed solid and human wastes, increased water pollution and reduction in ecological services. Consequently, these have exacerbated vulnerability of Jos town and its environ population and communities to natural disasters.

### **1.3 Scope of the study area**

The spatial scope consists of two jurisdictions which constitute the study area Jos North and Jos south. These were selected entities because there is a great deal of similarity among these jurisdictions concerning land cover, land use type, land area and land use practices. The temporal scope of the study is the assessment of the spatial pattern of urban sprawl in Jos town and its environs from 1986-2012. Finally, the contextual scope of the study defines urban sprawl as a form of urban development that spreads outward in a haphazard pattern, consuming more land than is necessary and creating excessive public cost for community facilities and services (Lee, Erickson and Kulikowski. 1998). The sprawl areas in Jos town and its environs includes: Farin-gada/Zaria road, Kabong/Rukuba road, Naraguta/Babal, Zinariya/Rikkos, Yan-trailer/Fudawa/Laminga, Katon-rikkos/Lamingadam, Gwarandok/Shiyaka/Gold & base, Rayfield/Gut, Gura-topp, Angwan-doki/Rahwol-kannang, Sabon-gari/Tudun-wada/Tudun-wadaring road, Kufang/Longwa, Wild life park/Dong, Rantya, Rashik, Gyel/Kangang, Sabon-barki/Nyanko-gyel, Mun-gyel, Anguldi/Zawan/Dorowa, Kwata/Trade Center/NIPPS. (Dung-Gwom and JY, 2007)

The study area has transformed from several mining settlements and camps which have over the years merged to form the present metropolis. The settlements are: Naraguta, Mai-Adiko, Rayfield, SabonBarkin, Delimi village, Bukuru, Trade Centre, Dorowa. Jos presently occupies about 160 square kilometers and extends

over 50 kilometers along its North-South axis. Jos is a poly-nucleated metropolis due to the several mining settlements from which it has grown from. This makes it very difficult to clearly define and demarcate its urban areas. generally, Jos urban areas are characterized by sporadic developments, there exist high settlement density in this various locations, such as in Rayfield, Naraguta village, Mista-Ali, Sabon-Gari, Tudun-Wada, Dadin-Kowa, Zaramaganda, Sabon-barkin, Gyel,Gada-biyu, Federal and State low-cost, Bukuru, Trade Centre.(Dung-Gwom etal.2004)

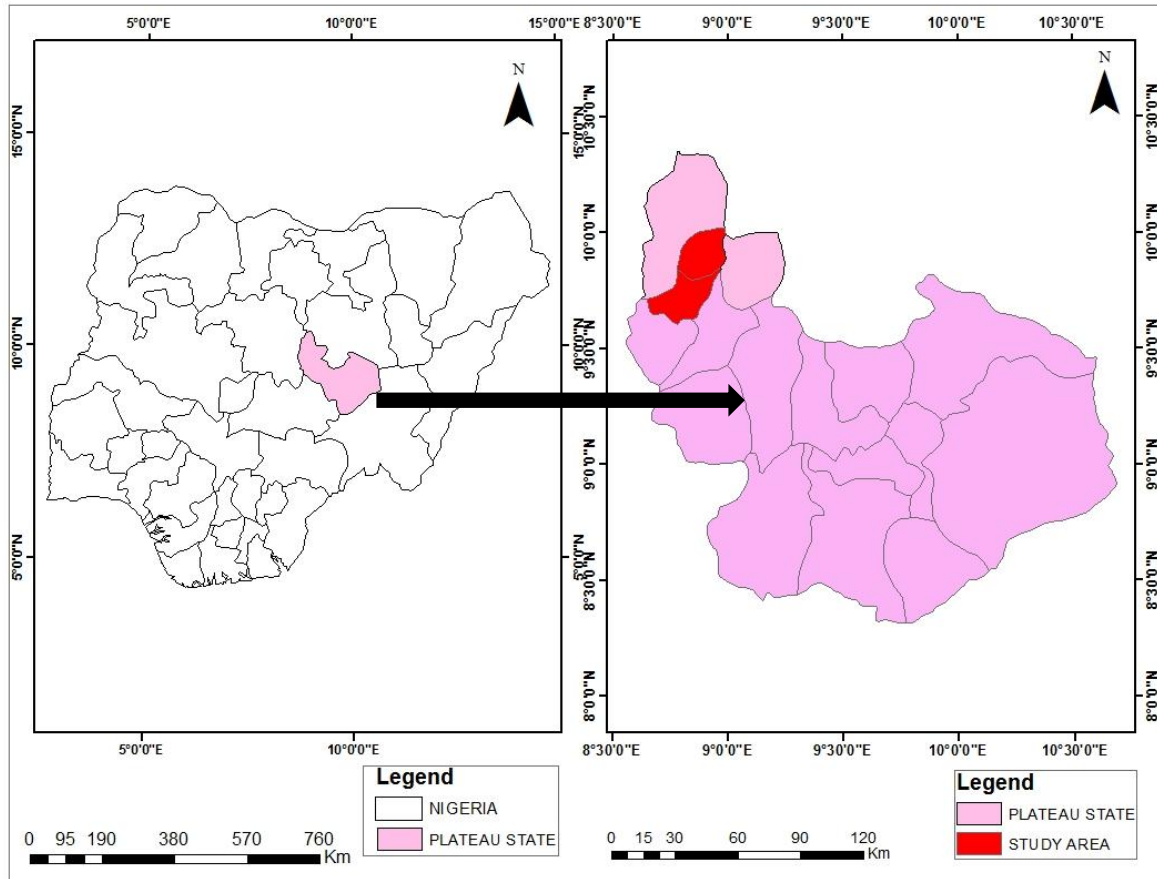


Figure 1: Location of the study area(Source:Settlement map of Nigeria, 1996)

### 1.4 Aim and Objectives of the Study

The aim is to assess the driver, causes and spatial pattern of sprawl in Jos town and its environs. The above stated aim will be achieved through the following specific objectives; To examine the causes/drivers of urban sprawl in Jos town and its environs. To assess the consequence of urban sprawl in Jos town and its environs.

## II. Data and Methods

### 2.1 Data and Source

The data used to achieve the research objectives and their source are presented in table

Table 3.1: Data used and their Sources

Data Type	Date of Production	Resolution	Source
Land-sat imagery	1986	30m	NCRS
Land-sat ETM	2001	30m	NCRS
Nig-sat X	2012	resample 22-30m	NCRS
Questionnaire	2015	57	Researcher
Study area map	1996		NCRS

### 2.2 Methodology

A design questionnaire was used in this research, administering of questionnaires was used to achieved the objective of the study as the causes & drivers and consequences of sprawl. A detailed field survey and administering of questionnaires was been carried out, through which specific general information was been obtained on sprawled areas in Jos, the sprawl drivers & causes and the consequences of sprawl development in Jos town and its environ. The questionnaire was designed to gauge information about the causes & driver and the

consequences of urban sprawl development in Jos town and it environ, specifically in areas that shows urban sprawl. such areas are: Farin-gada/Zaria road, Kabong/Rukuba road/Utan, Naraguta/Babal, Zinariya/Rikkos, Yan-trailer/fudawa/laminga, Katonrikkos/Lamingadam, Gwarandok/shiyaka/Gold & base, Rayfield/Gut, Gura-topp, Angwan-doki/Rahwol-kannang, Sabon-gari/Tudun-wada/Tudun-wadaring road, Kufang/Longwa, Wild life park/Dong, Rantya, Rashikgyel/Kangang, Sabon-barki/Nyanko-gyel, Mun-gyel, Anguldi/Zawan/Dorowa, Kwata/Trade Center/NIPPS. (Dung-Gwom and JY, 2007)

The questionnaire administered in the field about cause & drivers and consequence of urban sprawl in Jos town and its environ was analysed and presented in tabular form to show the percentage of respondent in each particular question.

### III. Result and Discussion

#### 3.1 Result, Analysis and discussion

The result, analysis and discussion for this research are explained below as a statement of the cause and drivers and the consequence of sprawl obtained in the research objective in the study.

#### 3.2 Assessing sprawl causes & drivers as a result of land use land cover change which will lead to the consequence of sprawl in Jos town and its environs using GIS as tool for the analysis.

This analysis used cross analysis change detection techniques to analyse the trend of sprawl cause & driver in Jos town and its environ which push for more land use land cover change which has also created so many sprawl consequences related problem in Jos town and its environs. The conversion map, unchanged land use map, land use changes map, statistics table, settlement data, road network and which land use has been converted to what, and which land use has not been converted. But our main concern was to see the gain in settlement development from 1986-2012 and to see which classes contributed higher to settlement development in Jos town and its environ (figure 2 and table 1).

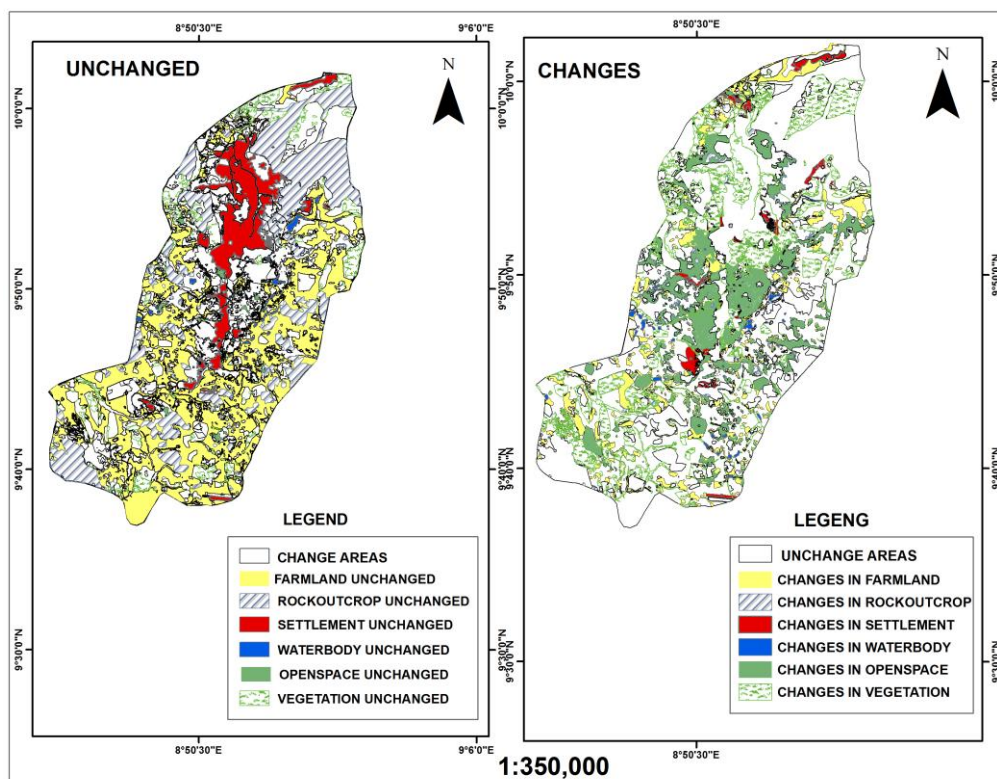


Figure 2: Map showing cross analysis change detection map 1986-2012 (Source: Author GIS Analysis, 2013)

Figure 2 unchanged and changed maps is showing the result of the cross-change detection analysis of what land use in 1986 remained the same land use in 2012 and what land use in 1986 has converted to which land use in 2012. So a further analysis on this map show clearly what cross change detection analysis is all about and this is what the below section will concern about.

Figure 2 map is showing unchanged land use land cover in Jos town and its environs from 1986 to 2012 on how farmland, vegetation, settlement, open space, rock outcrop and water body 1986 remained farmland, vegetation, settlement, open space, rock outcrop and water body land use in 2012. Also figure 2 shows changes in land use

land cover in Jos town and environs from 1986-2012 on how farmland, vegetation, settlement, open space, rock outcrop and water body that have change to other settlement land use between 1986-2012.

**Table 1:** Land Use Transformation in Jos and environ 1986-2012(area in hectare)

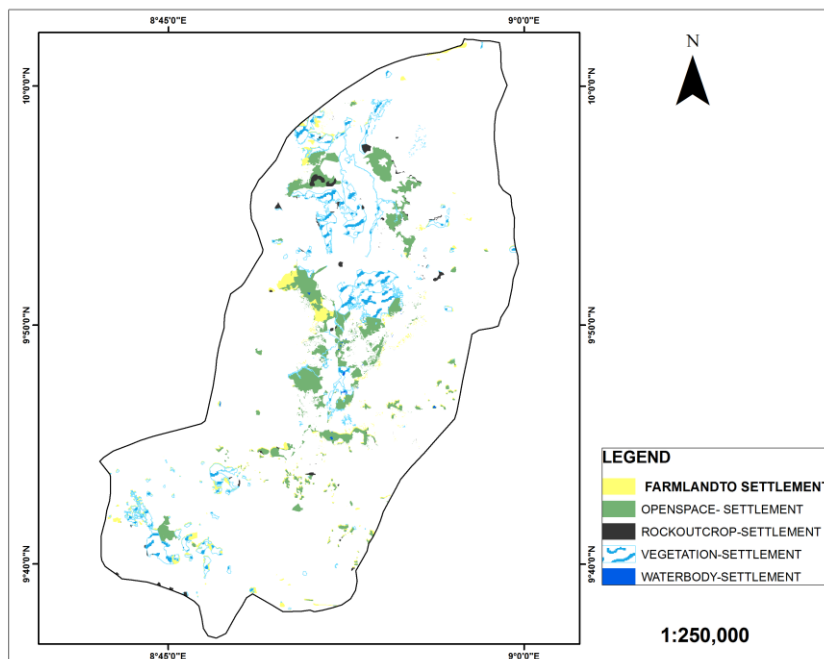
Land use	Farmland	Openspace	rockoutcrop	Settlement	Vegetation	waterbody
Farmland	24756	1488	0.00	1338	2663	31
Openspace	5971	358	0.048	3896	488	18
Rockoutcrop	0.007	0.081	14601	327	0.0083	0.0010
Settlement	951	312	0.002	6149	86	0.0087
Vegetation	8373	823	0.0056	3678	2595	0.0069
Waterbody	588	0.0030	0.0011	31	0.0071	380

(Source: GIS and Statistical Analysis, 2013)

Table 1 is derived from the cross-analysis change dictation analysis in ARCGIS. The vertical column shows total amount of land used for a particular class in 1986. Horizontal line shows the total changes that have happened in a particular class within twenty-sixyears’ period 2012 and what type of land has contributed for this change. More to that, the horizontal line shows the decrease in land uses and vertical line show the increase in land uses. Land area in the above table cannot be the same with the study area land mark because these cross analyses involve the land uses from 1986 -2012 and the purpose is to see which land uses converted to which land uses. So, the grand total figure cannot be the same with the study area land area in table 1 which is showing only the study area land mark but the above table is showing the addition of land uses in 1986, 2001 and 2012 of all the land areas in 26 years to see many hectares of land uses has converted to which land uses.

**3.3Gains in settlement from other land use land cover in Jos town and it environ between 1986-2012**

This section focuses on the gains in settlement land use from 1986 – 2012, which has shown how other land use has been converted to settlement and shows how other land use is been seen as another driver and causes of urban sprawl in Jos town and environs.



**Figure 3:** Map showing a gain in settlement land use from other land use from 1986-2012(Source: Author GIS Analysis, 2013)

Figure 3 map is showing a gain in settlement land use in Jos town and it environ from 1986-2012, that also show how much a particular land use contribute higher as a driver of urban sprawl in the study area. Because change in a particular land use farmland, vegetation,rock-outcrop,waterbody and open space to settlement from 1986-2012 shows that there is an increase in urban growth which also appear in the form of the three different types of

sprawl in Jos town and its environs. So, the conversion of other land use to settlement land use has proof that change in land use in Jos town and it’s environ is another driver and causes of sprawl in the study area.

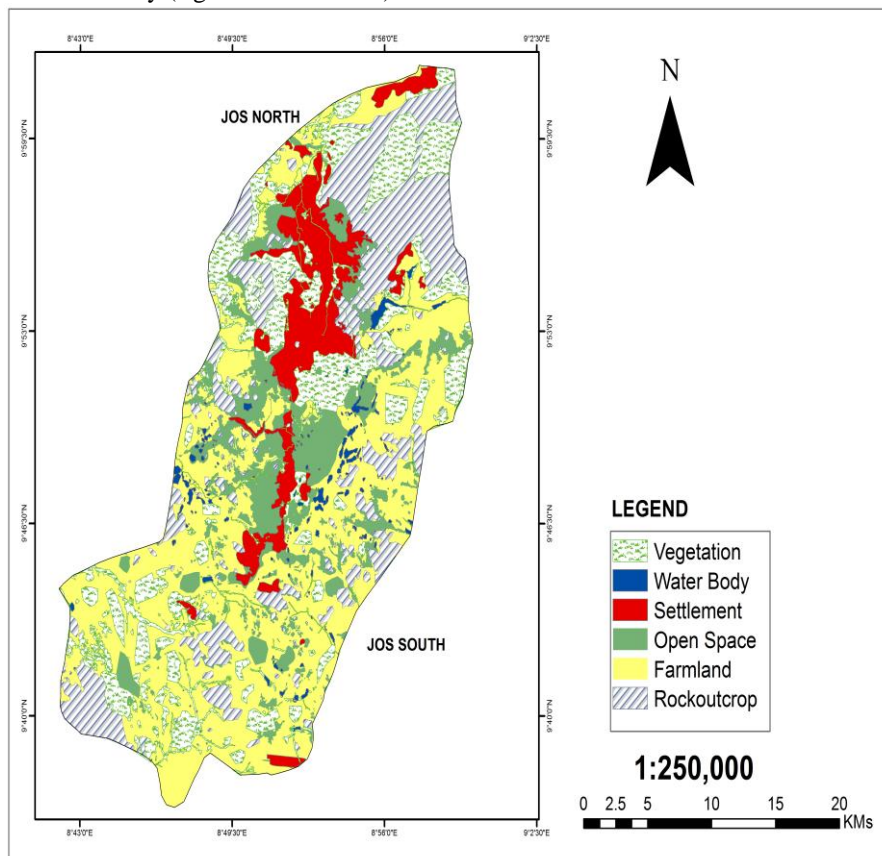
**Table 2:** Gain in settlement land use from 1986-2012(area in hectare)

land use change 1986- 2012	area(hectare)
farmland to settlement	1338
Openspace to settlement	3896
Rockoutcrop to settlement	327
vegetation to settlement	3678
waterbody to settlement	31
<b>Total</b>	<b>9270</b>

(Source: Author GIS ANALYSIS 2013)

Table 2 shows the statistic of the result extracted from the cross detection change analysis to enable us to narrow our analysis to the particular area of interest, which enables us to see which land use contribute to settlement development in Jos town from 1986-2012.From the statistics table, it shows that 3896 hectares of open-space has been converted to settlement, vegetation 3678-hectare land, farmland 1338-hectare land, rock-outcrop 327-hectare land and water-body 31-hectare land area converted to settlement between 1986 to 2012.

Assessing sprawl in the study area based on land use changes, the rate, type and patterns of densities of new growth between 1986 and 2012. The land use land cover of Jos north and Jos south was analysed to improve understanding and to find the driving forces of land use changes so that sustainable land utilization could be practice to avoid urban sprawl. In this analysis cross analysis change detection result and overlay analysis (ARCGIS) was performed to detect “where other land use change has occurred and which type of land use has transformed to settlement land use. Because of the steady growth in population in the study area, sprawl has extended outward by encroaching fertile farmland, vegetation, open space, water body and rock outcrop. This is well documented in the study (figure 3 and table 2).



**Figure 4:** Map showing land use land cover of Jos in 1986 (Source:Author GIS Analysis, 2013)

Figure 4 Map is showing the land use land cover classification map of Jos and environ. This was done to help in examine the driver and causes of urban sprawl in the study area in 1986. The above map is showing the graphical representation of vegetation, water body, settlement, open space, farmland and rock outcrop in the study in 1986. Figure 4 shows that farmland constituted the dominant land use land cover type (37.8 %) followed by vegetation (19.3 %), rock outcrop (18.9 %), open space (13.4%) The remaining land was covered by settlement and water bodies 9.3 % and 1.3 % respectively, (Table 1 and Figures 4).

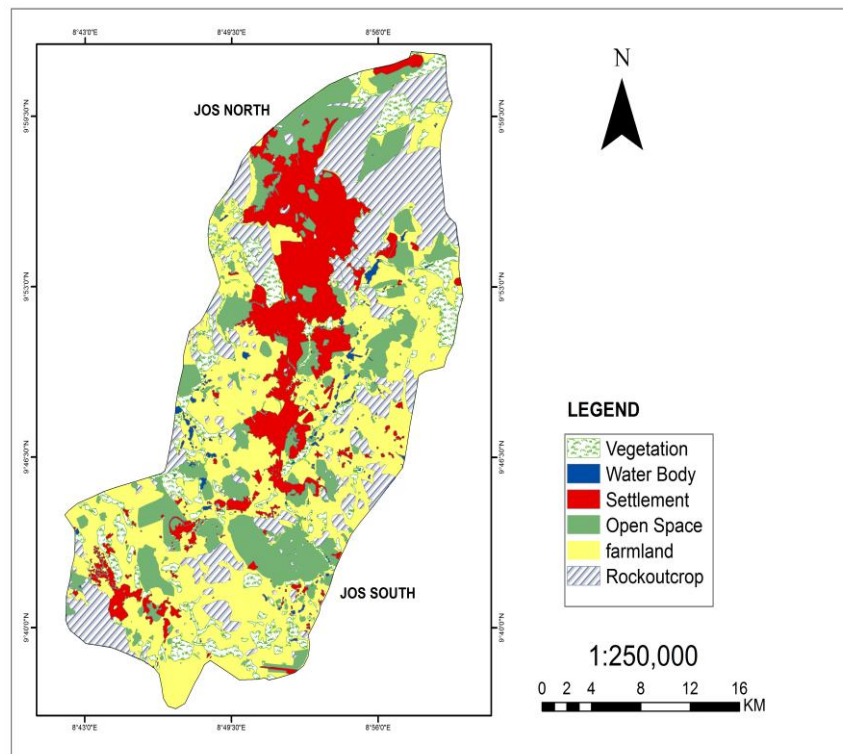
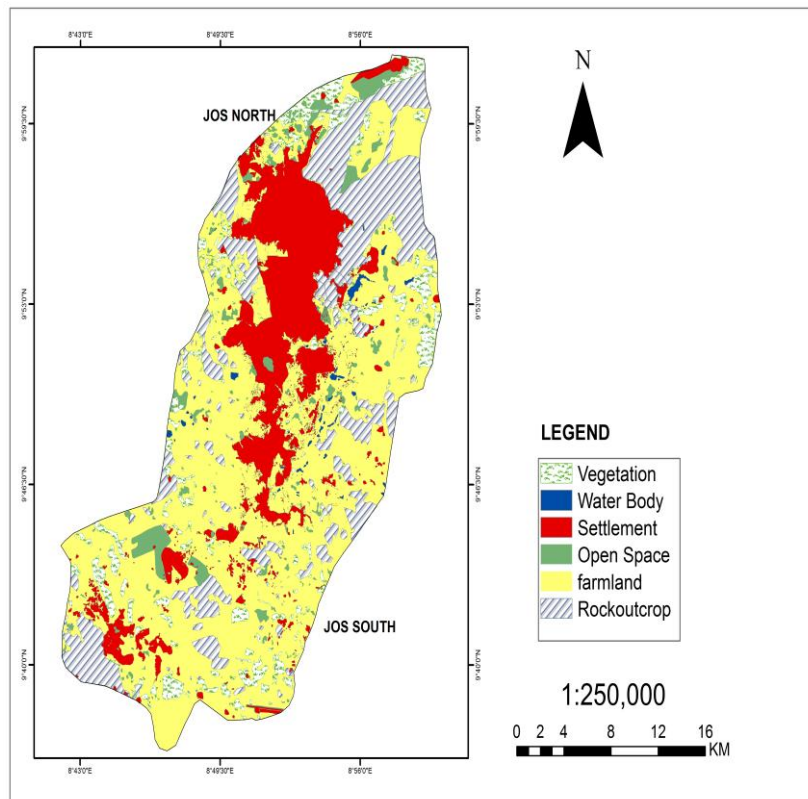


Figure5: Map showing land use land cover of Jos in 2001 (Source:Author GIS Analysis, 2013)

Figure 5 Map is showing the land use land cover classification map of Jos and environ. This was done to help in examine the drivers/causes of urban sprawl in the study area in 2001. The above map is showing the graphical representation of vegetation, water body, settlement, open space, farmland and rock outcrop in the study in 2001. Figure 5 shows that farmland constituted the dominant land use land cover type (37.9 %) followed by rock outcrop (18.7 %), open space (17.4 %), settlement (15.6%) The remaining land is vegetation and water bodies 9.3 % and 0.9 % respectively, (Table 1 and Figures 5)

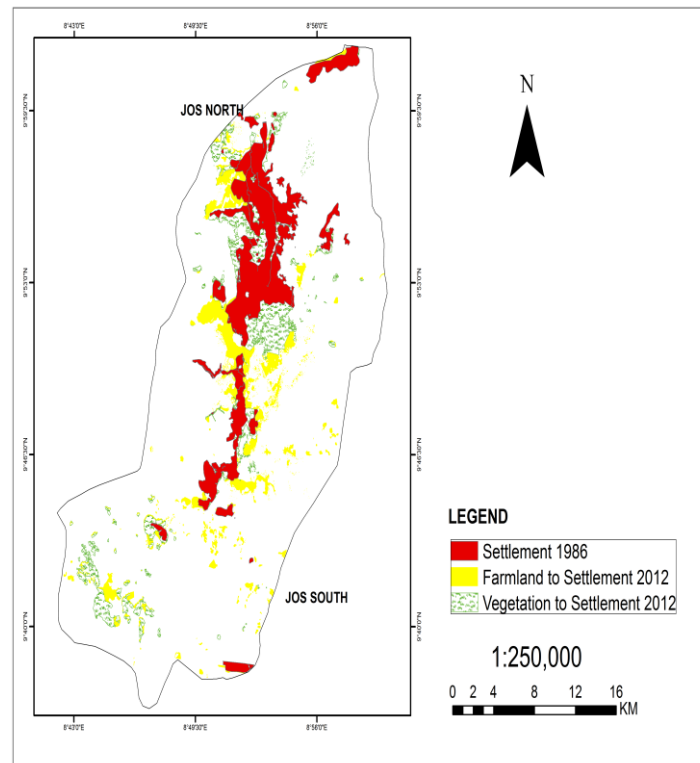


**Figure6:** Map showing land use land cover of Jos and environs in 2012(Source: Author GIS Analysis, 2013)

Figure 6 Map is showing the land use land cover classification map of Jos and environ. This was done to help in examine the drivers and causes of urban sprawl in the study area in 2012.The above map is showing the graphical representation of vegetation, water body, settlement, open space, farmland and rock outcrop in the study in 2012. Figure 6 shows that farmland constituted the dominant land use land cover type (50.9 %) followed by settlement (19.2 %), rock outcrop (18.2 %), vegetation (7.3%) The remaining land is open space and water bodies 3.9% and 0.5 % respectively, (Table 1 and Figures 4.15

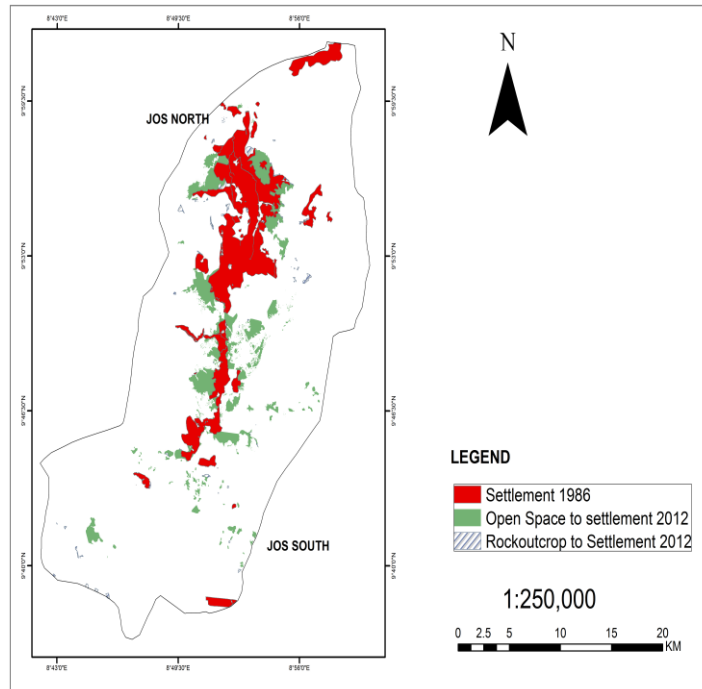


### 3.4 Conversion maps showing Gain in Settlement from other classes in Jos town and its environs from 1986-2012



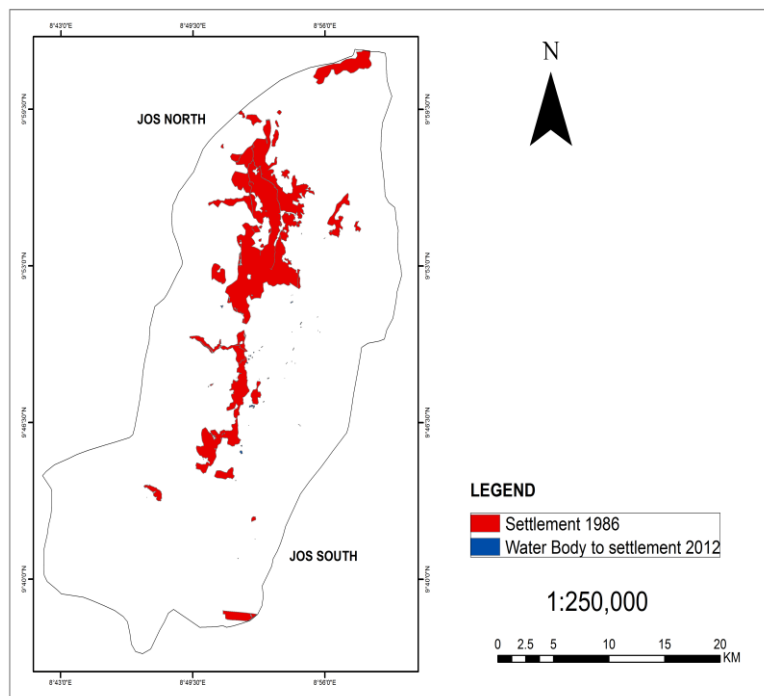
**Figure 7:** Conversion of farmland and vegetation to settlement (Source: Author GIS Analysis 2013)

Figure 7 shows that settlement in 1986 is 7525 area hectares (table 2). For the rapid increase in settlement in 2012 is as a result of vegetation land and farmland land that converted to settlement development. Vegetation land has contributed 3678 area hectare and farmland land has contributed 1338 area hectare (Table 7). This shows changes that occur in the area in the year 2012 that is the conversion of vegetation and farmland land to settlement. In figure 3 one can easily identify exactly where the vegetation and farmland land were transformed into settlement. New settlement such as Kuru, Turu, Barakin-mari and Naraguta were developed within farmland and vegetation. The increase in settlement development have reduced the farmland and vegetation land area.



**Figure 8:** Conversion of open space and rock outcrop to settlement(Source: Author GIS Analysis, 2013)

Also figure 8 shows how open space and rock outcrop land use conversion to settlement. Open space land has contributed about 3896 area hectare and rock outcrop contribute about 327.



**Figure 9:**Conversion of water body to settlement(Source:Author GIS ANALYSIS 2013)

Figure 9 in the year 1986 the total surface of water body was 1087 hectare, 2001 is 688 hectares and in 2012 is 474 hectares (table 2). So, there is 613-hectare changes in water body from 1986 -2012. 13 hectare of water body has been converted to settlement.

### 3.5 Examining the drivers, causes and the consequence of urban sprawl in Jos town and its environs through questionnaire administer in the field.

This section involves the analysis of the driver, causes and consequence of urban sprawl. Below is table showing the number of responses and percentage explaining the responses to the question on the driver, causes and consequence of urban sprawl.

#### 3.5.1 Social-Demographic Personnel Information about an Urban Dweller in the Study Area

The result of the survey derived from the 54 valid responses out is presented to address the driver, causes and consequence of urban sprawl in Jos town and its environs. The responses to key question that define the outcome of the research are presented in table, number of responses and percentage.

**Table 3:** Social-demographic information

Name of LGA residence	Responses	Percentage (%)
Jos North	21	38.90
Jos South	33	61.10
<b>Sex</b>		
Male	43	79.60
Female	11	20.40
<b>Age group</b>		
25-34yrs	23	42.60
35-44yrs	25	46.30
44yrs+	6	11.10
<b>Educational status</b>		
Non formal	2	3.60
Primary education	1	1.90
Secondary education	1	1.90
Tertiary education	50	92.60
<b>Total</b>	<b>54</b>	<b>100</b>

(Source: Author Fieldwork 2015)

Table 3 shows that 61.1% of the respondents were from Jos south part of the study area, 38.9% of the respondents were from Jos north area of the study area. This means that Jos south has the higher percentage of respondents because it has the higher number of urban sprawl area in Jos and its environs. Also, 79.6% of the respondents are male, while 20.4% are female. Similarly, 42.60% of the urban dwellers in the study area that respond to the questionnaire are between age 25-34. This group are mature land owners and house owners and they have knowledge about urban sprawl, 46.30% of the respondents were 35-44 year and 11.10% of the respondents were 44 years and above. On the level of education, 3.6% of the respondents have attended non-formal education, while 1.9% attended primary education, 1.9% attended secondary education and 92.6% attended tertiary education. This is because the percentages of those who have accumulated higher level of education are those that agreed to respond the questionnaire.

#### 3.5.2 Examining the Causes & Drivers of Urban Sprawl in Jos Town and its Environs

The causes/driver of urban sprawl in Jos town and environ was assessed to examine the factors that causes the emergence of sprawl in the study area. This was achieved through the analysis of the questionnaire administered in the field to sample people's views about the drivers and causes of urban sprawl in Jos town and its environs

#### 3.5.3 When did development start emerging in your area?

It has been an establish fact that Jos plateau state has a cold weather and dominated with mining activities. However, it was observed that there was variation in the emergency of development in Jos town and its environs. In view of above, information on the emerging of urban development activities carried out by the questionnaire administer was collected as presented in Table 4

**Table 4:** Development trend in the Jos town and its environs

Development trend	Responses	Percentage (%)
1986-2000	22	40.70
2001-2012	32	59.30
Others	0	00
<b>Total</b>	<b>54</b>	<b>100</b>

(Source: Author Fieldwork 2015)

From Table 4 it can be seen that, 40.7% of the respondent in the study area confirmed that development became evident in the area from 1986-2000, while 59.3 of the respondents revealed that development started emerging in the area from 2001-2012. This means that there is a significant increase in settlement development between 2001- 2012. From the above analysis, development in the study area is increased in recent times.

### 3.5.4 Land use activities practice in the area before the emerging of development in the area.

Table 5 what kind of land use activities practice in your area before the emerging of development in the area?

The phenomenon of land use land cover change in the study area depend on the most important land use activity practice in Jos town and its environs at a present time series.

Types of land use practice before	Responses	Percentage (%)
Farmland	34	62.9
Quarrying of sand and gravel	4	7.40
Mining	13	24.1
Open space	3	5.6
<b>Total</b>	<b>54</b>	<b>100</b>

(Source: Author Fieldwork 2015)

The land use practices in Jos town and it environ shows in table that 62.9% land was farmland, while 7.4% is quarrying of sand and gravel, 25.1% is mining land activities and 5.6% is open space. Based on the responses, before the emerging of settlement development in Jos town and its environs. Farmland was the dominant land use in the study area and mining activities takes about 24.1% which when trace to the history of plateau that mining was one of the land use activities that have driven some many in to Jos city in the 80s and 90s.

### 3.5.5 Current land use activities practice in your area.

Table 6: what is the current land use activities practiced in your area?

Current land use practice in your area	Responses	Percentage (%)
Residential	51	94.50
Farming	3	3.70
Quarrying of sand and gravel	0	0
Mining	1 1.80	
Others	0	0
<b>Total</b>	<b>54 100</b>	

(Source: Author Fieldwork 2015)

The change in land use land cover in Jos town and it environ was traced from 1986 -2012 to see which land use has change to what land use from the table above it shows that 94.55 respondents indicated that, the present land use in the area is residential that is settlement. While 3.7% is farmland, quarrying of sand and gravel is 0% which is as result of shift in quarrying of sand and gravel land use is to another land use due to replacement to settlement. Mining land use activities has 1.8 % presently; this is as a result of urban sprawl expansion that discourages most vital mining activities in study area in the recent time. The result in the table 6 shows clearly how most urban land uses within the study area have changed to residential areas within the study area.

### 3.5.6 The drivers and causes of urban sprawl in your area.

**Table 7:** what are the driver and causes of urban sprawl in your area?

<b>Drivers and causes of urban sprawl</b>	<b>Responses</b>	<b>Percentage (%)</b>
Proximity to the city centre	15	27.80
Present of higher institution around your area	3	5.60
Cheap land for settlement development	15	27.80
Availability of social amenities and facilities.	9	16.60
Religion crisis and ethno-religions crisis	12	22.20
Other	0	0
<b>Total</b>	<b>54</b>	<b>100</b>

(Source: Author Fieldwork 2015)

The drivers and cause can only be known by urban duellers that are responsible for land use land cover conversions within Jos town and it's environ. Table7 shows the factor responsible for sprawl development within the study area Proximity to the city shows 27.8% percentage responsible for urban sprawl in the study area, presence of higher institution in an area 5.6% was been responsible for the urban sprawl, while 27.8% was cheap land for settlement development this is because most urban duellers acquire cheap land to build houses which are not always conform to town planner policy of building plan in Jos town and its environs. More on that, 16.6% of respondents that availability of social amenities and facilities is responsible for urban sprawl and 16.6% availability of social amenity and facility are responsible for settlement development. Finally,22.2% revealed that ethno-religious crisis is responsible for the urban sprawl experience in Jos tow and it environ from 2001 to 2012 as that is the period when most parts of Jos was divided base on religion. So, religion crisis plays vital role in urban sprawl experience in Jos and environ from 2001 to date that most Jos residents migrate to areas that is more secure for their lives and properties. The religion crisis also lead to more pressure on land uses within the study because most people houses were destroyed so there is need to build new houses to ease the problem of accommodation. Consequently, proximity to city centre and cheap land for settlement development are the higher driver and causes of urban sprawl in the study area from 1986-2012.

### 3.5.7 Assessing the Consequence of the Spatial Pattern of Urban Sprawl in Jos and its Environs.

The environmental effect of urban sprawl in the study area is one of the main consequences of urban sprawl in the study area. As land use land cover change from one land use to another, there must be the negative consequence about.

**Table 8:** The effect of urban sprawl on your immediate environment

<b>Consequence of urban sprawl</b>	<b>Responses</b>	<b>Percentage</b>
Yes	46	85.20
No	8	4.80
<b>If yes specify as follow:</b>		
Traffic congestion	27	59.80
Pollution, poor sanitary system and poor waste management	22	30.80
Vulnerable and prone to disaster	2	1.90
Destruction of natural vegetation cover	3	7.50
Other	0	0
<b>Total</b>	<b>54</b>	<b>100</b>

(Source: Author Fieldwork 2015)

As can be seen in the Table 8 shows that 85.2% of the respondents revealed that urban sprawl has consequences to the immediate environment.in a similar pattern, 59.8% of the respondents agreed that traffic congestion is one consequence of urban sprawl in the study area,30.8% also agreed that pollution, poor sanitary system and poor waste management is another consequence of urban sprawl and it is related to the cluster area of urban sprawl in the study area where there is haphazard and unguided plan development of settlements. While 1.9% revealed that their area is vulnerable and prone to disasters as the consequence of urban sprawl. Finally, 7.5% revealed that the destruction of natural vegetation cover is another consequence of urban sprawl. More to that, only 4.85% disagreed and stated that urban sprawl has no consequences to the immediate environment and it is mostly associated to leapfrog sprawl areas and they are areas with a low population with few houses that cannot have sprawl consequence but the area lacks inadequate social amenities. Mostly the leapfrog area has not yet experienced any consequence of sprawl.

The immediate consequence of urban sprawl in the study area shows that traffic congestion is the most common consequence of sprawl because residents of move from one area to another which involves in traffic congestion.

**3:5:8Did urban sprawl hinder the provision of social amenities in your area?**

**Table 9:** Does urban sprawl hinders the provision of social amenities in your area?

<b>Does Sprawl hinder provision of social amenities</b>	<b>Responses</b>	<b>Percentage (%)</b>
Yes	34	64.8
No	20	35.2
<b>Total</b>	<b>54</b>	<b>100</b>

**If yes specify as follow:**

A cluster pattern of development too close to the road for any future road expansion	17	31.50
Fast development area without proper planning to accommodate future development	19	35.20
Too expensive to compensate settler if government want to build any future public facilities in your area	4	7.40
No open space for building any recreational and social facilities in your area	14	25.90
Other	0	0
<b>Total</b>	<b>54</b>	<b>100</b>

**If no, state your reason**

Available land and space for future development	11	55
Leapfrog sprawl type	5	25
There is No social amenity in their area	2	10
Organise town planning in the area	2	10
<b>Total</b>	<b>20</b>	<b>100</b>

(Source: Author Fieldwork 2015)

The emerging of urban sprawl in Jos town and its environs has caused so many problems like the provision of social amenities to some sprawled areas in Jos town and its environs. Table 9 shows that 64.8% of the respondent agree that urban sprawl has hinder the provision of more social amenities to the area and also stated the reasons they think so 64.8% revealed that urban sprawl hinders the provision of social amenities in the study area, 31.5% indicated that cluster pattern of settlement development too close to the road hinder any future road expansion because of high compensation hinder the government to able to construct more road in some cluster settlement area while 35.2% agree that sprawl hinder provision of social amenity because of fast development without proper town planning to accommodate any future community oriented social amenities like; dispensary, recreational facility in that particular sprawl area in Jos town and its environs. More to that, 7.40 % revealed that compensation problem hinders the government to provide some needed amenities due to unplanned settlement development and 25.9% believes that there are no open spaces for the government to build any social facility in the area for all the community benefit.

Table 9, 35.2% of the respondent said urban sprawl did not hinder the provision of social amenities in the area and their reasons are highlighted as follow: 2 respondent revealed that there was no even amenities from the beginning, 11 respondents revealed that there is more space to accommodate future development, 5 respondents said leapfrog pattern of settlement development isolated from the main city where there is social amenity, 2 respondent revealed that there is organised town planning in their area. Finally, 64.8% of the respondents agree that urban sprawl hinders the provisions of more social amenities and 35.2% think that urban sprawl has not hindered the provisions of social amenities in the area.

**3.5.9 Does your area have sufficient social amenities to cope with the type of urban sprawl?**

Haphazard and unplanned Sprawl development create problem for the spatial distribution of social amenity in Jos town and its environs. Also lack of social amenities creates so many problems for the new settlement development. As observed during the fieldwork and administering of questionnaire, urban sprawl creates so many problems but some of the areas have available social amenities.

**Table 10:** Does your area has sufficient social amenities to cope with the type of urban sprawl

<b>Is there sufficient social amenity to cope with urban sprawl</b>	<b>Responses</b>	<b>Percentage (%)</b>
No	52	96.2
Yes	2	3.7
<b>Total</b>	<b>54</b>	<b>100</b>
<b>If no specify as follow:</b>		
Poor accessibility of road network	27	50
Problem of electricity connection due to cluster urban sprawl	13	24.1
Problem of pipe born water	14	25.9
Others	0	0
<b>Total</b>	<b>54</b>	<b>100</b>
<b>If yes state your reason:</b>		
Electricity and pipe born are available	1	50
Availability of social amenity exist	1	50
<b>Total</b>	<b>2</b>	<b>100</b>

(Source: Author Fieldwork 2015)

As presented on Table 10, 96.2% of the respondents revealed that there are no social amenities to cope with the level of settlement development in the area, while 3.7% of the respondent agrees that there are social amenities to cope with the level of settlement development in the area. Further analysis shows that 50% of the respondents believe that there is poor accessibility of road networks, 24.1% revealed that there is a problem of electricity connection due to cluster type of urban sprawl and 25.9 % of the respondents consider problem of pipe born water reason for saying there is no sufficient social amenity in the area in Jos town and its environs. Consequently, from the table above only 3.7% of the respondent agree that there is availability of social amenity in the area to cope with the type of urban sprawl in Jos and it environ. Finally, the analysis shows that, the study area needs social amenity to cope with the increase in settlement development and good town planning policies to be developed and implemented in Jos town and it environ to overcome any further consequences of urban sprawl in the study area

## IV. Summary, Conclusion and Recommendation

### 4.1 Summary

The assessment of the causes & drivers of urban sprawl in Jos town and its environ shows that farmland contribute most in urban sprawl because most farmland are presently converted to residential areas in Jos town and environ. Also, proximity to city centre and cheap land for settlement development are main drivers of urban sprawl in Jos town and it's environ follow by religion crisis, ethno-religion crisis and availability of social amenity.

Assessing the consequence of urban sprawl in Jos town and its environ shows that 85.2% agrees that urban sprawl effect their immediate environment and state those consequences that affect sprawl in Jos town and it environ as traffic congestion, pollution, poor sanitary system, inadequate proper waste management and vulnerable and prone to natural disaster. More to that, 64.8% of the respondent agree that urban sprawl hinder the provision of social amenity while 35.2% said urban sprawl do not hinder the provision of social amenity in the study area. Fast development area without proper planning to accommodate future development, cluster pattern of development too close to the road for any future road expansion and too expensive to compensate settler if government want to build any future public facilities. 79.6 % of respondent said there is no sufficient social amenity to cope with the level of urban sprawl in the study area and also said 50% said poor road accessibility is a problem confronting the sprawl developed area in the study area, 24.1% problem of electricity due to cluster sprawl and 25.9% said pipe born water is the consequence of urban sprawl in Jos town and its environ.

### 4.2 Conclusion

The two objectives of the study deal with what are the causes & drivers and consequences of urban sprawl in the study area. Detecting the reason why the land use change has occurred and which type of land has transformed to settlement land use? The result of the causes, drivers and consequence of urban sprawl was been done to validate the result of cross change detection analysis method in ARCGIS which produce the conversion maps of which land use has been convert to settlement, which land use remained unchanged settlement land use,

how rock outcrop ,farmland, open space land, vegetation and water body has been converted to settlement land and finally, the cross change detection analysis produce a statistic table that show the rate at which a land use has change in area hectare and the percentage of changed of new urban growth in Jos town and its environ. The analysis result of the sprawl driver and consequence provided the reason for the land use land cover changed that has occurred in the in Jos town and its environ.

Most sprawl areas around Jos town and environ lack infrastructural services and good planning, many sprawl areas in Jos need upgrading and planning, Communal crises in Jos town are really propelling sprawl development in Jos town and environs, the location of public institution and facilities in Jos and environ is also encouraging sprawl development in Jos and environs, Sprawl in Jos town has led to the conversion of some land uses to another land uses, Land cost in around Jos has also propelled sprawl development especially the leapfrog type of sprawl in Jos and environs, community altitude of scattering development without due regard to the master plan of the city has also encourage sprawl in Jos and environs, Sprawl in Jos can be found in the inner city and at the city fringe, Sprawl is been found in all direction and at various area in Jos and environ, Sprawl developments are more changing and more mixed in term of land uses in the north, south, east and west of Jos town and environs.

#### **4:3 Recommendation**

In light of the above findings and conclusions the following recommendations have been made:

- The government should put in place measures to monitor urban growth and thereby encourage vertical growth instead of sprawl growth.
- Current levels of flora in the environs of the study should be protected from abuse through policy measures from central government.
- The state should put in place policies and measures that prevent rural to urban migration so that urban areas to cope with the demands of a growing urban populace without resorting to outward expansion.
- The state encourages the use of remote sensing and geographic information system as a means of data sources to increase availability of up to date information to stake holders in land management. The state as a custodian of land information through its own departments such as the Surveyor General, Soils, Geology and others provide funds for the purchase and utilization of such data and technology.

Additional research can be carried out to identify the land uses within the built-up area causing urban growth.

#### **Conflict of Interest Statement**

Authors declare no conflict of interest, But good relation in the coordinating of the research work.

#### **Authorship**

Author 1. Made substantial contributions to conception and design, literature review, data analysis, validation of results, interpretation of results and discussions, drafting and collation of the final version to be published article.

Author 2. Made substantial contributions to conception and ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Author 3. Field work, made substantial contributions to conception, and design.

Author 4. Field work, made substantial contributions to conception, and design.

Author 5. Field work, data analysis, referencing.

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#### **References**

- [1]. Dung-Gwom, J.Y. &Oladosu, R.O. (2004), 'Characteristics and physical planning implications of slums in Jos', *Jrl. of Environ. Sciences* Vol 8(2), 118-127.
- [2]. Dung-Gwom, J.Y. (2007). Urban renewal in Jos Bukuru metropolis, paper presented at the Nigerian Institution of Estate Surveyors and Values MCPD Workshop, on October 25th 2007.
- [3]. Ewing, R. (1997) 'Is Los Angeles-style sprawl desirable?' *Journal of the American Planning Association*, 63(1): pg107-125.
- [4]. Turkstra J. (1996). Urban growth and land use options for lower-income groups: a case study of Villavicencio, Columbia. *ITC Journal*, 1996-1: pp. 57 – 63.
- [5]. Lee, J., Tian, L., Erickson, L.J., Kulikowski, T.D (1998):Analysing Growth-Management Policies with Geographical Information Systems.*Environment and Planning B: Planning and Design*, 25 (6): 865-879.
- [6]. Wheeler, S. (2000): 'Planning for Metropolitan Sustainability' *Journal of Planning Education and Research*, 20: 133-145
- [7]. Wilson, E.H., Hurd, J.D., Civco, D.L., Prisløe, M.P., Arnold, C. 2003: Development of a Geospatial Model to Quantify Describe and Map Urban Growth. *Remote Sensing of Environment* 86: 275-285.



- [8]. Wilson, E.H., Hurd, J.D., Civco, D.L., Prisloe, M.P., Arnold, C. 2005: Development of a Geospatial Model to Quantify Describe and Map Urban Growth. *Remote Sensing of Environment* 98: 350-487.
- [9]. Zhang, T. (2001): Community features and urban sprawl: the case of the Chicago Metropolitan region. *Land Use Policy* 18: 221-232.

Boyi James mairiga ,etal. "An Assesment Of The Causes And Drivers Of Urban Sprawl As Result Of Land Use Land Cover Changes In Jos Town And Its Environs Plateau State, Nigeria Using Quantitative And Qualitative Techniques." *IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT)*, 14(4), (2020): pp 42-59.