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Research Paper

Determinants of Land Use Land Cover Dynamics In Minna Metropolis, Niger State-Nigeria

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ABSTRACT:*The study assessed the determinants of land use land cover dynamics in Minna Metropolis, Niger State-Nigeria. Variables considered based on land use land cover dynamics and used for the study include: population growth, rural-urban migration, sales of land, household sizes, income level, and farm sizes among others. A sample size of 400 respondents were selected and administered questionnaire, but only 397 respondents returned their questionnaire. Three sampling techniques were employed for the study. Firstly, stratified sampling technique was used to stratify the study area into twelve (12) locations. Secondly, systematic random sampling was used to select four streets from each location bringing the total to 48 streets. One street out of every four streets was selected and one house out of every ten houses on the street was selected for questionnaire administration. Purposive sampling technique was used in questionnaire administration due to variation in land uses in the study area. The data collected for the study was analysed using factor analysis because of its ability to reduce large variables to manageable factors. Using factor analysis based on Kaiser Principle, three factors were extracted using the variable maximization method with Eigen value of 5.6, and percentage contributory variance of 92.4%. These land use land cover determinants include population growth with Eigen value of 5.6 and variance of 40.3%, urbanisation with Eigen value of 4.1 and variance of 29.6%;and sustainable livelihood with Eigen value of 3.1 and variance of 22.4%. The study concludes that it is obvious that these determinants would influence land use land cover dynamics in the study area. The study therefore recommends that planning agencies should develop appropriate regulatory approach to curtail the haphazard provisions of infrastructures, land use and land cover challenges in the study area.*

KEYWORDS: *Determinants, Land use Land cover, Dynamics, Minna, Nigeria*

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I. INTRODUCTION

The natural and socio-economic factors and their utilization by humans in time and space determine the land use land cover dynamics pattern of a region[1][2][3][4]. The surface of the earth has been modified considerably over the past 100 years by human activities especially through urbanisation, deforestation and intensive agricultural practice. The conversion of grass land, wood land and forest into crop land and pasture during the last few decades has risen dramatically in the tropics[4][5] Land use land cover dynamics on the earth are so intense that, when aggregated globally, they significantly affect key aspects of the earth system functioning. Such changes also determine, in part the vulnerability of places and people to climatic, economic or socio-political perturbations [6]. Moreover, this change could be the result of complicated interactions of socio-economic and biophysical situations like economic diversification, technological advancement, demographic pressure and many other related conditions [7].

Land use land cover dynamics are influenced by a variety of factors operating on more than one spatial and temporal level and acting not in isolation but in intricate webs of place and time-specific relationships [8]. Several theories, originating in the natural and the social sciences and most recently, in interdisciplinary research, have been advanced to describe and explain land use and land cover dynamics [8]. Land use change occurs initially at the level of individual land parcels when land managers decide that a change towards another land use and land utilization type is desirable [8]. A first distinction, thus, emerges between those factors that are pertinent to the level of the individual land parcel and those that apply to higher spatial levels. At both the macro and micro levels, the factors influencing land use and land cover dynamics are broadly distinguished further into

biophysical and societal, depending on their origin. Biophysical and societal factors at the micro and the macro levels are intricately interrelated and interdependent.[9] have demonstrated that land use and land cover dynamics produce environmental and socio-economic impacts that frequently feedback and modify the biophysical and societal factors causing them. [10]distinguish the macro level societal factors further according to the role they play in the process of change into human driving forces, human mitigating forces, and proximate sources of change. Proximate sources of change are human actions that directly affect land cover. They refer to the immediate land management strategies employed that convert land cover from one type to another or that modify an existing land cover type, under the influence of the underlying driving forces [10].The drivers of land use and land cover changes can be divided in various ways into those of biophysical and socioeconomic factors [11]. Also those anthropogenic factors can be further divided into economic, technological, demographic, institutional and cultural factors [12]. Also [13] however presents a slightly different classification of land use and land cover changes factors which can be biophysical, economic, social, interactive, neighbourhood, and or political in nature. Finally, according to the Food and Agriculture Organization of the United Nations [14], the various reasons for agricultural land abandonment can be grouped in the following categories: natural constraints, land degradation, socio-economic factors, demographic structure and the institutional framework.

The mentioned sources list various categories of human-related factors, all of which agree on the separate role of biophysical and natural factors. It is not unusual for the study of land use and land cover changes to be focused on human- related factors [15][16][17][18] or in contrast, environmental biophysical factors [19][20]. Integrating remote sensing with population dynamics is a plausible approach to understand the determinants of land use land cover dynamics and its impact on biophysical environment. Integration of remotely sensed data with socio-economic information in GIS has widened considerably [21]. Much of the research has focused on linking census and survey-based socio-economic data to remotely sensed land use data, particularly for modeling the drivers of land use land cover dynamics in rural areas[22]. This study is therefore posed to examine the determinants of land use land cover dynamics in Minna Metropolis, Niger State, Nigeria.

II. MATERIALS AND METHODS

Study area

The study area Minna lies between longitude 6° 34' E and 6° 42'E of the Greenwich meridian and latitude 9° 33' N and 9° 45'N of the equator. It is bounded in the North by Shiroro Local Government and in the South by Kachia Local Government. On the other hand, Wushishi Local Government lies in the west of the city while in the East the town shares boundaries with Paikoro Local Government Minna covers about eight hundred and eight five hectares that can be distributed into the following land use groups: Industrial and Commercial, Residential, Educational Institutions, Government Institutions and Other Institutions, Controlled Open Space. The town has yearly rain-fall of 1334mm. The rainy season begins from the month of April every year and last still October every year. Minna Town derives its name from Gbagyi word. "Min" and "Na" the word "Min" signifies spray and "Na" signifies Fire. The town formerly was on the mountain at Sayako and walls (Ganuwa) built around it. Many of the Gbagyi villages and towns in and around the present site of modem Minna[23]. Minna accommodates over seventy percent economic activities like shopping centers, hotels, neighborhood markets, shops, banks and street vendors among others [24] (Figure 1)

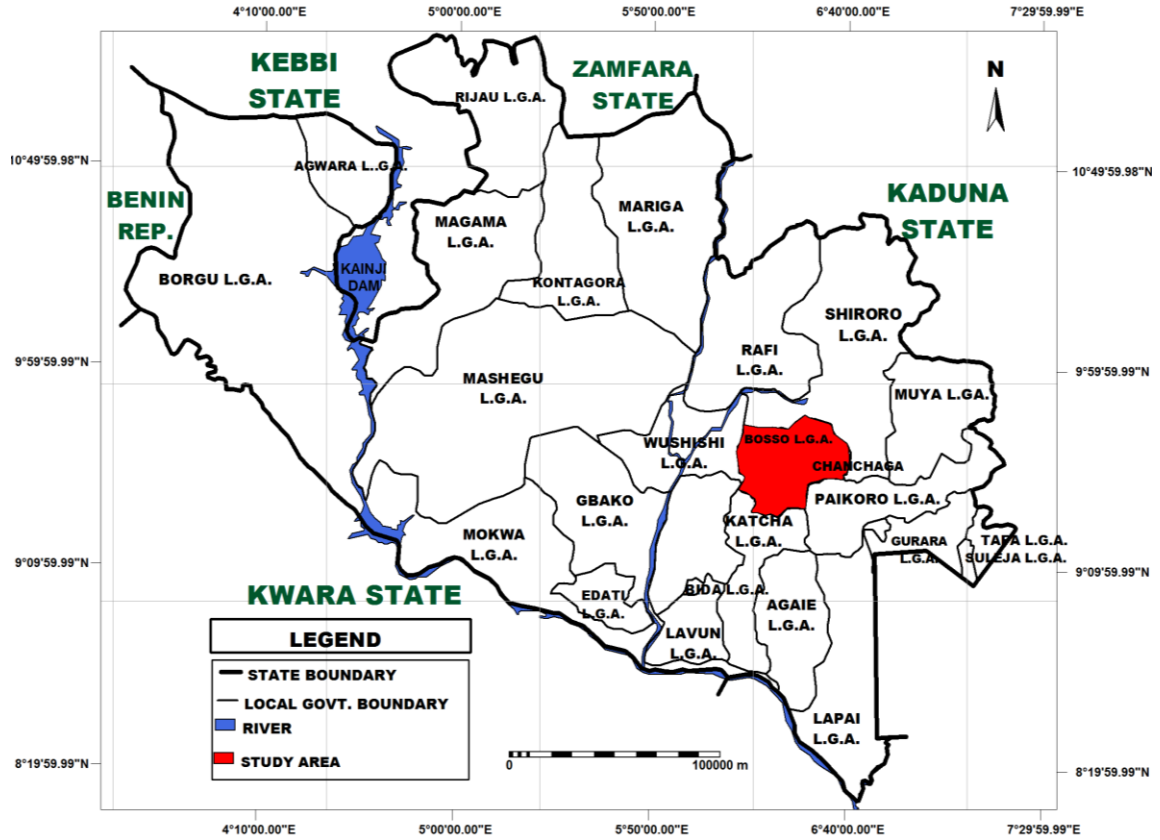

Figure 1: Niger State showing Minna

Source: Ministry of Land and Housing Minna, 2015

Data

Data on determinants of land use land cover dynamics in Minna Metropolis were collected using sample size of 400 respondents out of which 397 respondents returned their questionnaire. Three sampling techniques were employed for the study. First stratified sampling technique was used to stratify the study area into twelve (12) locations of Boss estate, Dutsen Kura, Jikpan, Bosso town, F-Layout, Agwan-Daji, Maitumbi, Tudun-Wada, Chanchaga, Barkin Sale, Tunga and Sauka-Kahuta. Secondly, systematic random sampling technique was used to select four streets from each location bringing the total to forty-eight (48) streets. One street out of every four streets was selected and one house out of every ten houses on the street was selected for questionnaire administration. Purpose sampling technique was used to administer questionnaire. The choice of purpose sampling technique is due to the variations in the various land use and land cover dynamics in the study area.

The parameters used for the study were sourced through questionnaire and are defined as follows:

X1= Household Sizes
X2= Income Level
X3= Boundary Expansion
X4= Government Policy
X5= Development Plans
X6= Lack of Technical Assistance
X7= Cost of Lands
X8= Population Growth
X9= Sales of Land
X10= Range land Modification
X11= Shifting Cultivation
X12= Farm Sizes
X13= Urbanisation
X14= Rural- Urban Migration

Variables X1, X2, X3, X4, X5, X6, X7, X8, X9, X10, X11, X12, X13, X14, were measuredthrough the use of questionnaire. Factor analysis was used in summarizing and analyzing thedata; as well as identifying the principal dimensions of the selected variables responsible forland use land cover dynamics in the study area, to

identify their relative contributions in determining land use land cover dynamics in Minna Metropolis. The factor analysis generated both the correlation matrix and the rotated factor matrix, in which only factors with Eigen values above unity with 5% or more explanatory powers were considered as separate orthogonal dimensions or factor components [25].

III. RESULTS AND DISCUSSIONS

Determinants of Land Use Land Cover Dynamics in Minna Metropolis

From the correlation of land use and land cover variables; there are numbers of positive andnegative correlations between and among the selected variables. By implications, inverse and associative relationships exist from the interaction of the variables that influence land use and land cover changes in the study area. Correlation coefficients of ± 0.5 are considered significant at 0.5 confidence level (one tailed).

These factors produced a number of significant variables (in parenthesis) that define the factors influencing land use land cover dynamics in Minna Metropolis. The result shows that the factors offer a significant contributory explanation of 92.35%, leaving just 7.65% unexplained which could be determinants not considered in the study.

TABLE 1:Factor Matrix of Land Use and Land Cover Dynamics in the Study Area

Variables	Land use and land cover factors		
	I	II	III
Household sizes	.528	.510	.652
Income level	.426	.555	.654
Boundary expansion	-.337	.851	-.333
Government policy	-.191	.629	.626
Development plans	.930	-.258	-.170
Lack of technical assistance	-.141	.466	.763
Cost of lands	.598	.690	-.192
Population growth	.933	-.263	-.171
Sales of land	.915	.315	-.181
Range land modification	.342	.852	.327
Shifting cultivation	-.102	-.086	.932
Farm sizes	.502	.775	-.220
Urbanization	.894	.944	.184
Rural-Urban Migration	.932	-.282	-.175
Eigen-Value	5.639	4.149	3.143
% Variance	40.278	29.636	22.450
% Cumulative explained	40.278	69.913	92.35

Table 1 shows the rotated factor matrix for the entire Minna metropolis, with three factors that cumulatively explained 92.35% of the population variance. Factor one (1) which has an Eigen value of 5.639 accounts for 40.278 percent of the total variance. It has high positive loadings on variables 1 (household sizes), 2 (income level), 5 (development plans), 7 (cost of lands), 8 (population growth), 9 (sales of land), 10 (range land modification), 12 (farm sizes), 13 (urbanization), 14 (rural-urban migration). Factor one (1) also has negative loadings on variables 3 (boundary expansion), 4 (government growth policy), 6 (lack of technical assistance), and 11 (shifting cultivation). Based on the loadings of its variables, this factor can be described as population growth factor. Factor II has an Eigen-value of 4.149 and explains 29.636 percent of the total variance. This factor has significant loading on variable 1(household sizes), 2 (income level), 3 (boundary expansion), 4 (government growth policy), 6 (lack of technical assistance), 7 (cost of lands), 9 (sales of land), 10 (range land modification), 12 (farm sizes), 13 (urbanization) and negative loadings on variable 5(development plans), 8 (population growth), 11 (shifting cultivation), and 14 (rural-urban migration). The absence of these variables within Minna metropolis could influence land use and land cover changes. The underlying factor here can be described as urbanization factor.

Factor III, has an Eigen-Value of 3.143 and explains 22.50 percent of the total variance. This factor has positive loading on variables 1 (household sizes), 2 (income level), 4 (government growth policy), 6 (lack of technical assistance), 10 (range land modification), 11 (shifting cultivation) and 13 (urbanization). Factor III also has negative loading on variables 3 (boundary expansion), 5 (development plans), 7 (cost of lands), 8 (population growth), 9 (sales of lands), 12 (farm sizes), and 14 (rural-urban migration). The absence of these variables within the study area could influence land use and land cover changes. The underlying factor here is sustainable livelihoods factor.

IV. CONCLUSION

This study has examined the determinants of land use land cover dynamics in Minna Metropolis and discovered that much of the land use land cover dynamics determinants in the study area owe much to population growth, urbanisation, livelihood activities, rural-urban migration, range land modification, shifting

cultivation among others. This is crystal clear as such determinants would influence land use land cover dynamics in the study area. The study recommends that planning agencies in the study area should develop appropriate regulatory approach to curtail the haphazard provisions of infrastructures, land use and land cover challenges.

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