Urbanization and Environmental Impact of Urban Sprawl in Ogu Town, Rivers State, Nigeria

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Abstract:-**This study focused on urbanization andenvironmental impact of urban sprawl in Ogu town, Rivers State, Nigeria. It essentially dealt with the issue of population explosion and ecological devastation in the study area. The thrust of the study is to examine the relationship between urban sprawl and environmental degradation. Ogu town is made up of 50 communities out of which 10 were selected for this study through random sampling technique. One hundred and fifty (150) respondents were selected from the 10 communities through stratified and systematic sampling method and questionnaires were prepared and administered to the respondents. Information from the respondents were analysed and tested by the use of pearson product moment correlation coefficient and validated with the student t-test. The hypothesis was to test the relationship between urban sprawl and Environmental degradation. The findings of the study showed among others that urban sprawl has significantly led to environmental degradation resulting to different environmental and Ecological problems in the area. To solve these problems, it was recommended that the principle of urban planning should be integrated in the planned discipline and planning of urban areas. Also, the place of EIA should be incorporated in the planning of urban area.**

Keywords: **Planning; UrbanSprawl; Environment; Impact; Nigeria**

I. INTRODUCTION

Urbanization, urban sprawls, poverty and slum are often connected, and posed major challenges to developed and developing nations alike, but these challenges are more pronounced in developing nations among which Nigeria is not immune. Urbanization has been a major demographic trend in Nigeria and most especially in the major cities across the country in the last half of the century because of the relative increase in both social and economic development that is presently resulting in the uncontrolled population growth of Nigerian major cities, some of which are manifesting in the unnecessary pressures on available infrastructure, environmental degeneration, traffic congestion, housing shortages and high level of crimes(Bakare, 2014).

Urban sprawl and unplanned urban development are among the most visible consequences of rapid urbanization, along with the increasing vulnerability of hundreds of millions of urban dwellers to rising sea levels, coastal flooding and other climate-related hazards. The world is increasingly becoming urbanized and the rate at which city populations grow and the rate at which countries urbanize is an indication of the pace of social and economic change (Donk, 2006).Urban sprawl is directly identified with urban growth – as cities get bigger, they expand around their peripheries. But sprawl is more specific as it is defined as an 'uncoordinated growth'; the expansion of a community without concern for consequences or environmental impact. It can be defined as the scattering of new development on isolated tracts, separated from other areas by vacant land (Wizor, 2014;Rosemary, 2016). It often involves the construction of residential and commercial buildings in rural areas or otherwise undeveloped land at the outskirts of a city. Omole(2010) defined urban sprawl as a formless dispersal of congested urban area with little or no regard for the inter-relationship of such factors as transportation, employment, health, and recreational needs. It has also been described as leapfrog development (Rosemary, 2016).

Urban sprawl is characterized by an unplanned and uneven pattern of growth, driven by multitude of processes and leading to inefficient resource utilization. It has become a pejorative term without any serious examination of its qualities or benefits and without any critical analysis of its troubled alternative – urban congestion while the formation of the world's cities has always been determined by the means of available transport (Rosemary, 2016).

Ukojeand Kanu (2014)has stated in literature that problems and effect of urban sprawl on public health are housing decays, waste generation, and disposal problem, congestion in housing unit, squatter settlement development and pollution of surface and underground water. Thus, Wizor (2014) noted that rapid population growth and unprecedented rate of urbanization coupled with the impact of such sprawl on the urban environment have all increased the need for planning urban centers.

It is worthy however to note that much of these phenomena is due partly to the absence of land planning statutes that encompasses the evolving functions and responsibilities of urban planners in urban areas as various studies have documented, and the need to integrate urban and regional planning framework in government planning agenda (Mabogunje, 1976, 1999, Ojo, 1978, Adeyemo, 2002 and Abam, 2008). It is this unique quest that provided the broad justification for undertaking their studies.

This present paper seeks to examine urbanization and environmental impact of urban sprawl in Ogu town, Rivers State, Nigeria.

II. MATERIALS AND METHODS

The data for this study were derived from both primary and secondary sources. The instruments adopted for data collection are oral interviews, direct field observation and questionnaire administration. The questionnaires areopen ended and structured in two parts (part 1 and part 2). Part 1 deals with the demographic characteristic of respondents while part 2 deals with the issues of urbanization and environmental impacts of urban sprawl in Ogu town. The questionnaires were prepared and tested for validity and then hand delivered to the respondents in their homes. Several follow-ups were done to ensure that the respondents complete the questionnaires appropriately.

Eighteen (18) purposively selected communities constitute the required population size for this study. These communities therefore constituted the primary sampling units (PSU). Stratified and systematic random sampling techniques was used to selectone hundred and fifty(150) households from each of the 18 selected communities in Ogu town where a household was selected after every ten (10) households in a street. However, only one hundred and thirty five (135) questionnaires were retrieved. A wide range of analytical and statistical tools were used to analyzeresponses from the respondents. Person Product MomentCorrelation Coefficient was particularly utilized to test the degree of relationship between urban sprawl indicators and environmental impacts in Ogu town.

Study Area

Ogu town is the Headquarters of Ogu Bolo Local Government Area (LGA) of Rivers State in the Niger Delta region of Nigeria. It is located on latitude $5^0 15'$ North of the Equator and longitude $3^0 45'$ East of the Greenwich Meridian (Amadi and Tamuno, 2001). It lies along the Bonny River (eastern distributaries of the Niger), 40 miles (60 cm) upstream from the Gulf of Guinea. The population of Ogu town has grown from 10,000 persons in 1991 to an over 74,000 persons in 2006 (NPC, 2006). The nucleated and displaced settlement pattern abounds in the area. The house types found in the area include the self-contain bungalow, block of flats, Duplex, tenements and even shanties towards the coastal areas.

It enjoys hot humid climate with two distinct seasons: the wet and dry season; with the wet season usually longer (from April to October) and the dry season usually shorter (from November to March). There is usually a break in the wet season called the August Break. The relative humidity varies approximately between 58% to 61% or more depending on the season, (Atemie, 2001). Ogu town consist of accumulations of cretaceous and tertiary sediments which are 70 million years old and have been influenced by gravitational instability and forces of tectonics. The oldest of these deposits found at the bottom, is the Calabar shale over lain by the shales of the Akata formation (Adeyemo, 2002). On the top of these are the more recent Agbada and Benin formations. In general, the major structural trend in the Southern Niger Delta where Ogu is situated is NW-SE and NE-SW for the Western Niger Delta (Oyegun and Adeyemo1999). The trend is the S-W for the coasted tidal flat between the Bonny River and the Atlantic Ocean. The sedimentary environment corresponds lithologically to the Benin, Agbada and Akata formation.

The soil of the area consists of various types of superficial deposits overlying thick tertiary sandy and claying deposits which are over 100m thick in places. The sedimentation of the Bonny and Benin rivers, and the consistently high rainfall and uniform temperature all years round result to the formation of clay minerals and the alluvian deposits found in the area (Abam, 1999).The vegetation of Ogu town is the fresh watch swamp and mangrove forest enriched with a variety of peers species such as green foliage, Napia palm, Raffia palm, Mahogany, Obeche etc. Ogu town is a flat plain land mass. Its average height above seas level is less than 13m in most places and about 9-11m in some places (Abam, 2001). The popular dendritic drainage pattern observed in the deltaic region is what is experienced in Ogu town and its environs. The entire area is drained by the Toruaka River (Umeuduji and Aiseuebeogun, 1999)
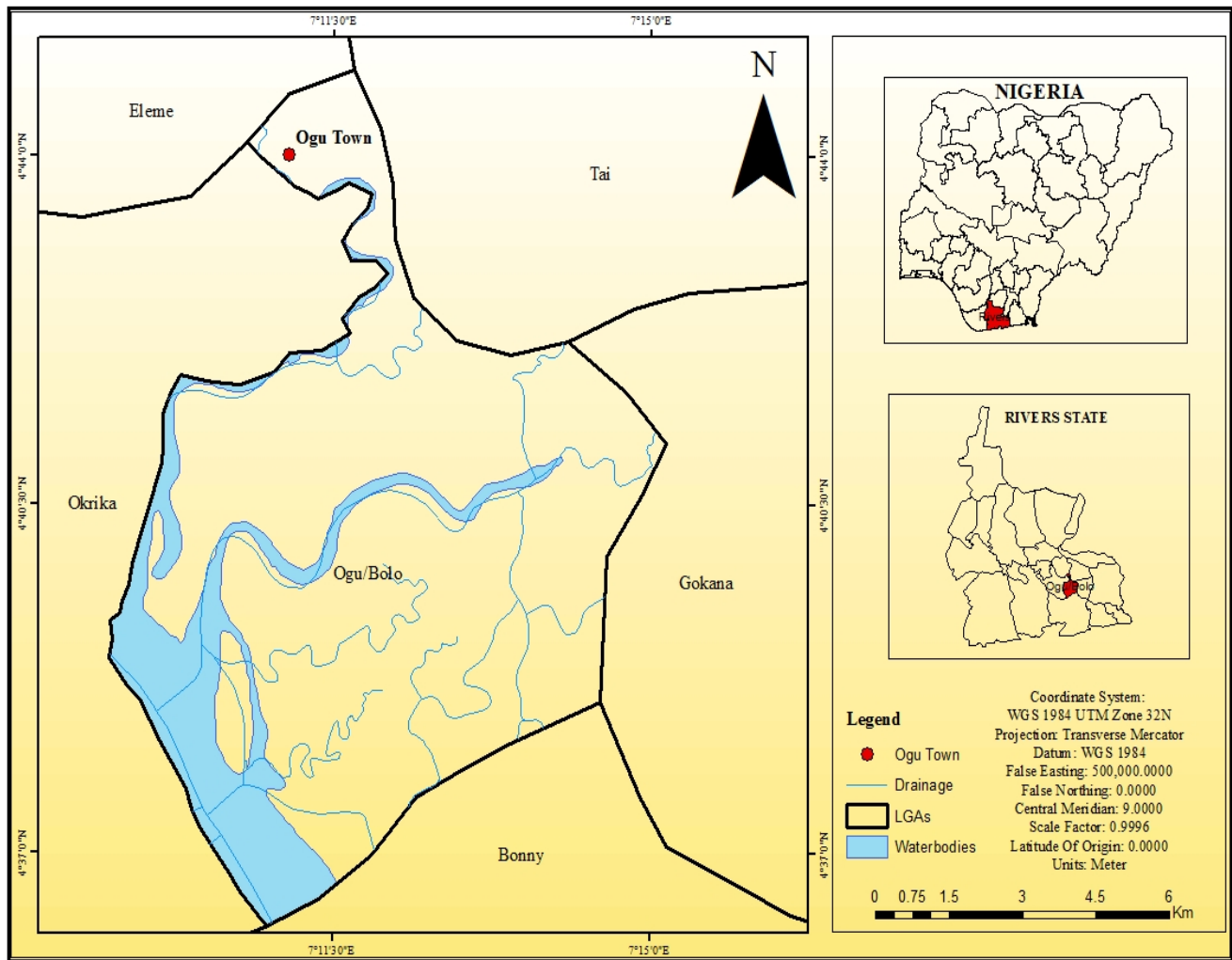
Figure 1 Location Map of Ogu Town, Rivers State, Nigeria

Source: Cartography Laboratory, University of Port Harcourt, Nigeria

III. RESULTS/DISCUSSIONS

Socio-Economic Characteristics of Respondents

Table 1 Age Distribution of the Respondents

Age	Frequency	%
21 – 30 years	24	17.8
31 - 40 years	30	22.7
41 - 40 years	54	40
51 - 60 years	17	12.6
61 and above	10	7.40
Total	135	100

Source: Authors' Survey, 2019

The data presented aboveshows that majority of the respondents fall between the ages of 41 – 50 years with 40% while 22.2% of the respondents are between the ages of 31 – 30 years. However, the respondents between the ages of 51-60 years and 61 and above have 12.6% and 7.40% respectively.

The significance of this statistics is that the respondents are aware of the nature of urban sprawl and the impact it creates on the environment of Ogu town.

Table 2 – Sex Distribution of the Respondents

Sex	Frequency	%
Male	81	60
Female	54	40
Total	135	100

Source: Authors' Survey, 2019

Table 2 above shows that 60% of the respondents are male while 40% of them are female. This therefore shows that a good number of the respondents were head of households.

The marital status of the respondents is depicted on table 3 below. 52.6% of the respondents are married while 40% are single.

Table3 – Marital Status Distribution of the respondents

Marital Status	Frequency	%
Married	71	52.6%
Single	54	40
Others	10	7.4
Total	135	100

Source: Authors' Survey, 2019

Table 4 – Educational Qualification Distribution of the Respondents

Educational Qualification	Frequency	%
FSLC	11	8.11
OND/HND/NCE	13	9.6
BA/B.Sc/B.ED/BENG	75	55.6
MA/MSC/MED/MENG	30	22.2
PhD	6	4.4
Total	135	100

Source: Authors' Survey, 2019.

Table 4 above revealed that 75 of the respondents representing 55.6% are Bachelors degree holders, 30 representing 22.2% of the respondents are Masters degree holders, 13 respondents representing 9.6% are either OND, NCE or HND holders while 6 out of the total respondents representing 4.4% are PhD holders. This therefore shows that majority of the respondents, more than 91% are graduates and have knowledge of the process and growth of urban sprawl and the attendant environmental problems associated with such phenomenon.

Table 5 – Occupational Distribution of the Respondents

Occupational	Frequency	%
Civil Servant	34	25.2
Company Worker	40	29.6
Business man	39	28.9
Informal workers	22	16.3
Total	135	100

Source: Authors' Survey, 2019.

From table 5 above, the analysis revealed that 34 of the total respondents representing 25.2% are Civil Servants.40 out of the 135 sampled respondents representing 29.6% are company workers, 39 of the respondents representing 28.9% are businessmen while 22 respondents representing 16.3% are informal workers

The Nature and Processes of Urban Growth

The nature and processes of urban growth in this peri-urban settlement are discussed in this section.

Table 6 – Distribution and Nature of Urban Sprawl

S/N	Natureof Urban Growth	Frequency	%
A	Rapidly Increasing	6	4.4
B	Unprecedentedly Growing	21	15.6
C	Slowly Growing	15	11.1
D	Normally Growing	24	17.8
E	It is Sporadic	24	17.8
F	It is Astronomically Growing	20	14.8
G	It is Expanding	15	11.1
H	It is Accelerating	10	7.4
	Total	135	100

Source: Authors' Survey, 2019

Table 6 above shows the various forms and nature that urban sprawl assumes in Ogu town as represented by the respondents' observation.It clearly revealed that urban growth rates are either rapidly, slowly, astronomical, expanding gradually or accelerating.

However, the processes of urban growth and sprawl phenomenon are many as shown in table 7 below:

Table 7- Urban Growth Process Distribution

S/N	Process of Urban Growth	Frequency	%
A	Migration ofPeople	75	55.6
B	Industrialization	30	22.2
C	Urbanization	13	9.6
D	Population Explosion	11	8.1
E	Infrastructural Development	6	4.4
	Total	135	100

Source: Authors' Survey, 2019.

From the table above, it is revealed that migration is the dominant process of urban sprawl as it occupies 75 out of 135 responses position from the respondents representing 55.6%, followed by industrialization with 22.2% and urbanization with 9.6%.

Population Growth and Urban Sprawl

With reference topopulation growth rate and urban sprawl, table 8 below showed growth of population and urban sprawl in the study area. Respondents observed that the population growth rate was either rapid with 12.6%, astronomical with 17.8%, unprecedented with 14.8, exploding 22.2 and that it is steady has a 7.4%.

Table 8 – Distribution of Population Growth Rate

S/N	Population Growth Rate	Frequency	%
A	It is Rapid	17	12.6
B	It is Astronomical	24	17.8
C	It is Unprecedented	30	22.2
D	It is Alarming	24	17.8
E	It is Exploding	30	22.2
F	It is Steady	10	7.4
	Total	135	100

Source: Authors' Survey, 2019

Causes of Urban Sprawl

Table 9 below shows that many factors are responsible for urban sprawl in the study area.Continuous migration of people from rural areas has 40 response from the respondents representing 29.6%, inequality in socio-economic development 19.3%, the impact of colonial administration has 20.7% while influence of trade, commerce and economic activities has 14.8% and access to social infrastructure has 15.6% as shown:

Table 9 – Distribution of Cause of Urban Sprawl

S/N	Causesof Urban Sprawl	Frequency	%
A	Continuous Migration	40	29.6
B	Socio-economic Development Inequality	26	19.3
C	Impact of Colonial Rule	28	20.7
D	Impact of Trade and Commerce	20	14.8
E	Access to Social Infrastructure	21	15.6
	Total	135	100

Source: Authors' Survey, 2019

Environmental Impact of Urban Sprawl

Taking into cognizance, the main thrust of this studywhich is to evaluate urbanization and the environmental impact of urban sprawl in Ogu town, table 10 below shows that loss of environmentally fragile lands was a major impact of urban sprawl on the environment having 40 out of the total respondents representing 29.7%.

Table 10– Distribution of Environmental Impact of Urban Sprawl

S/N	Environmental Impact	Frequency	%
A	Loss of Environmentally Fragile Land	40	29.7
B	Position of Different Media	30	22.2
C	Ecosystem &Ecological Destruction	11	8.1
D	Increased Run-off of Storm Water	15	11.1
E	Aesthetic Landscape Loss	15	11.1
F	Land Fragmentation	15	11.1
G	Impact of Auto Usage	6	4.4
H	Shorelines &Wasted Erosion	3	2.3
	Total	135	100

Source: Authors' Survey, 2019

Further evidence from table 10 above shows that pollution of different media accounted for 22.2% whileecosystem and ecological destabilization have 8.1%.Increased run-off of storm water, aesthetic landscape disappearance, and land fragmentation accounted for 11.1% each while increased impact of auto usage has 4.4% and shore line degradation and coastal erosion has 2.3% as of the total responses.

Sequel to the issue in this section and in relative terms, table 11 below which is capped the extent of damage done to environment shows that destruction of acres of mangrove forest in the most experienced phenomenon and has 42 respondents representing 31.1%, destruction of marine organisms has 36 respondents representing 26.7%, followed by pollution of water bodies having 22.2% while species extinction has 13.3% and wide spread poverty has 6.7%.

Table 11– Distribution of Extent of Damage

S/N	Extentof Damage	Frequency	%
A	Destruction of Acres of Mangroves	42	31.1
B	Destruction of Marine Organisms	36	26.7
C	Pollution of Water Bodies	30	22.2
D	Species Extinction	18	13.3
E	wide Spread Poverty	9	6.7
	Total	135	100

Source: Authors' Survey, 2019

Managing the Environmental Impact of Urban Sprawl

With reference to ameliorating the impact of urban sprawl in the study area, table 12 below shows the various control measures.It was observed that development control has the highest responses of 25.9%. This isclosely followed by provision of decent and affordable housing units with 30 respondents representing 22.2% and provision of equitable social amenities having 27 respondents representing 20% of the respondents. Enforcement of urban planning law has 15 respondents representing 11.1% while proper land use zoning has 2.2% and proper urban planning and design has 18.6%.

Table 12 - Control of Urban Sprawl

S/N	Controlof Urban Sprawl	Frequency	%
A	Development Control	35	25.9
B	Provision of Housing	30	22.2
C	Equitable Social Amenities	27	20
D	Land Use Zoning	3	2.2
E	Adherence to Urban Planning Law	15	11.1
F	ProperUrban Planning and Design	25	18.6
	Total	135	100

Source: Authors' Survey, 2019

However, in addressing the environmental impacts of urban sprawl in Ogu town,some recommendations have been offered

to manage the environmental consequences and ameliorate the impacts. This is shown in table 13 below titled managing the environmental impact of urban sprawl. From the table, it was noticed that integrating the principles of EIA in urban planning have 30 respondents representing 22.2%. Design and adoption of development control also accounted for 22.2%.However, creation of open spaces has 7.4%, urban renewal has 14.8%, improvement on urban master plan has 20.1% while redesigning urban drainage and housing has 11.1% and reduction in rural-urban migration has 2.2%.

Table 13- Distribution of Managing Environment Impact of Urban Sprawl

S/N	Managing Environment Impact	Frequency	%
A	EIA in Urban Planning	30	22.2
B	Development Control	30	22.2
C	Creation of Open Spaces	10	7.4
D	Urban Renewal	20	14.8
E	Improvement on Urban Master Plan	27	20.1
F	Redesigning Drainage &Housing	15	11.1
G	Reduce Rural-Urban Migration	3	2.2
	Total	135	100

Source: Authors' Survey, 2019

Features/Indicators of Urban Sprawl

From the data gathered from the field, it was discovered that urban sprawl in this peri-urban town has some distinctive features/indicators that characterized the urban environment. This is shown in table 14 below.Segregated land uses have 20 respondents representing 14.8%, emphasis on Auto for transit has 25 indicating 18.5%, a push for growth at the boundary has 15 indicating 11.1%, high residential and employment density has 20 representing 14.8%, homogenous population has 15 representing 11.1%, and inability of local council to plan 11.1%. Meanwhile presence of trade and commercial activities has 7.4% while vegetation and fragile land loss has 11.1%. This result shows that the indicators of urban growth in this Nigerian peri-urban town is similar to indicators of urban growth in most parts of both developing and developed world.

Table 15 - Distribution of Indicators of Urban Sprawl

S/N	Indicators of Urban Sprawl	Frequency	%
A	Segregated Land Uses	20	14.8
B	Emphasis on Auto for Transit	25	18.5
C	A Push for Growth at the Boundary	15	11.1
D	Residential &Employment Density	20	14.8
E	Homogenous Population	15	11.1
F	Inability of Local Council to Plan	15	11.1
G	Presence of Trade and Commerce	10	7.4
H	Vegetation and Fragile Land Loss	15	11.1
	Total	135	100

Source: Authors' Survey, 2019

Testing of Hypothesis:

As stated earlier, the authors postulated one null hypothesis.

H_o: There is no significant relationship between urban sprawl and environmental degradatio in the study area.

This hypothesiswas tested using the person product moment correlation (r) coefficient and validated using the student t-test.

Hence,data on nature of urban sprawl indicators (table 15)was correlated with data on environmental impact (table 10) using the Pearson Product Moment Correlation.

Table 16Correlation of x and y

Urban Growth Indicators	X	Environmental Impact of Urban Sprawl	Y
A	20	A	40
B	25	B	30
C	15	C	11
D	20	D	15
E	15	E	24
F	15	F	15
G	10	G	6
H	15	H	3
Total	135	Total	135

Source: Authors' Computation, 2019

Table 17 – Computation of x and y

S/No	X	Y	$(x-\bar{x})$	$(y-\bar{y})$	$(x-\bar{x})(y-\bar{y})$	$(x-\bar{x})^2$	$(y-\bar{y})^2$
A	20	40	3.125	23.125	72.266	9.766	534.76
B	25	30	8.125	13.125	106.64	68.063	172.26
C	15	11	-1.875	-5.875	11.02	3.516	34.52
D	20	15	3.125	-1.875	-5.859	9.766	3.52
E	15	24	-1.875	-1.875	3.516	3.516	3.52
F	15	15	-1.875	-1.875	3.516	3.516	3.52
G	10	6	-6.875	-10.875	74.766	47.266	118.26
H	15	3	-1.875	-13.875	26.016	3.516	310.78
Σ	135	135			291.881	148.569	1181.18
$\bar{x}$, $\bar{y}$	16.875	16.875					

Source: Authors' Computation, 2019

Standard deviation of x and y

$$\frac{\sum \sqrt{(x-x)^2}}{N} \quad = \quad \frac{\sum \sqrt{(y-y)^2}}{N}$$

$$= \frac{\sqrt{148.569}}{8} \quad = \quad \frac{\sqrt{1181.18}}{8}$$

$$= \sqrt{18.5711} \quad = \quad \sqrt{147.64.8}$$

$$= 4.309 \quad = \quad 12.151$$

Therefore $r = i \dfrac{\sum (x-\overline{x})(y-\overline{y})}{n \ \Delta x \ \Delta y}$

$$= \frac{1/8 \ \times 291.881}{4.309 \times 12.151}$$

$$= \frac{0.125 \times 291.881}{4.309 \times 12.151}$$

$$= \frac{36.485}{52.358}$$

$$r = 0.696$$

$$= 0.70$$

From the above correlation coefficient result of (r = 0.70), it shows a strong positive correlation between urban growth indicators and environmental degradation.

This value will be validated using the student t-test as follows:

$$t = r \ \frac{\sqrt{N-2}}{1-r^2}$$

$$= \frac{0.70 \ 8-2}{1-(0.70)^2}$$

$$= \frac{0.70 \ \sqrt{6}}{1-(0.70)^2}$$

$$= \frac{0.70 \ \sqrt{6}}{0.51}$$

$$= 0.70 \times 11.764$$

$$t = 8.238 \quad = \quad 8.24$$

$$t_{cal} \quad = \quad 8.24$$

$$r \quad = \quad \text{calculated} \longrightarrow 8.24$$

$$\text{Table value} \longrightarrow 2.31$$

Degree of freedom = 6

Decision Rule:

With a computed t_{cal} value of 8.24 and table value t_{crit} of 2.31 tested at 0.05 level of significance, it therefore follows

that since the t_{cal} value of 8.24 is greater than the t_{crit} value of 2.31, we accept the alternate hypothesis and reject the null hypothesis. This clearly indicates that there is a strong statistical relationship between urban sprawland environmental degradation.

IV. CONCLUSION AND RECOMMENDATIONS

The responses from the respondents indicated that the population of Ogu town is expanding and that this is due largely to a number of factors though with minimal impact on the sprawl phenomenon. This response supports the census and projection of the national population census (NPC, 2006) which puts the population of Ogu town at 325,000. Thus, the research showed that the construction of houses and other projects to accommodate the expanding population does not comply with the original master plan of the city.

It was further observed that the rate of environmental and ecological destruction in this peri-urban town is alarming in the area as environmentally fragile land and shore lines including vast mangrove forests and coastal wetlands are destroyed due to severe human and development impact on them. This is in agreement with the result of the hypothesis which showed significant and statistical relationship existing between the phenomenon of urban sprawl and environmental decay. This has culminated in different socio-economic and environmental problems in the study area.

Therefore, we conclude that the expanding rate of urban sprawl in Ogu town has tremendously impacted on the environmental quality of this urban fringe settlement. Hence, there isthe urgent need to conduct an environmental impact assessment (EIA) in the town to known the pre and post environmental condition of the town so as to utilize adequate planning framework for the area. Furthermore, it is recommended that government of Rivers state, Nigeria should adopt and implement development control mechanisms in urban planning which is the possible option to recognize the setback posed by the country and town ordinance of 1946 which provided a lopsided planning frame work for regional and urban development planning.

Finally, we suggest that there should also be the proper adoption and provision of urban land use zoning principles which will utilize different land uses to the appropriate zone so as to avoid conflict of land uses and to avoid urban environmental pollution. Accelerated provision and development of essential social amenities in the urban residential area are also advocated in this paper.

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