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ASSESSMENT OF THE IMPACT OF POPULATION GROWTH ON LANDUSE AND LANDCOVER CHANGES IN ENUGU URBAN AREA SOUTHEAST NIGERIA

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Keywords: *changes, Growth, landcover, Landuse, Population*

Abstract: *The study assesses the impact of Population Growth on Land use and landscover changes in the Enugu Urban area in Southeast Nigeria. The specific objectives are to; determine the effect of Birth (Natality) Rate on Land use and landscape changes and examine the effect of Migration on Land use and landscape changes in the Enugu Urban area in Southeast Nigeria. A descriptive cross-sectional research design was used for this study. A questionnaire designed with a five-point Likert scale was used to collect data for the study. SPSS 28.0 using regression analysis was used to analyzed the data. The result revealed that the Birth (Natality) Rate has a significant positive effect on Land use and landscape changes in the Enugu Urban area with a value of (5.311; p-value =0.013), and Migration has a significant positive effect on Land use and landscape changes in the Enugu Urban area with a value of (0.991; p-value=0.001), Southeast Nigeria. The study concludes that Population Growth has a significant effect on Land use and landscape changes in the Enugu Urban area in Southeast Nigeria. The study recommended developing and implementing a comprehensive urban planning framework that anticipates future population growth and guides sustainable land use.*

1.1 Introduction

Population growth is a fundamental factor influencing land use and landcover changes worldwide. As human populations expand, the demand for land resources escalates, driving significant alterations in land use patterns and landcover configurations (United Nations 2017). This dynamic is particularly pronounced in urban and peri-urban areas, where the need for residential, commercial, and infrastructural development competes with agricultural and natural landcovers. The relationship between population growth and land use change is multifaceted, involving socio-economic, political, and environmental dimensions. Increasing population density often leads to

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urban sprawl, deforestation, agricultural intensification, and the transformation of natural habitats into built environments. According to Chiras (2012), every minute, the human population increases by approximately 165 people, which is the equivalent of three new residents every second. At this remarkable rate of growth, nearly 1.7 million people join the human population every week. This means that the world population increases by eighty-seven million people a year. These changes have far-reaching implications for ecosystem services, biodiversity, climate regulation, and overall environmental health. According to the UN (2023), the current world population is nine billion people. Hence, the population is increasing rapidly while the doubling period is decreasing at the same pace.

In the context of the Enugu Urban area in southeastern Nigeria, rapid population increase has led to significant land use and cover transformations. As the population expands, the pressure on land for residential, commercial, and industrial purposes intensifies, often at the expense of natural landscapes. This dynamic interplay between population growth and land use/land cover changes (LULCC) presents a complex challenge for sustainable urban planning and environmental management. Enugu, known for its historical and economic significance, has experienced substantial demographic shifts over recent decades (Mahtta, et al 2022). The urban sprawl resulting from this population boom has prompted the conversion of forests, farmlands, and other green spaces into built-up areas. These changes alter the physical land cover and have profound implications for local ecosystems, biodiversity, and climate patterns (Clark, 2020). Understanding the extent and nature of LULCC in Enugu is essential for developing strategies that balance urban development with environmental sustainability. This assessment aims to analyze the impact of population growth on land use and land cover changes in the Enugu Urban area. By employing remote sensing and geographic information system (GIS) techniques, this study will map and quantify the changes in land cover over a specified period from 1990 - 2020.

1.2 Statement of the problem

The Enugu Urban area in Southeast Nigeria has been experiencing rapid population growth over the past few decades, leading to substantial changes in land use and landcover patterns. This burgeoning population has intensified the demand for residential, commercial, and infrastructural development, often resulting in the conversion of agricultural lands, forests, and other natural landcover into urbanized areas. Despite its economic and historical significance, Enugu's rapid urbanization poses significant challenges to sustainable land management and environmental conservation.

The impact of this population growth on land use and landcover changes in Enugu is not fully understood, and there is a critical need for comprehensive assessment and analysis. The

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lack of detailed, up-to-date data on the extent and nature of land cover transformations hampers effective urban planning and policy-making. Moreover, the socio-economic drivers and environmental consequences of these changes remain inadequately explored, making it difficult to develop strategies that balance urban development with the preservation of natural resources. This study aims to address these gaps by systematically assessing the impact of population growth on land use and landcover changes in the Enugu Urban area. Utilizing remote sensing, geographic information systems (GIS), and spatial analysis techniques, the research will quantify land cover changes over time and identify the key factors driving these transformations.

1.3 Objective of the study

The main objective of this study is to examine the assessment of the impact of Population Growth on Land use and landscape changes in the Enugu Urban area Southeast Nigeria. The specific objectives are to;

i. To determine the Birth (Natality) Rate on Land use and landcover changes in the Enugu Urban area of Southeast Nigeria.

ii. To examine the effect of Migration on Land use and landcover changes in the Enugu Urban area in Southeast Nigeria.

1.4 Hypotheses of the study

i. Birth (Natality) Rate has no significant effect on Land use and landcover changes in the Enugu Urban area of Southeast Nigeria.

ii. Migration has no significant effect on Land use and landcover changes in the Enugu Urban area of Southeast Nigeria.

Review of Related Literature

2.1 Conceptual Review

Population Growth

According to Weeks (2012), population growth refers to an increase in the size of a population over time, depending on the balance of birth and death rates. Two types of population growth exist, namely, exponential and logistic growth. If a population is given unlimited amounts of resources, such as food, water, land and oxygen, it will grow exponentially while a logistic growth occurs when environmental pressures such as natural hazards and inadequate resources slow the rate of growth (Iwejingi, 2011). Population growth is caused exclusively by the operation of fertility, mortality, and migration, although, regarding the population growth of the entire country, the effect of migration is normally not as influential as the effect of fertility and mortality which are usually considered to be the major factors directly causing national population growth (Weeks, 2012). According to Theodore (2006), population growth rate is considered as the increase or decrease in the number of persons in the population during a certain period of time, expressed as a percentage of the population at the beginning of the time period.

On the other hand, the average annual (population) growth rate, more accurately known as the compound annual (population) growth rate, shows an average value for the

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annual rate of population change over a period of time allowing for the compound effect of growth. Openstax (2012), cited that average annual growth rates for all ages as well as for particular age groups are calculated on the assumption that population growth is continuous which subsequently if unchecked becomes rapid. Population growth becomes rapid when the population grows at exponential rates to a size that exceeds the environmental carrying capacity of a region which often leads to population explosion (Waite, 2014). Nevertheless, technological advances have lowered environmental resistance, thereby increasing the Earth's carrying capacity for humans, often at the expense of other organisms. According to Chiras (2012), carrying capacity of the Earth is determined by two factors which include resource availability, such as food supplies, and the environment's capacity to absorb and detoxify wastes. In other words, the higher the rate of population growth and pressure on landcover, the lesser the carrying capacity of the environment. According to the United Nations (2017), ninety percent of growth in population takes place in the poorer nations, where nearly 80% currently live in deplorable conditions.

Land use and Landcover change

Land plays a crucial role as the backdrop for human habitation and economic endeavors. Falcucci, Luigi, and Luigi (2007) note that not only do humans reside on land, but they also conduct various economic activities there. Moreover, land supports wildlife, natural vegetation, and facilitates transportation and communication networks. Approximately ninety-five percent of essential human needs such as food, clothing, and shelter are fulfilled by resources derived from land. The utilization of land, commonly referred to as "Land use," encompasses a spectrum of purposes including food production, habitation, recreational activities, resource extraction, material processing, and the inherent biophysical characteristics of the land itself. Land use is influenced by two major forces: human needs and environmental processes.

The term "Landcover," as described by Turner, Lambin, and Reenbern (2007), denotes the biophysical state of the Earth's surface and its immediate subsurface. This encompasses the physical condition of the land surface, encompassing features like croplands, mountains, and forests. According to Praveen (2017), landcover encompasses the quantity and types of surface vegetation, water bodies, the earth's crust, and man-made structures including buildings. While originally referring to vegetation types, the concept has broadened to encompass various aspects of the physical environment such as soil composition, biodiversity, and surface and groundwater resources.

Birth (Natality) Rate

Eliya (2012) defines the birth rate as the number of live births per year per 1,000 individuals in a total population, while the death rate represents the number of deaths per year per 1,000

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individuals in the total population. These annual rates are primarily influenced by the levels of fertility and mortality experienced by individuals. The birth rate, or fertility, is a key determinant of population growth because it reflects whether a population is experiencing growth (Eliya, 2012). A total fertility rate (TFR) above 2.0 indicates that, on average, a woman will have more than two children in her lifetime. If the TFR exceeds 2.1, it signifies above-replacement fertility, enabling population growth through fertility. Mortality is also significant because the death rate determines the number of individuals who can no longer contribute to population growth. Consistent fertility and mortality rates typically result in stable population growth rates (Birdsall, Kelly, and Sinding, 2001).

The crude birth rate for a given year or period represents the total number of live births per 1,000 individuals in a population, adjusted for the period's length in years. Typically, this data is sourced from a universal registration system for births, census records, and estimations derived from specialized demographic techniques (Birdsall et al., 2001). Unfortunately, countries in regions like Nigeria often lack adequate universal registration systems for birth and death rates, and censuses are not conducted as frequently as necessary. The average global birth rate was 18.5 births per 1000 total population in 2016 and the death rate was 7.8 per 1000, thus, the rate of national increase (RNI) was 10.6 percent. The 2016 average of 18.5 births per 1000 total population is estimated to be about 4.3 births/per second or about 256 births/per minute for the world. The current birth rate for Nigeria in 2020 was 37.2 births per 1000 people, a 1.1% decline from 2019; The birth rate in 2019 was 37.6 births per 1000 people, a 1.09% decline from 2018, the birth rate in 2018 was 33.0 births per 1000 people, a 1.25% decline from 2017 while the birth rate in 2017 was 38.5 birth per 1000 people, a 1.24% decline from 2016 (United Nations, 2020). This rate of decline appears to be insignificant to population growth compared with the decline in death rate, which invariably implies a steady increase in population.

Migration

Many demographic scholars consider migration a fundamental aspect of population dynamics within geographic regions. Gold and Stephanie (2013) define migration as the movement of individuals or groups across political or administrative boundaries, either through emigration or immigration, often driven by the transient availability and shifting location of resources. Migration is implicitly acknowledged as a response to resource availability, with people often migrating in connection with the accessibility of resources (Gold & Stephanie, 2013). While fertility and mortality rates shape natural population growth, migration patterns can lead to significant fluctuations in population size, indicating that migration can be responsible for sudden large changes in population size (Schacter, 2001). Gould and Prothero (2015) identified various types of migration based on time and space, such as daily, periodic, seasonal, long-term, irregular, and permanent migration, as well as rural-rural, rural-urban, urban-rural,

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and urban-urban migrations. It's crucial to differentiate between internal and international migration within these categories. Passel and Cohn (2018) suggested that migration is driven by factors like low income at the place of origin and the expectation of increased income at the destination, as well as economic factors like employment opportunities and dissatisfaction with current job prospects (Schachter, 2001).

De Jong (2010) emphasized the role of economic factors in migration decisions, while Obono and Omoluabi (2014) argued that migration in developing countries is often driven by the pursuit of better educational opportunities and social services. Migration affects population growth by both increasing the population of receiving regions and depopulating areas of origin (Passel & Cohn, 2018). The consequences of migration on population growth land use and land cover change are manifold. Cerrutti and Massey (2014) suggested that migration accelerates economic activities and resource exploitation in receiving areas, while migrants leaving rural areas for urban centers contribute to issues like unemployment, crime, social unrest, and inadequate infrastructure, affecting land use and land cover in those areas. Land use and land cover changes aggravate environmental problems at local, regional, and global scales, including biodiversity loss, disruptions in hydrological cycles, and climate change (United Nations, 2017). These changes differ between developed and developing countries, driven by economic reasons in the former and population growth, poverty, economy, and political factors in the latter (Chiras, 2012). Migration is a major driver of population growth in developed countries, while birth and death rates play a more significant role in developing countries.

The distinction between involuntary and voluntary migration is challenging, as motivators for migration are often interconnected. The World Bank estimated that, as of 2010, 16.3 million migrants qualified as refugees, growing to 19.5 million by 2014 (UNFPA, 2013). Nomadic movements and temporary travel or tourism are not considered migrations, as they lack the intention to settle in new places (Bongaarts, 2005). Human migration has largely positive impacts on the national and global economy. In 2015, migrants, constituting 3.3% of the world population, contributed 9.4% of global GDP (Cerrutti and Massey 2014). Opening all borders could potentially add $78 trillion to the world's GDP (IOM, 2020). Additionally, migrants contribute significantly to socio-cultural and political life through food, sports, music, art, ideas, beliefs, and participation in civic duties (De Jong, 2000).

Urbanization

Urbanization is a process of more people, and a greater fraction of people, living in urban areas over time (Mahtta, et al 2022, Scheuer, 2016, Weeks 2010). The process can be decomposed into two phenomena, urban population growth and built environment expansion. Rural-to-urban and/or urban-to-urban migration are critical sources of population growth for growing cities in addition to natural increase. Clark summarized the reasons why people move, and over 50% of the moves were associated with the desire of improved housing quality, safe neighborhoods, and accessibility to public facilities (e.g., universities, schools, and subway stations) (Clark, 2020). A third of the moves resulted from life cycle changes (e.g., marriage, divorce, new or deceased household members), while the remainder of the moves stemmed from

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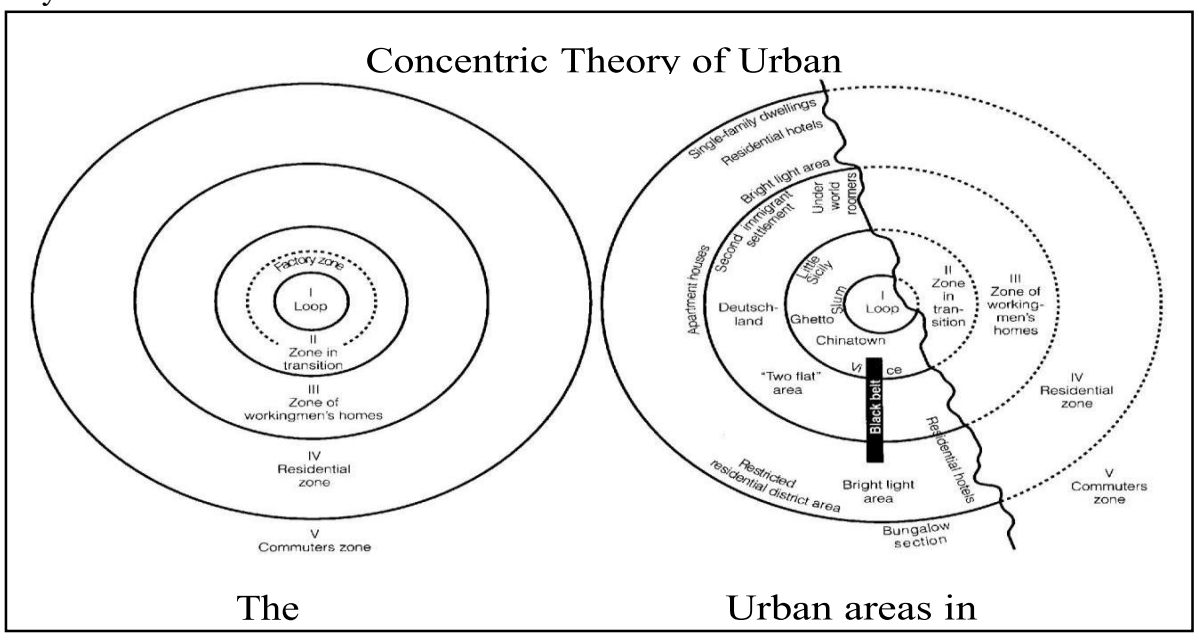
forced moving (e.g., housing eviction, wars, natural hazards) or employment change. Nevertheless, Clark pointed out that people often move for multiple reasons and were more likely to move when they lived five miles from their workplace (Clark, 2020).

2.2 Theoretical Framework

Concentric Zone Theory

The concentric zone scheme or model of urban landuse was propounded by E.W. Burgess, an American urban sociologist in the year 1925 on the basis of study of American cities in general and Chicago in particular. Burgess concept was first published as, 'The growth of the city: an introduction to a research project' – a chapter in the book "The city" written with R.E. Park in 1925. It is known as concentric zone model or zonal theory of urban landuse pattern. It is one of the earliest theoretical models to explain urban social structures. It is also the earliest descriptive urban landuse model which divided cities in a set of concentric circles expanding from the down town to the suburbs. It is based on the concept that the development of a city takes place outwards from its central area, to form a series of concentric zones. According to Burgess there are five concentric zones showing different types of landuses.

They are –



Source: (Burgess, 1925).

The theory was also supported by the study of (Shih, et al 2024), the dominant relationships between population change and land use change in an urbanizing area occur as follows: (1) After new commercial and industrial establishments are built in a given place, job seekers from other places move to the vicinity of these establishments and primarily become renters of residential dwellings; (2) Increasing numbers of residents prompts the demand for housing,

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which leads to new residential developments in the place of work or nearby; (3) After the new residential buildings are completed, people can "officially" move into the new housing developments, which indicates that the migrants are officially recorded in a registered population system; and (4) Places in the process of urbanization will continue to densify with new small-scale businesses and transportation developments, and more migrants will move in.

Study Area

According to Okechukwu (2014), prior to the declaration of Enugu as a State in 1991, it existed as a town in the Old Anambra State. Enugu State is one of the five states in Nigeria's South East geo-political Zone, situated at the base of the Udi Plateau. It lies between latitudes 6°21′ N and 6°30′ N and longitudes 7°26′ E and 7°37′ E of the Prime Meridian, operating on a +1 hour GMT in the World Time Zone. The state shares borders with Abia and Imo to the south, Ebonyi to the east, Benue to the northeast, Kogi to the northwest, and Anambra to the west. Enugu State spans an area of 7,161 km² (2,765 sq mi), making it the twenty-ninth largest state out of Nigeria's 36 states in terms of land area. It comprises 17 Local Government Areas (LGAs), which include Aninri, Awgu, Enugu North, Enugu East, Enugu South, Ezeagu, Igbo Etiti, Igbo-Eze North, Igbo-Eze South, Isi-Uzo, Nkanu East, Nkanu West, Nsukka, Oji River, Udenu, Udi, and Uzo-Uwani.as shown in (Figure 3.1).

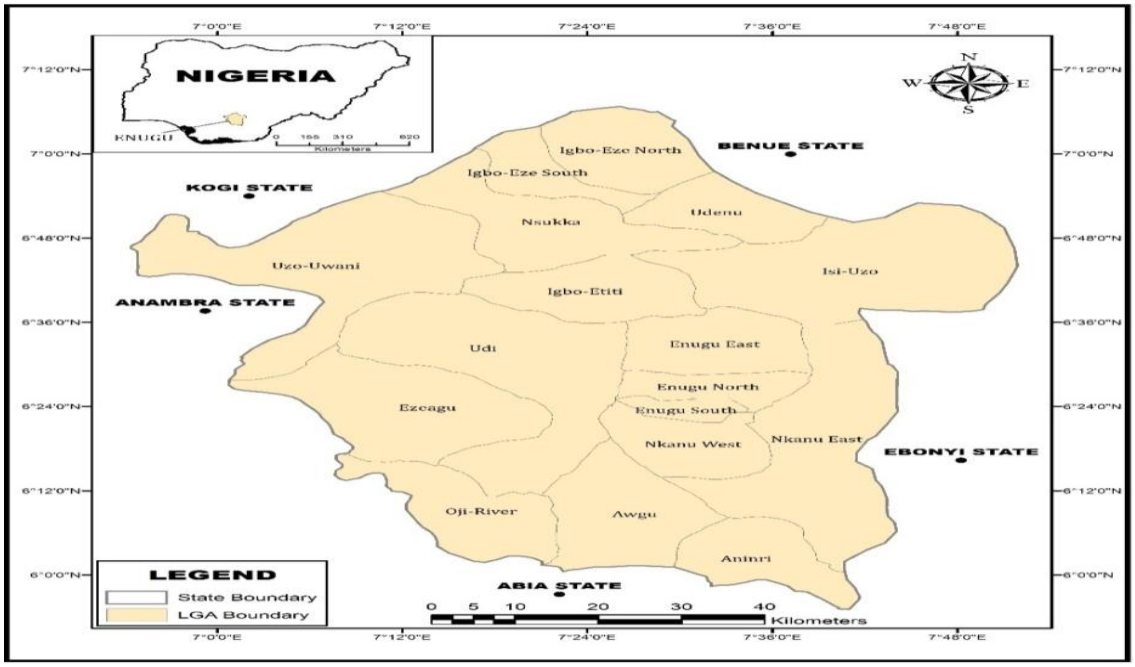

Figure 3.1: Map of Enugu State showing Local Government Areas
Source: Geospatial Analysis Mapping and Environmental Research Solutions (GAMERS, 2018)

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3.0 Methodology

A descriptive cross-sectional research design was used for this study. The respondents were drawn from various urban areas in Enugu state. The study used purposive sampling to select these zonal areas. The questionnaire results were analyzed in SPSS 28.0 using regression analysis. The study aimed to look into the examine the assessment of the impact of Population Growth on Land use and landscape changes in the Enugu Urban area Southeast Nigeria.

3.1 Model Specification

The model specification used in hypothesis one for this research work is linear regression analysis, which is defined as follows based on the relationship between predictors and dependent variables in mathematical form:

$$Y = \pi_0 + \pi_i x_i \dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$

$$LULC = \pi_0 + \pi_1 x_1 + \pi_2 x_2 \dots\dots\dots\dots\dots\dots\dots\dots\dots (2)$$

Where Y=Dependent variable represented by land use and landscape changes (LULC).
x_i= Predictors variable
π_0= Slope or intercept
π_1 & π_2= Regression coefficients
μ= Error term

Therefore, to examine the distinct effect of birth rate, migration in land use, and landcover change. The model can be stated in the below econometric model form as in equation 4 below

$$LULC = \beta_0 + \beta_1(BR) + \beta_2(M) + \mu \dots\dots\dots\dots\dots\dots (4)$$

Where:
LULC= Land use and landcover changes
M= Migration
BR = Birth rate

4. Data Analysis and Interpretation

The section contains the presentation, analysis, and interpretation of data gathered from respondents in the various firms studied. The responses were categorized by coding them in a Likert scale format to achieve our objective for this study. The analysis of the structured questionnaire was done using a statistical package for social science (SPSS version 28.0).

Table 1: Response Rate

	Frequency	Percentage	Cumulative Percent
Returned	238	93.3%	93.3%
Unreturned	17	6.7%	100%
Total	255	100	

Source: Field Work 2024

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The above table 1 shows that one hundred and fifty (255) copies of the questionnaire were distributed but only one hundred and nineteen (238) were returned, while the remaining were not returned. The unreturned amounted to seventeen (17).

	Frequency	Percentage
Gender		
Male	98	41.2%
Female	140	58.8%
Marital Status		
Single	112	47.1%
Married	107	44.9%
Divorced/Widowed	19	7.90%
Age		
<30 yrs.	73	30.7%
30-39 yrs.	83	34.9%
40-49 yrs.	52	21.8%
>50 yrs.	30	12.6%
Qualification of Respondents		
Tertiary Education	136	57.1%
Secondary Education	65	27.3%
Professional Certificates	37	15.5%

Table 2: Demographic Data Presentation (n=238)
Source: Fieldwork 2024

Table 2 is the demographic profile of the respondents, it shows a higher representation of females, with 140 participants (58.8%) compared to 98 males (41.2%). The marital status distribution indicates that nearly half of the respondents are single (112 participants, 47.1%), while a slightly lower proportion are married (107 participants, 44.9%). A smaller segment of the respondents, 19 individuals (7.9%), are either divorced or widowed. This diverse marital status distribution adds depth to the demographic data.

In terms of age, the largest group of respondents falls within the 30-39 years age range, with 83 participants (34.9%), followed by those under 30 years old (73 participants, 30.7%). The 40-49 years age group includes 52 participants (21.8%), and the smallest group consists of individuals over 50 years old (30 participants, 12.6%). Educational qualifications reveal that a significant majority of respondents have tertiary education (136 participants, 57.1%), while 65 participants (27.3%) have secondary education, and 37 (15.5%) hold professional certificates.

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This educational background highlights a well-educated respondent base with a diverse range of academic achievements.

	LULC	BR	NI
LULC	1		
BR	.52[.001] *	1	
M	-.41[.071]	.33[.201]	1

Table 3: Spearman's Correlation of the variables

[ ] represent the probability value; * represent a significant correlation.

LULC= Land use and landcover changes

M= Migration

BR = Birth rate

Table 3 represents the correlation analysis, the variables are found to be correlated with the dependent variable respectively, and the probability value < 0.05 indicates that the relationship did not occur by chance otherwise they did not occur by chance.

4.3 REGRESSION

MODEL (Land use and land changes)

Table 4: Estimation of Result and Interpretation

Variables	Coefficients	T-Statistic	P-value	Std. Error	95% Confidence Interval	
					Lower	Upper
BR	5.311	5.464	0.013	0.972	[4.38774]	[10.59218]
M	0.991	9.769	0.001	0.183	[0.56132]	[1.268121]
R^2	0.541					
Adjusted R^2	0.502					
F-stat	47.89					
Prob of (F-stat)	0.000					

Computed with SPSS 28.0 Compiled by the Researcher.

BR = Birth rate; M= Migration.

[p<0.05] Implies significant at 5%.

Table 4 is the regression analysis which explores the impact of birth rate and migration on land use and land changes, with the model demonstrating significant findings. The coefficient for the birth rate is 5.311, suggesting that for each unit increase in the birth rate, land use and land changes rise by 5.311 units, assuming other factors remain constant. The

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coefficient for migration stands at 0.991, indicating that each unit increase in migration results in a 0.991-unit increase in land use and land changes. Both coefficients are statistically significant, with p-values of 0.013 for birth rate and 0.001 for migration, both below the standard significance threshold of 0.05.

The model's explanatory power is reflected in its R-squared value of 0.541, which means that approximately 54.1% of the variance in land use and land changes is accounted for by the birth rate and migration. This suggests a moderate level of fit for the model. The adjusted R-squared value of 0.502, which adjusts for the number of predictors, indicates that about 50.2% of the variance in land use and land changes is explained by the model, accounting for its complexity. This slight decrease from the R-squared value is expected as it provides a more accurate measure of the model's explanatory power.

The overall significance of the regression model is confirmed by the F-statistic of 47.89 and its associated p-value of 0.000, which is well below the 0.05 significance level. This indicates that the model, as a whole, significantly explains the variation in land use and land changes. In summary, the findings reveal that both the birth rate and migration have significant positive effects on land use and land changes, with the birth rate having a larger impact. The model provides a moderate explanation of the variance in land use and land changes, and its overall statistical significance underscores the importance of these predictors in understanding land use dynamics.

4.4 HYPOTHESIS TEST

H_{o1}: The birth rate has no significant effect on Land use and landcover changes in the Enugu Urban area of Southeast Nigeria.

H_{o2}: Migration has no significant effect on Land use and landcover changes in the Enugu Urban area of Southeast Nigeria.

4.5 DISCUSSION OF RESULTS

This study investigated the impact of birth rate and migration on land use and land changes, employing a regression model to elucidate the relationships. The analysis revealed several noteworthy findings, which are pivotal in understanding the dynamics of land use in response to demographic factors.

The coefficients derived from the regression model indicate that both birth rate and migration significantly affect land use and land changes. Specifically, the coefficient for the birth rate is 5.311 ($p = 0.013$), suggesting a substantial positive impact. This implies that for every unit increase in the birth rate, land use and land changes increase by 5.311 units, holding other factors constant. Similarly, the coefficient for migration is 0.991 ($p = 0.001$), indicating that each unit increase in migration results in a 0.991-unit rise in land use and land changes. These findings underscore the critical role of demographic factors in driving changes in land use patterns. The statistical significance of these coefficients, with p-values well below the

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conventional threshold of 0.05, reinforces the robustness of these results.

The explanatory power of the model is demonstrated by the R-squared value of 0.541, indicating that 54.1% of the variance in land use and land changes can be attributed to the birth rate and migration. This suggests a moderate to strong fit of the model, highlighting that demographic factors are substantial predictors of land use dynamics. The adjusted R-squared value of 0.502 further refines this estimate, accounting for the number of predictors in the model and suggesting that 50.2% of the variance is explained when adjusting for model complexity. The slight reduction from the R-squared value to the adjusted R-squared value is typical and indicates the model's appropriateness and reliability. The overall significance of the regression model is confirmed by the F-statistic of 47.89, with a p-value of 0.000. This p-value indicates that the model is statistically significant, affirming that the combination of birth rate and migration significantly explains variations in land use and land changes. This finding is crucial as it validates the model's ability to capture the relationship between demographic changes and land use dynamics comprehensively.

In conclusion, the study's findings highlight the significant and positive effects of birth rate and migration on land use and land changes. The high explanatory power and statistical significance of the model suggest that demographic factors are vital determinants of land use patterns. These results have important implications for policymakers and urban planners, emphasizing the need to consider demographic trends in land use planning and management. Future research could further explore other potential predictors and their interactions to provide a more holistic understanding of land use dynamics.

Summary

1. Birth rate (5.311; p-value =0.013), Significant at 5% level
2. Migration (0.991; p-value=0.001), Significant at 5% level

5. Conclusion

The study of the impact of population growth on land use and landcover changes in the Enugu Urban area of Southeast Nigeria reveals significant correlations with both the birth rate and migration. The findings indicate that an increasing birth rate, or natality, has a substantial positive effect on land use and landcover changes. This demographic trend has led to the expansion of residential areas, commercial zones, and infrastructural developments to accommodate the growing population. Consequently, there has been a transformation in the urban landcover, with more land being converted from natural or agricultural use to urban purposes.

Migration, both from rural areas and other regions, also plays a critical role in shaping the land use and landcover of the Enugu Urban area. The influx of people seeking better economic opportunities and living conditions drives the

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demand for housing, services, and amenities. This surge in population density accelerates urban sprawl and necessitates the development of new urban infrastructures, further altering the landcover.

Overall, the combined effects of a high birth rate and significant migration underscore the dynamic relationship between population growth and urban land use changes in Enugu. The urban area is experiencing continuous evolution, characterized by increasing construction activities and shifting land use patterns. These changes call for effective urban planning and sustainable development strategies to manage the environmental and socio-economic impacts of rapid urbanization. The study conclude that Population Growth has significant effect on Land use and landscape changes in the Enugu Urban area in Southeast Nigeria.

Recommendations

Given the significant positive effects of both birth rate (natality) and migration on land use and landcover changes in the Enugu Urban area of Southeast Nigeria, several recommendations are proposed to manage and mitigate the impact of rapid population growth:

i. Develop and implement a comprehensive urban planning framework that anticipates future population growth and guides sustainable land use. This plan should include zoning regulations, infrastructure development, and the preservation of green spaces to balance urban expansion with environmental sustainability.

ii. Develop strategies to manage the flow of migrants into the Enugu Urban area. This could include the promotion of economic opportunities in rural areas to reduce the migration pressure on urban centers, and the integration of migrant populations into the urban planning processes.

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