



Original Research Article

Assessment of Urban Growth and Deforestation in Ebonyi State, Nigeria

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<http://doi.org/10.5281/zenodo.10442775>

ARTICLE INFORMATION

Article history:

Received 03 Oct. 2023

Revised 30 Oct. 2023

Accepted 12 Nov. 2023

Available online 30 Dec. 2023

Keywords:

Deforestation

Forest cover

Landmass

Land use

Spatial growth

ABSTRACT

The study assessed urban growth and deforestation in Ebonyi State, Nigeria. Data on the rate of deforestation which was obtained from world resource institute website were utilized, data on determinants and effect of urban growth were obtained through questionnaires. Purposive sampling technique was used to administer 400 questionnaires to the respondents in the area. Trendline analysis and relative importance index (RII) were used to analyze the data. The result showed that the highest (255 ha) deforestation rate was in 2001 while the lowest (5 ha) was in 2006. The linear trend line equation was positive, inferring that deforestation in the study area increased during the study period; and that deforestation rate in the study area is expected to increase by 5.57 ha per annum. The study also revealed that the extent of forest in 2000, which is the base of the study, accounted for 71.0% of the total landmass while in 2020 the forest landmass decreased accounting for 45.5% of the total landmass of the study area. Findings also showed that the spatial growth of Ebonyi State is mostly by increase in population as a result of immigration and natural birth. Finally, the RII revealed that the growth of the state has an effect on all the factors stated with increase in the cost of land having the highest mean ranking. Based on the aforementioned findings, the study recommended that the state government should prioritize afforestation and reforestation programs to restore degraded areas and increase forest cover.

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1. INTRODUCTION

Deforestation emerges as a pressing environmental concern on a global scale, commanding huge attention due to its far-reaching consequences for ecosystems and the planet as a whole. The loss of forest cover not only upsets invaluable habitats and biodiversity but also significantly contributes to climate change by releasing substantial carbon dioxide (CO₂) emissions (Isikhuemen, 2018). Forests, being critical agents of carbon sequestration, naturally safeguard against the impacts of climate change. Unfortunately, deforestation is estimated to account for approximately 10% of the world's carbon emissions, placing it among the primary

drivers of climate change (Moussa et al., 2019). This has grave implications for communities worldwide, as climate change fosters extreme weather events, water scarcity, and various other environmental disasters.

Deforestation has reached disturbing levels on a global scale, particularly in tropical regions. The insatiable demand for land, driven by agriculture, logging, urbanization, and infrastructure development, has expedited the conversion of forests into alternative land uses (Boafo, 2013). The ramifications of deforestation extend far beyond the immediate areas affected, as the destruction of forests disrupts global weather patterns, exacerbates climate change, and triggers ecological imbalances. Understanding the broader implications and driving forces behind this issue necessitates examining the global context of deforestation. The concern is profound worldwide, with tropical rainforests experiencing the most substantial losses.

The phenomenon of urban growth and deforestation is also a global concern that has far-reaching implications for sustainable development and environmental conservation (Lawanson, 2005). Rapid urbanization, driven by population growth and industrialization, has led to the expansion of cities and towns worldwide. As urban areas expand, there is a growing need for land to accommodate infrastructure, housing, and commercial establishments, often resulting in the conversion of natural ecosystems, including forests, into urban landscapes (Lawanson, 2005). The global scale of urban growth and deforestation underscores the importance of studying its impacts and identifying effective strategies to balance urban development with environmental preservation (Uzonu, 2018).

Nigeria, as the most populous country in Africa, faces significant urbanization pressures and environmental challenges. Rapid population growth, urban migration, and economic activities have transformed the landscape of many Nigerian cities and states (Nzeh, 2012). The country's economic growth and industrial development have increased the demand for land and resources, leading to widespread deforestation and forest degradation (Uzonu and Bala, 2016). In Nigeria, forests play a crucial role in supporting biodiversity, regulating the climate, and providing essential ecosystem services. However, the expansion of urban areas and the conversion of forests into agricultural lands and infrastructure have threatened these vital ecosystems (Uzonu and Umoru, 2020).

Ebonyi State, nestled in southeastern Nigeria, is one of the states grappling with the dual challenges of rapid urban growth and deforestation. The state's capital, Abakaliki, has experienced significant population influx and economic activities, leading to the expansion of urban areas and the encroachment into nearby forested regions (Nzeh, 2012). The fertile land in Ebonyi State has attracted agricultural activities, further contributing to deforestation. The consequences of urban growth and deforestation in Ebonyi are multifaceted, impacting the environment, biodiversity, and the livelihoods of local communities. Forests are not only a vital habitat for wildlife but also play a crucial role in providing ecosystem services, such as water regulation and soil conservation. The loss of forest cover can exacerbate climate change, trigger soil erosion, and disrupt local ecosystems. Since Ebonyi State exemplifies this interplay between urban growth and deforestation, it is therefore pertinent to study this interplay.

2. METHODOLOGY

2.1. Study Area

Ebonyi State is located in the southeastern part of Nigeria, between Latitude 6° 31' 0" N and 5° 37' 0" N of the equator and Longitude 8° 16' 60" E and 7° 30' 0" E of the Greenwich meridian (Figure 1). The state covers an area of approximately 5,670 square kilometers, making it one of the smallest State in Nigeria. It is bordered by Benue State to the north, Enugu State to the west, Abia State to the south, and Cross River State to the east. The climate of Ebonyi State is typically tropical, characterized by two distinct seasons - the rainy season and the dry season. The rainy season usually spans from April to October, with peak rainfall occurring between July and September. The annual average rainfall in the state ranges from 1,800mm to 2,200mm, nourishing the fertile soil and supporting a vibrant agricultural sector. During the dry season, which typically extends from November to March, temperatures can be quite high, reaching up to 35°C. However, the dry season also offers cooler nights, providing some relief from the daytime heat.

Ebonyi State is renowned for its lush greenery and abundant forests. The state's vegetation is predominantly characterized by tropical rainforests and savannas, which play a crucial role in maintaining the ecological balance of the region. The forests are home to diverse flora and fauna, providing habitats for various plant and animal species, some of which are rare and endemic to the area. The topography of Ebonyi State is diverse, encompassing various relief features that add to its scenic beauty. The state's landscape consists of undulating hills, valleys, and plateaus, all of which contribute to the rich geological history of the region. The rocky hills in some areas add a touch of ruggedness to the picturesque scenery. Ebonyi State is part of the southeastern basement complex of Nigeria, with rocks that date back to the Precambrian era. The state is endowed with valuable mineral resources, including lead, zinc, limestone, and salt, which contribute to its economic potential.

Ebonyi State is home to a diverse mix of ethnic groups, with the major ones being the Igbo, Hausa, Yoruba, Igalla, Ibibio and Efik. The people of Ebonyi State are known for their warm hospitality and rich cultural traditions. As of the last available census, the population of Ebonyi State was estimated to be around 3.7 million people, and it has likely grown since then due to its relatively high birth rate. Agriculture is the backbone of Ebonyi State's economy, with the state being one of the leading producers of rice and yam in Nigeria. The fertile soil, combined with favorable climatic conditions, allows for the cultivation of various crops, including cassava, maize, and vegetables. In addition to agriculture, the state's mineral resources, particularly lead and salt, contribute significantly to its economy. The people of Ebonyi State also engage in various crafts and trades, such as weaving, pottery, and wood carving, showcasing their artistic talents and preserving their cultural heritage. In recent years, there has been a growing interest in tourism, as visitors are drawn to the state's natural beauty, historical sites, and vibrant culture.



Figure 1: Ebonyi State showing Local Government Areas

2.2. Data Collection

Land use data were obtained from Global Forest Watch website. Landsat 7 Enhanced Thematic Mapper (ETM+) of 2000 with spatial resolution of 30 and Landsat 8 Operational Land Imager and Thermal Infrared Sensor (OLI/TIRS) of 2020 with spatial resolution of 30 m which were both gotten from US geological survey website. Data on the perceived cause and effect of urban growth were gotten through questionnaires while population of the state was obtained from National Population Commission (NPC) Ebonyi State Chapter. To obtain the sample size, the population census figure of the sampled LGAs in the study area for the year 2006 was used and projected to the year 2022 using the exponential growth formula with 3.25% growth rate of the state. Yamane's (1967) formula was also used to determine the sample size at 95% confidence level and 5% sampling error assumption. The sample size for this study was calculated to be approximately 400 which also determined the number of questionnaires administered. The questionnaire was administered purposively to the respondents.

3. RESULTS AND DISCUSSIONS

3.1. Trend of Deforestation in the Study Area

In a general sense, a trend refers to the general direction or pattern of change over time. The trend of deforestation in the study area is shown in the Figure 2. Figure 2 clearly indicates the fluctuating trend of deforestation in the study area over the years. In 2001, the highest deforestation rate recorded was approximately 255 hectares, while in 2006, the lowest rate was just 5 hectares. The plotted linear trend line ($Y = 5.574x + 35.791$) indicates a positive slope, suggesting a consistent increase in deforestation throughout the study period. This implies that the study area has been facing a steady rise in deforestation, with an estimated annual increase of 5.57 hectares. These findings align with similar research conducted by Uzonu (2018) in Nigeria, Ickowitz et al. (2015) in Congo, Basyuni et al. (2018) in Indonesia, and FAO (2020), which all reported a surge in deforestation rates globally. This indicates that deforestation has become a pressing global issue that demands urgent and multi-faceted interventions for effective resolution. A key driver of deforestation in the study area is agricultural expansion. As the world's population grows, the demand for food and agricultural products increases, leading to the clearance of forests for large-scale commercial farming and small-scale subsistence agriculture. This conversion of forests into farmland results in the loss of forest cover, depletion of biodiversity, and the release of stored carbon in trees, significantly contributing to climate change (Ladipo, 2012). Another factor contributing to the rising deforestation is logging and timber extraction. Trees are felled for timber, which is utilized in construction, furniture production, and paper manufacturing. However, unsustainable logging practices, including illegal logging and clear-cutting, can cause severe damage to forest ecosystems, disrupting habitats and diminishing forest health and resilience (Uzonu and Bala, 2016).

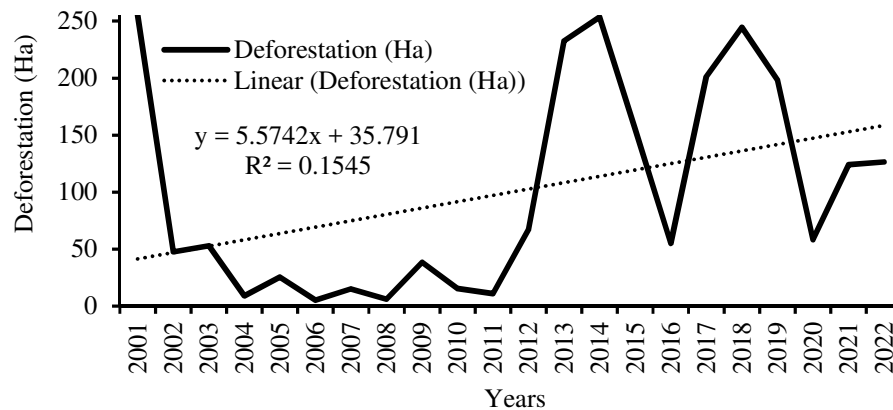


Figure 2: Trend of deforestation in the study area

3.2. Extent of Urban Growth in the Study Area

The extent of urban growth of Ebonyi State is presented in Table 1; Figures 3 and 4. Table 1 revealed that the extent of forest in 2000, which is the base of the study, was 3950.8 km² of land, which accounts for 71.4% of the total landmass of the study area, while in 2020 the forest landmass decreased to 2517.2 km² which accounts for 45.5% of the total landmass of the study area. It can be deduced from the result that there has been a steady decrease in the forest area of Ebonyi state which shows that there is an enormous deforestation going on in the study area. This result is in agreement with the findings of Ade and Afolabi (2013) who in their study stated that most forest areas of any city or country is never static that it changes per time. This is because forests often undergo dynamic processes of growth, decay, and regeneration. Factors such as natural disturbances, climate change, human activities, and ecological interactions constantly shape and modify forest ecosystems. While some forests may naturally regenerate or recover from disturbances, others face continuous degradation due to factors like unsustainable logging, conversion to

agriculture, or urban expansion, leading to a decline in their overall health and biodiversity. Similar to the broader global context, deforestation and forest degradation are evidently a significant concern in the study area.

Table 1: Extent of deforestation in the study area

Land use land cover class	2000		2020	
	Area (km ²)	%	Area (km ²)	%
Water	17.0	0.3	66.4	1.2
Forest	3950.8	71.4	2517.2	45.5
Built-up	1489.7	26.9	1786.9	32.3
Bare surface	76.0	1.4	1161.8	21
	5533.5	100	5532.2	100

From Figure 3, Ebonyi State could be seen still at a formative stage with few built up areas. This is in line with Uzonu and Umoru, (2020) who opined that there could be an accelerated growth in new states which will lead to increased development. This was the case in Ebonyi State as a lot of economic activities sprung up in areas like Abakaliki, Afikpo and Ishiagu due to influx of people to those areas. This increased population continue to depend on forest resources for sustained livelihood. Figure 4 shows an increase in built-up areas and a significant reduction in forest size. This could be attributed to drivers of deforestation in the state which are agricultural expansion, logging, fuelwood collection, and urbanization (Ajier et al, 2019). Uzonu and Umoru (2020) opined that having the state capital in the rain forest belt will encourage deforestation since the forests will give way to basic amenities. Such amenities reflect the cultural, social and economic values of a society, as it is the best physical and historical evidence of a country's civilization (Omole, 2010). The conversion of forests into farmland, especially for crops like oil palm, cassava, and rubber, has led to the loss of forest cover and fragmentation of habitats. This was evident in Table 1 where built-up (1489.7 - 2517.2 km²) and bare surface (76.0 - 1161.8 km²) increased by 5.4% and 19.6% respectively.

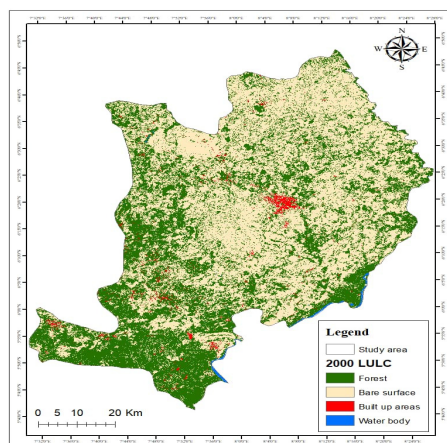


Figure 3: Extent of the urban growth in 2000

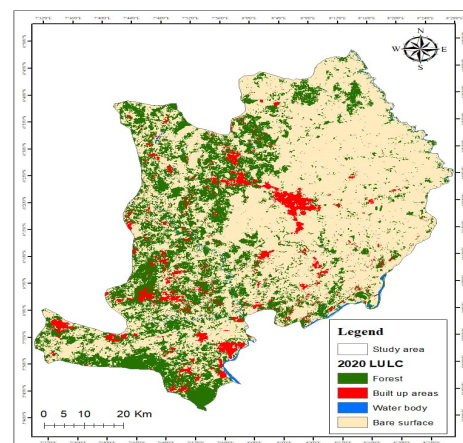


Figure 4: Extent of the urban growth in 2020

3.3. Determinant of Spatial Growth

Table 2 revealed that population increase had the highest ranking (1st) which suggests that it is the most significant factor that is influencing the spatial growth of the state. Access to health facility had least ranking of 8th, topography had a ranking of 7th and both tourism and Creation of Satellite towns was ranked 2nd and 3rd respectively, However, increase in the number of industries was ranked 5th while presence of social amenities was ranked 6th. This agrees with the findings of the in-depth interview conducted which suggested that increase in population is the major determinant of urban growth where all the interviewees unanimously

quoted population increase as the major determinant of the spatial growth of the study area. This result is in agreement with the findings of Ade and Afolabi (2013) who in their study identified that population dynamics are the underlying drivers of development and environment changes in any city. However, the result from the interview conforms to land use land cover analysis which showed that built-up has consumed a substantial part of other land use in the study area. This is as a result of the increase in population. Because land scape transformation in urban environment throughout space and time are mainly dominated by anthropogenic activities and are greatly influenced by the spatial expansion of built-up land.

Table 2: RII on the determinant of the spatial growth of the study area

Factors	Rating (W)					$\sum W*N$	RII	RANK
	1	2	3	4	5			
Presence of social amenities	3	4	8	109	260	1771	0.922	6 th
Topography	0	6	17	135	226	1734	0.903	7 th
Presence of tertiary institution	0	0	15	81	288	1809	0.942	4 th
Creation of satellite towns	0	0	0	69	315	1851	0.964	2 nd
Tourism	0	0	9	53	322	1849	0.963	3 rd
Availability of industries	0	10	18	59	297	1795	0.934	5 th
Population increase	0	0	9	25	350	1877	0.977	1 st
Access to health Facility	0	4	66	181	133	1595	0.830	8 th

3.4. Effect of the Spatial Growth on the Study Area

It is evident from Table 3 that out of the 400 respondents 268 of the respondents stated that the spatial growth of the state possesses some effects.

Table 3: RII of the effects of the spatial growth of the study area

Factors	Rating (W)					$\sum W*N$	RII	Rank
	1	2	3	4	5			
Availability of skilled jobs	2	4	6	105	250	1702	0.925	4 th
Conversion of urban fringes to urban area	2	2	30	105	229	1660	0.902	5 th
Conversion of farm lands residential within and fringes of the metropolis	0	2	25	220	121	1564	0.850	10 th
Forest depletion at the fringe of the metropolis	0	17	21	114	216	1633	0.887	7 th
Environmental pollution	1	13	26	113	215	1632	0.886	8 th
High rate of crime	0	5	23	118	222	1661	0.902	5 th
Pressure on road	2	5	33	132	196	1619	0.879	9 th
Poor state of housing	0	3	38	119	208	1636	0.889	6 th
Pressure on land within the metropolis	0	0	0	115	353	1725	0.937	2 nd
Increase in the cost of land within the metropolis	0	0	3	107	258	1727	0.938	1 st
Increase in the cost of house rent	0	0	31	64	274	1715	0.932	3 rd
Erosion	9	25	58	130	147	1488	0.808	11 th
Traffic congestion within the metropolis	15	7	121	129	96	1388	0.754	12 th

Increase in the cost of land had the highest mean ranking of 1st which suggests that it is the most significant factor that on the effect of the growth of the state. Conversion of farm lands to residential within and at the fringes of the state was ranked 10th, high rate of crime and conversion of urban fringes to urban area were ranked 5th while forest depletion at the fringe of the metropolis had a ranking of 7th, environmental pollution was ranked 8th, pressure on road was ranked 9th and poor state of housing had a ranking of 6th. Interestingly, increase in the cost rent was ranked 3rd and pressure on land within the metropolis has the second highest ranking of 2nd and availability of skilled job had a ranking of 4th while erosion and traffic congestion within the metropolis had a ranking of 11th and 12th respectively. The figures revealed that the growth of the study area has high influence on all of the factors. The result agrees with the findings of Uzonu and Umoru (2020) which revealed that the urban infrastructures such as roads/streets, electricity, water supply system and waste

management system are depreciating, and this has compounded the way the cities are sprawling far beyond the range for which the facilities were planned and projected.

4. CONCLUSION

This study analyzed urban growth and deforestation trends in Ebonyi State, Nigeria. The study revealed an alarming increase in deforestation, resulting in a significant reduction in forest cover over time. Urbanization was primarily driven by population growth, impacting land use patterns. The findings highlight the urgent need for sustainable land management and conservation efforts to preserve the environment. Policy measures should address the challenges posed by urbanization and deforestation, ensuring a balanced and sustainable future for Ebonyi State.

5. ACKNOWLEDGEMENT

The authors wish to acknowledge the inputs of GIS expert, Mr. Lucky Esemuze and the research assistants that administered the questionnaires.

6. CONFLICT OF INTEREST

No conflict of interest is associated with this work.

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