ANALYSIS OF LAND USE TYPES ALONG MAJOR TRANSPORT AXIS IN THE BENIN METROPOLIS

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ABSTRACT

This paper examines analysis of land use types along major transport axis in the Benin metropolis. The overall aim of this paper is to undertake a comprehensive analysis of land use types and pattern along the major transport axis in the Benin Metropolis. The satellite imagery of Benin was obtained with the help of Arcgis 10.2. Benin street guide map was sourced from Ministry of Lands and Survey, Benin City. Field observations were also adopted. Five selected routes were focused on and these corridors include Ugbowo-Isiohor-Oluku, Sapele road-Okha, Siluko road-Egor, Upper Sakponba road-Idogbo, and Aduwawa-Idokpa axis. It was found out that the land use along major transport axis in the Benin metropolis indicated that mixed land use and commercial land use are the most predominant along the major transport corridors. The existing land use analysis along selected major transport axis revealed that, on the average, 80 percent of the lands are of mixed uses followed by commercial land use which has 16.6 percent on the average. It was recommended that governments at all levels should consider the construction, maintenance, and rehabilitation of arterial roads, collector and local access roads. This is because socio-economic activities are a measure of wealth of a nation and enhanced value through provision of good road network will be worthwhile

INTRODUCTION

Transport systems provide a key to the understanding and operation of many other systems at different scales. Two features of transport systems make transport different from other services provided in Benin City. Firstly, transport constitutes a land use in the city and as such it does not only serve the city, but it also

services its own. It occupies 35 to 40 percent of land surface in most urban areas. Secondly, other land-uses within the city do not exist independently of the transport system that serves them (Oyesiku 2002). Transport is the most significant public investment activity in physical development of any country. However, in spite of obvious empirical and conceptual relationships, transportation and land-use are commonly being regarded as distinctly separate matter in urban problem analyses (Aiworo, 2016; Chapin and Kaiser, 1979). There are several perspectives in understanding the relationships between land-use and transportation system, such perspectives are as follows:

    a. Transportation serves as services system to support activity patterns within the city.

    b. Also land-use serves as a variable policy input, to transportation system.

    c. In addition, transportation serves as a determinant of land-use.

In the first perspective, common to both transportation and land-use planners, transportation can be seen as a service, which enables people, firms and other organizations to carry on activities in separate locations. Activity centres, in particular, usually require accessibility and visibility and thus, coordination with the transportation system. In the second perspective, closely related to the first, land-use is seen as an important determinant of demand for travel and therefore as partially determining the performance of transportation system. A third perspective, direct to the first two, relates to the impact of transportation on land-use. There can be no doubt that, historically, transportation has exerted a major influence on urban form and very little doubt that it will continue to do so. Within urban areas, transportation improvement is an essential aspect of accessibility and thereby land development or redevelopment potential is expected to expand the land area available for urban development, in other words, no transport, no adequate land-use system (Aiworo, 2016; Chapin and Kaiser 1979).

Aim

The overall aim of this paper is to undertake a comprehensive analysis of land use types along the major transport axis in the

Benin Metropolis.

The Study Area

The study area, Benin City is the capital of Edo State and has three Local Government Areas, which are Oredo, Ikpoba-Okha and Egor Local Government Areas. Benin City lies within Latitudes of $6^014'$ and $6^021'$ north of the Equator and within Longitudes $5^034'$ and $5^044'$ east of Greenwich Meridian and measures approximately 112.5 km^2 in area (Aiworo, 2016; Aiworo, 2002). Fig. 1 shows Benin metropolis- Egor, Ikpoba-Okha, Oredo part of Uhunmwonde and part of Ovia North-East local government areas. Benin City has been a state capital since the then Mid-Western Region, Bendel State and now Edo State.
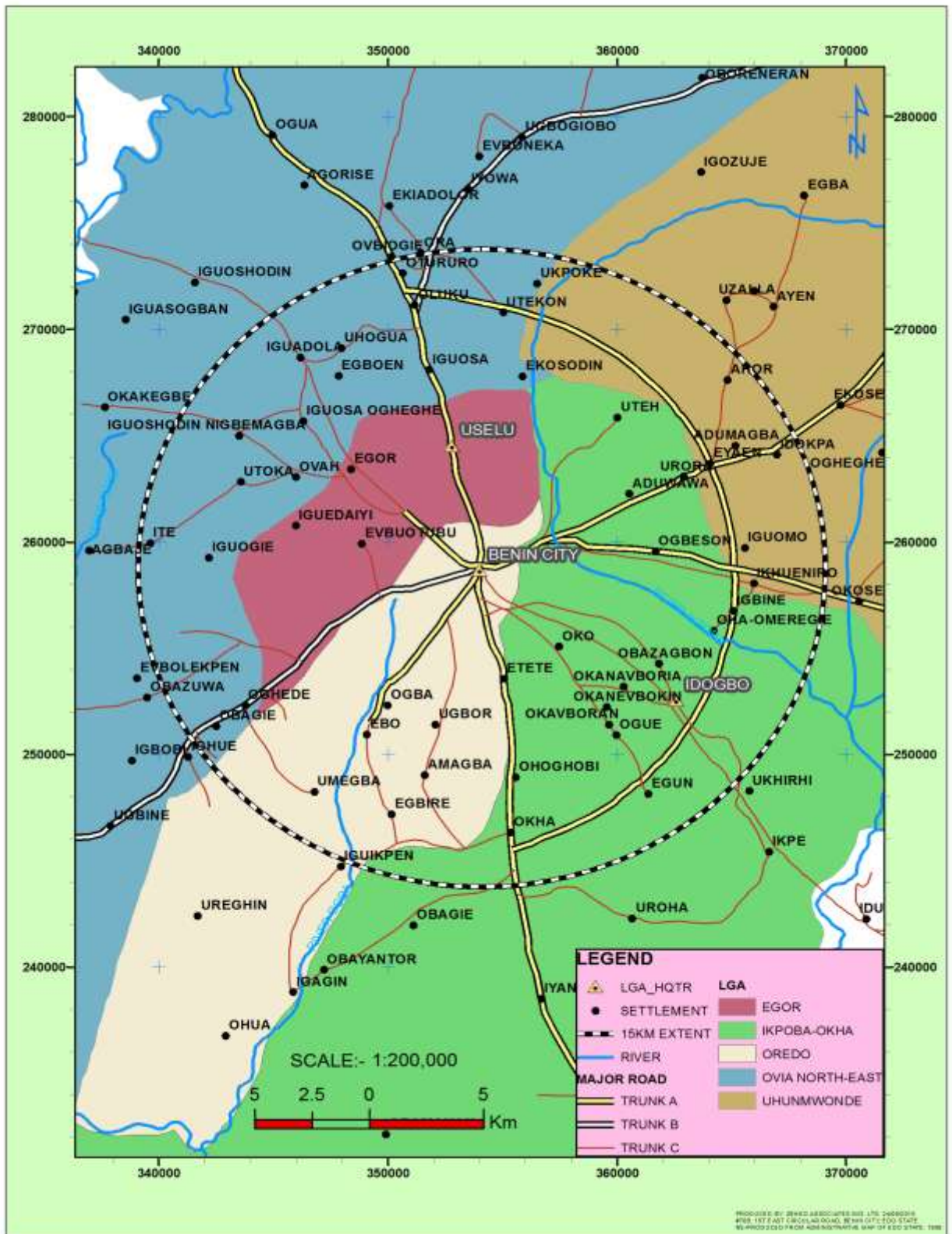
Fig. 1 The Benin Metropolis.

Literature Review

Adeboyejo and Abolade (2006) analysing spatial changes in Ogbomoso between 1914 and 2003 using secondary source data gave ecological and socio-economic changes of urban expansion by concluding that as much as 260.7 hectares of rural land was engulfed by the city in the period under review. However, they did not specify the problems associated with land use. Dar Al Handasah's (2008) study shows that existing village settlements grew without proper control along major highways, that developers' interest and land assignment was carried out in a haphazard manner. These therefore result in the congestion, confusion and irregularities of the remaining assignments and that the *ad hoc* distributions of residential layouts have resulted in a highly negative and obstructive land occupation.

The study by Aluko (2010) on the effects of urban expansion on land use problems in Lekki development corridor of Lagos posited that there are large areas of land designated for development in an unplanned and ad hoc manner. If allowed to go ahead without careful planning of transportation system and other infrastructure services, this development will result in significant socio-economic problems for the area. The USGS (2009) program studies the landscape transformations that resulted from the growth of metropolitan regions over time. Using sources such as historic maps, aerial photographs, and Landsat satellite data, USGS scientists first assembled retrospective urban land use databases that reflect several decades of change. These databases were then used to analyze the effects of urbanization on the landscape, and modelled urban growth and land use change under alternative growth scenarios.

Emmanuel, Yonika, Emmanuel and Richard (2011), evaluated the impacts of socio-economic activities on Lake Victoria in Musoma Municipality, Tanzania. Primary data were gathered by administering the questionnaire to a sample of 220 households. Participatory rural appraisal techniques, participant observation and checklist were employed in data collection. The land use types and land use changes were examined through analysis of satellite imageries. This was attained by making use of ArcGIS10

and ERDAS Imagine 9.1. Findings show that there is a strong relationship (r =91.3%; p=0.001) between the anthropogenic activities and land use type/ changes. However, the study recommends that, natural resources management (including wetlands) should be integrated in the curriculum at all education levels to foster awareness raising campaign on the role of wetland benefits to local people's livelihoods.

Ojeifo and Gbakeji (2014) in the study and analysis of the spatial distribution of vacant land use in Ekpoma metropolitan area of Edo State posited that the dominant land use types in Nigeria urban centres include institutional, water bodies, commercial, industrial, residential, open space, circulation (transportation) and vacant land uses. They stress that it has been ascertained that urban population and socio-economic growth have brought about a progressive increase in the use of land for these purposes. It has also been ascertained that it is the rural lands that are constantly invaded to meet the high demand and need for the various uses of land in urban areas.

It is well established that, land-use pattern of urban community is related to the physical characteristic of its transportation network. The use of land, therefore, defines the location of activities. The need for people and goods to travel between these location results in traffic demand upon the element of transportation system. It is becoming increasingly apparent that, the degree of circular casualty associated with this kind of transportation and land-use planning necessitated a similar high degree of interaction between transportation and land-use in the design and performance of functions (Oyesiku 2002).

Looking at this study, the Benin metropolis, during the early hours of the day, people move toward the city centre showing that most of the offices and facilities are located at the core of the city. The reverse is the case during the evenings. Both demand and supply for a particular activity affect significantly the mutual relationships that exist between land-use and transportation system. Both land-use and transportation have long and short range effects on the entire settlement. With these, it is obvious that, land-use and transportation are intractably interrelated. All

land-uses within a settlement require an adequate and efficient circulation system to make it functional. In a related vein, different types of land-use generate different and variable traffic flows. Major generators of traffic include industrial, commercial/public uses and recreational land uses.

Ojeifo (2005a) in the study of the planning implication of uncontrolled development in emerging urban centre of Ekpoma, Edo State, observed that several interrelated factors can be attributed to the observed pattern of land use. First among these is the tenure-ship system of land ownership. The land belongs to both community and individuals. Due to the failure of the land use decree of 1978, they could exercise rights over the sale of land at any given place and any given time. He concluded that the arbitrary developments are traceable to the wilful sale of land.

According to Agbola and Olatubara (2004), urban land areas are generally grouped according to the dominant use in different parts of the urban centre. In the Benin metropolis, such use of land could fall under the following classification;

(i) Residential land use (including individual property or plots, the access roads or local streets and other relevant facilities). High density, medium density and low density.

(ii) Mixed uses (a combination of permissible complementary uses that generally have little or no negative effects); residential/public land use, residential/commercial land use, public/commercial land use, institutional/commercial land use. The intermixing of uses, particularly retail and commercial uses with residential areas, is a central tenet of neo-traditional design and is also a characteristic of older neighbourhoods (Lawrence and Engelke, 2005).

(iii) Commercial land use; central business district, district and neighbourhood commercial centre, markets shopping malls, precints, etc.

(iv) Industrial land use; service, light, medium and heavy industrial areas.

(v) Institutional land use; educational, cultural and health institutions, research and development, libraries, religions, etc.

(vi)   Public/governmental land use; secretariats, police, fire service, post offices, community centres, etc.

(vii)   Infrastructural land use; transportation, water works, electricity, telecommunication, refuse dumping and disposal areas, sewage collection and treatment areas, etc.

(viii)   Public open space/reservations; parks and garden, recreation, urban agricultural lands, buffer zones, squares, streams and rivers courses, rock outcrops, and 'unusable' lands (cliffs).

METHODOLOGY

The satellite imagery of Benin was obtained with the help of Arcgis 10.2. Benin street guide map was sourced from Ministry of Lands and Survey, Benin City. Field observations were also adopted. There was an extensive travel throughout the study area especially along the major traffic routes for direct field observations. Five selected routes were focused on and these corridors include Ugbowo-Isiohor-Oluku, Sapele road-Okha, Siluko road-Egor, Upper Sakponba road-Idogbo, and Aduwawa-Idokpa axis. In this study, the stratified random sampling method was applied. This was done by stratifying the Benin metropolis into different transport corridors. To achieve the stated aim, data that were collected from various sources were analyzed descriptively and statistically. Descriptive analysis involved description of data using maps, charts, tables and other cartographic methods. Statistical analysis on the other hand involved the use of figures and statistical methods. The satellite imagery was analyzed to give a vivid picture of the land use types and pattern along the major transport axis in the Benin metropolis.

Some of the unavoidable problems arose in the process of collecting data for this study has to do with the measurement of journey to places of socio-economic activities. The first problem encountered in the field was that on secondary data collection. The current road network map of the Benin metropolis was not readily available in the Ministry of Lands and Survey, Benin City. The researcher had to update the old map provided using the data from the field survey. There was

also no record on the number of residential buildings in the Benin metropolis. The researcher resorted to field observations and National Population Census record made available to him after several visits to their office.
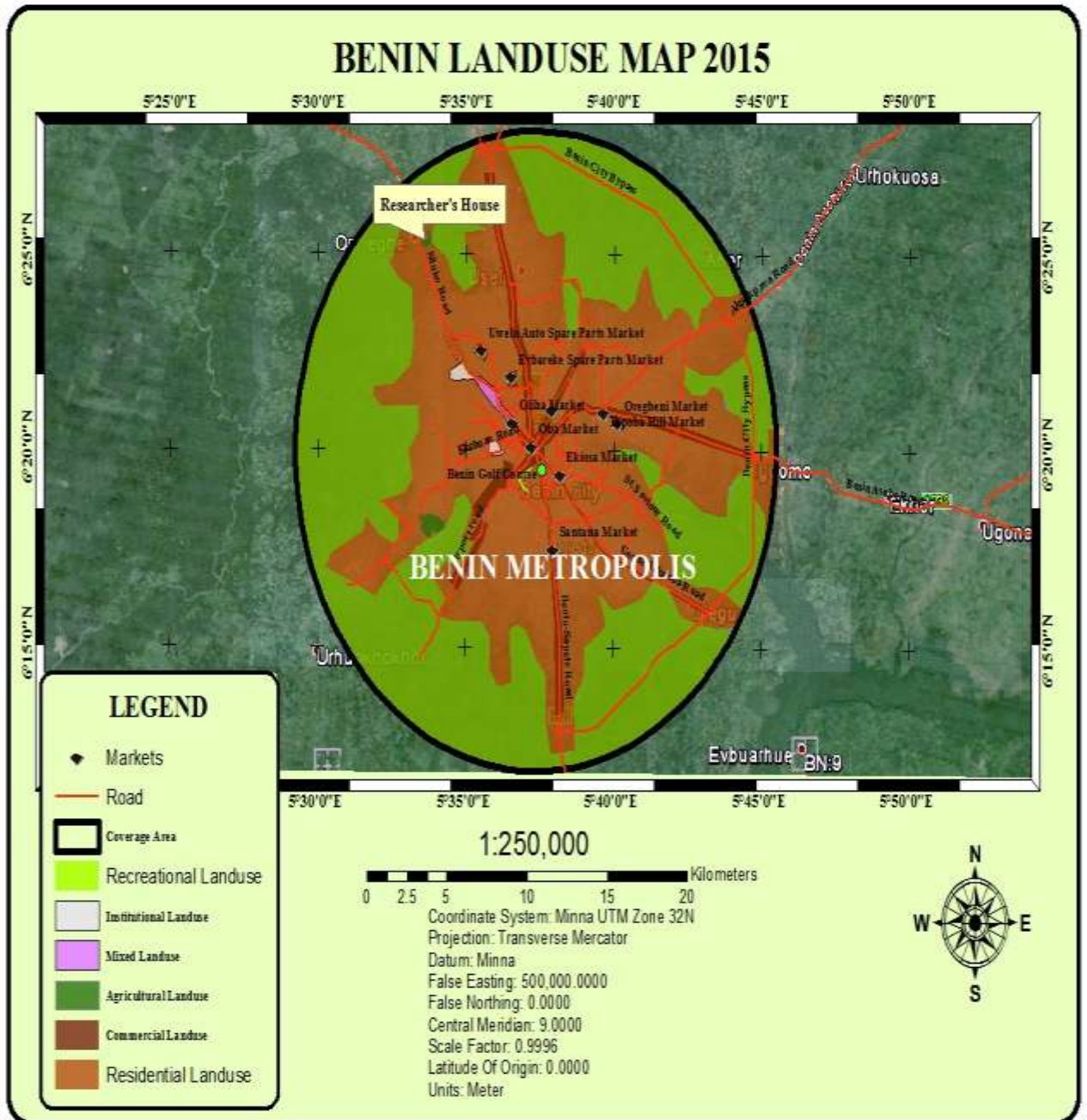
Result and Discussion

Fig. 2 Land use map of the Benin Metropolis

The predominant land use type in the Benin metropolis is the residential land use as shown in Table 1 and Fig 2. This covers a total of 47% of the 745.638 square kilometres in the Benin metropolis. This was calculated through the use of satellite imagery of the Benin metropolis using Arcgis 10.2

Table 1 Analysis of Land use Types in the Benin Metropolis

S/N	Land-use Type	Area Coverage (Km^2)	Percentage (%)	Degree (^{0})
1	Residential Land-use	355.428	47.67	171.6
2	Commercial Land-use	29.853	4.00	14.4
3	Institutional Land-use	1.796	0.24	0.9
4	Vegetal Cover	355.284	47.65	171.5
5	Mixed Land-use	1.343	0.18	0.6
6	Recreational Land-use	0.267	0.04	0.1
7	Agricultural Land-use	1.667	0.22	0.8
TOTAL		745.638	100	360

Source: Arcgis 10.2.

However, field survey conducted on land use along major axis in the Benin metropolis indicated that commercial land use and mixed land use are the most prominent along the major transport corridors as depicted in Table 2. In some cases, incongruous land uses were spotted in some locations as shown in Plate 1.

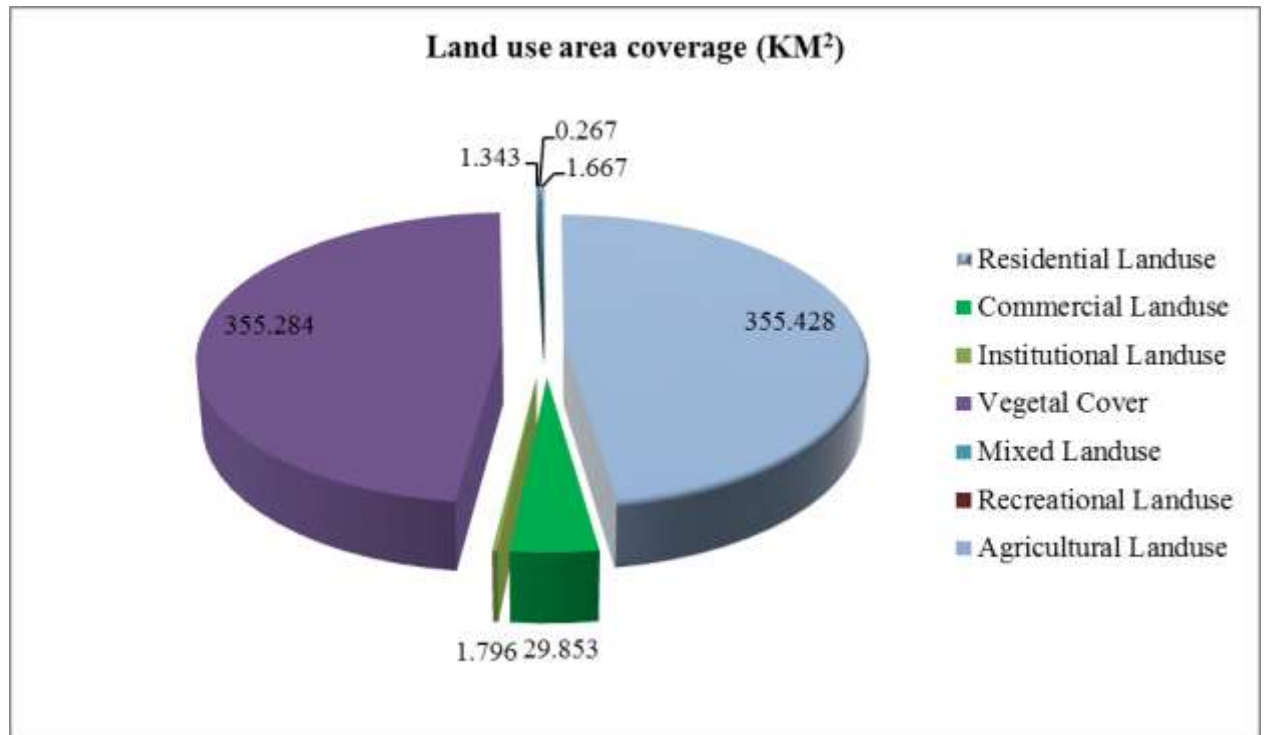Aiworo, Barry A.

Land use area coverage (KM²)

Fig. 3 Pie chart showing Area coverage

Plate 1 showing incongruous land uses along Akpakpava Road has attested to the fact of what Lean and Goodall posited in their work. According to Lean and Goodall (1977), the explanation of actual location or patterns of land use are distinguished from an explanation of rational location or pattern of land use. Location theory seeks to answer the question of what is the most rational location or pattern of land use. The theory starts from an assumptive base of fixed locations of markets and sources of factors of production and a given transport system, proceeding to build up the ideal of best location pattern. It relies on some criteria to judge what is the best pattern and earlier theorists define their criterion in terms of either costs or revenue and the most realistic one being profit-maximization. The same criteria are used for business uses in allocating urban sites amongst competing users.

Plate 1, Incongruous land uses Along Akpakpava Road

Table 2 Existing Land-Use Analysis along Selected Major Transport Axis in the Benin Metropolis

Land-Use Type	A		B		C		D		E	
	Ugbowo		Siluko Road		Upper Sakponba		Aduwawa		Sapele Road	
	Km²	%	Km²	%	Km²	%	Km²	%	Km²	%
Residential Land-use	0.18	2.05	0.04	.0.52	0.1	0.88	0.04	0.52	0.13	1.34
Commercial Land-use	2.4	27.30	1.6	18.29	1.1	9.65	1.4	18.32	0.9	9.25
Institutional Land-use	0.9	9.25	0.01	0.6	0.0		0.001	0.01	0.6	6.17
Vegetal Cover	0.0		0.0		0.0		0.0		0.0	
Mixed Land-use	5.3	60.30	7.1	81.14	10.2	89.47	6.2	81.14	8.1	83.25
Recreational Land-use	0.0		0.0		0.0		0.0		0.0	
Vacant Land/Open Space	0.01	0.6	0.0		0.0		0.0		0.0	
Total	8.79	100	8.75	100	11.4	100	7.641	100	9.73	100

Source: Author's Fieldwork, 2017.

FINDINGS

1. The findings revealed that the land use along major transport axis in the Benin metropolis indicated that mixed land use and commercial land use are the most predominant along the major transport corridors.
2. The existing land use analysis along selected major transport axis revealed that, on the average, 80 percent of the lands are of mixed uses followed by commercial land use which has 16.6 percent on the average.

RECOMMENDATIONS

1. Governments at all levels should consider the construction, maintenance, and rehabilitation of arterial roads, collector and local access roads. This is because socio-economic activities are a measure of wealth of a nation and enhanced value through provision of good road network will be worthwhile.
2. Edo State Government should increase its funding of road improvements including the construction, maintenance, and rehabilitation of the road network. Arterial road

network actually delivers location attributes, accessibility, and enhances demand, supply, quality of roads, and connectivity elements.
3. Most importantly, government should ensure sustainability of its roads project in the Benin metropolis. This can be accomplished by establishing the urban development and maintenance board to oversee road maintenance in the metropolis.

CONCLUSION

The researcher is hopeful that the findings in this study would be of great assistance to Governments at various levels in the formulation and implementation of policies and measures that will effectively promote and enhance accessibility through increased development of road networks. Accessibility has a great impact on journey to land use and places of socio-economic activities, which invariably are measure of growth and development of the urban economy.

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