IOSR Journal Of Humanities And Social Science (IOSR-JHSS)
Volume 24, Issue 10, Series. 9 (October. 2019) 22-31
e-ISSN: 2279-0837, p-ISSN: 2279-0845.
www.iosrjournals.org

Analysis of Noise Pollution Levels across Landuse Types in Port-HarcourtMetropolis, Rivers State, Nigeria

Bright ChikaAjoku, OdinakaAmadi-Wali,
Department of Geography and Environmental Studies,Ignatius Ajuru University of Education, Rumuolumeni Port Harcourt. Rivers State, Nigeria
Corresponding Author:Bright ChikaAjoku

Abstract: This research examined analysis of noise pollution levels across landuse types in Port Harcourt metropolis, Rivers State. The noise levels were captured using Mobile Application known as decibel X in infinix note 3 android smart phone. The locations of various land uses were obtained with handheld Garmin 78sc Global Positioning System (GPS) receiver for precise positional locations of the noise sample stations which was categorized as industrial, commercial, residential and silence zones. The Geospatial infrastructure stands as the main tool inthe manipulation of the data using an interpolation model known as Inverse Distance Weighting (IDW) in the morning and evening noise surface prediction modeling with Environmental Science Research Institute's (ESRI) software ArcGIS 10.4 version. Also, an average noise level measurement was calculated across the landuse categories, compared to the available standards of noise in various landuses as referenced by National Environment (Noise Standards and Control Regulations, 2003). The results of the analysis revealed that noise pollution occurs in residential, commercial and silence zones as their average noise decibels exceeded the acceptable limit of noise as some of the residential areas of Mile one, Mile two, Government Residential Areas (GRA) among others, have been converted to commercial hubs as observed. Hence, it was recommended that there is need to decongest the two local government areas of Port Harcourt City metropolis as they stand to be the only city in Rivers State.

Key Words: Noise, Pollution, Landuse and Port Harcourt metropolis.

Date of Submission: 05-10-2019 Date of Acceptance: 21-10-2019

I. INTRODUCTION

Noise pollution is one of the environmental pests in most urban communities of developing nations that forms several problems as a result of increase in urbanization, transportation and improper planning (Eriksson 2013). Noise has been given various definitions by different authors. Anomoharan and Iserhein (2004) define 'noise' as an unwanted or harmful outdoor sound created by human activities''. Ebeniro and Abumere (1999), definedenvironmental noise as an unwanted acoustic signal or sound dumped into the environment without regardto its adverse effect on both man and the environment''. Often times, noise exceed average levels. Acceptable levels of noise have been adopted by different agencies in different countries which are dependent on the administrative entities; it could be residential, commercial, recreational and educational among others. When noise exceeds a standard allowable, it is regarded as noise pollution.

The value given to noise borders on so many factors which include loudness, irregularities, periods, cadence, and suddenness above all, the ultimate factor is loudness, which depends on level of sound or pressure and the effects on human varies depending on the frequency of the occurrence. Noise is generated from both indoors and outdoors and their sources depend on where the noise is emanating from, such as traffic, train, aircrafts, and industries among others. These are sources of noise that are generatedoutdoorswhile that of the indoor noise occurs within an enclosed space such as electrical appliances, cell phone calls among others (Oyedepo 2012). According to World Health Organization (2005) 'Indoor and outdoor noises are the third most hazardous type of pollution after air and water pollution in big cities'.

Noise pollution is a byproduct of urbanization and several factors are responsible for such undesirable atmosphere mostly within the city environment such as factories, traffic, public address system and commercial activities. The health implication of noise pollution cannot be over emphasized as it is considered worldwide as an element that affects the quality of life in urbanized cities (Mansouri, Pourmahabadian and Ghasenkhani 2006).In Port Harcourt metropolis, noise is one of the common elements that affect the quality of lives owing to the nature of the environment as the area is one of the most highly industrializedmetropolises in Nigeria. There are lots of companies operating within and outside the metropolis which is one of the reasons for the high rate

ofinflux of people to the city of Port Harcourt and at the same time increase in human activities generally.Perhaps, it may be the reason for such undesirable nuisance (noise pollution) occurrence. According toAhamad, Abbas and Reem(2006)Ugwuanyi, Ahemen and Agbendeh(2004) 'Noise pollution has impact on the health status of people in most industrialized cities and urban areas all over the world. It may cause hearing impairment which may be temporal or permanent and physiological effects which include irritability, stress, anxiety; and finally interference with verbal communication and reduction in working efficiency'. This is not different from what is observable in the Port Harcourt metropolis, especially around major commercial hubs such as Rumuokoro, Rumuola, Oil Mill, Garrison, Lagos roundabouts as well as Mile 3, Waterlines, Trans-Amadi Industrial Layout among others.

In spite of the consequences of noise pollution, most people do not see noise pollution as anything harmful in Port Harcourt and its environs. The reason could probably be due to inadequate information on the effect of noise pollution on humans as well as improper planning, especially in the third world countries including Nigeria; hence the necessary steps should be adopted to curb this element so that people can have a better living environment. This paper will address specifically, the questions: "Does noise pollution vary with land use types in the study area? The aim of the study is to analyze noise pollution levels across land use types in Port Harcourt metropolis with the objectives as follows: to analyze mean noise distribution across the four land use types.

II. LITERATURE REVIEW

Previous studies have revealed that many environmentalists have conducted research on various aspects of noise pollution in Nigeria and beyond. This section therefore, critically reviews some studies to see how they relate or deviate from the present study with reference to the methodology, findings and conclusions drawn from thestudies.

David and Lobina (2015) carried out a similar study on 'quantified magnitude and level of noise pollution associated with different land uses in Ibadan and Ile-Ife urban settlements in Southwestern Nigeria'. Their study used Geographical Information Systems (GIS) tools in carrying out analysis and mapping out risk exposure areas. The data for their study came mainly from primary sources which are noise levels and coordinate points of various sample points of land uses using Global Positioning Systems (GPS) and noise meter SET 1350 calibrated to a range of 35-130 dB(A).Their study indicated that 20 noise sample size of location were averaged in the morning, afternoon, and evening periods of selected days in a week,starting from Monday, Wednesday, Friday, Saturday, and Sunday. Statistically, descriptive and inferential (one way ANOVA) were used in their study to quantify the effect of noise on land use types, which they affirmed that urban noises are influenced by land use.

Omubo-pepple, Briggs-kamara and Tamunobereton-Ari (2010) carried out a research also on noise pollution rather in Port Harcourt metropolis Rivers State Nigeria. Their study sample population was focused on age groups, gender and social status among others, which was collected through questionnaire while their analysis was subjected to simple statistical tools of percentages in which they found out that generator, automobiles and public address systems (loudspeakers) turn out to be the major sources of noise pollution, that loudspeakers and generators are frequently used for religious and social functions and has caused more harm than the benefits, such as hearing loss, sleep disruption, cardiovascular disease, social handicaps, reduce productivity, impaired teaching and learning among others. Their study further recommended that there should be public education, enlightenment, legislation, and active enforcement of noise ordinances by the government.

Tandel and Macwan (2012) conducted a research on 'The assessment and modeling of traffic noise at major roads of urban areas of Surat, India'. They asserted that vehicular noise is a major source of pollution in the urban environment. Their study transcended in developing models that enabled them in predicting noise level with consideration of various parameters affecting road traffic noise. Furthermore, in their study, they also affirmed in their result that both the increase in population growth and changes in travel patterns are significant causes of noise pollution, however, among the three arterial roads under study, that the noise levels exceed the allowable noise limit and the people living near the roads are more vulnerable to the noise pollution, hence mitigation measures should be strictly adhered to.

Enock and Galcano (2015) conducted a research on Noise Pollution Mapping Using GIS in central business district of Nairobi, Kenya. Their research data was taken from two main sources, the handheld GPS readings of the coordinate of sample points concurrently with the noise readings of equivalent noise levels (LAeq) which they affirmed as a value unit in decibel that is achieved within the periods of measurements. Secondary data was the map of Central Business District (CDB). Both spatial cum attribute data sets were used in the GIS to run the analysis that produced the end product of the visualization (Map). The result of their findings revealed that noise level varies from 61 dB to 78 dB, and that most of the noise comes from the vehicular traffic which they concludedthat noise levels are high enough that can warrant further research and action by the environmental authorities.

Serkan, Murat and Hasan (2014) studied 'thedetermination of the Noise Pollution on University Campuses Ataturk, Turkey'. The method of their research was based on the conceptof planning so as to reduce noise pollution. They revealed that 'noise pollution is among environmental problems associated with proximity to school campuses with the increase in vehicular noise levels and its implication in learning performance'. The population size of their work was limited to twelve (12) different locations of the University faculties where there is dense population of vehicular traffic flow and streets where there is relative less traffic. The selection of their location for measurement was done using two principles: sites that have proximity to service buildings and sites for movements of vehicles and the measurement of their noise datawere done using Cell 254 K2 model device in the morning, noon and evening periods and the value of their reading was converted to Leq units and analyzed with variance and Duncan multiple comparison tests. Modeling of noise levels was carried out using ArcGIS 9.1 software in which Inverse Distance Weighted (IDW) is embedded for interpolation. The result of their findings revealed that the noise generated within the campus exceeds the allowable limits of 55 dB(A) within the three periods of their study and they recommended that newly founded universities implement their study so to achieve low levels of noise on campuses. In consideration of literatures, it is observed that there are still gaps that need to be covered as this study sought to be one in the area of operational instrument of data acquisition of noise reading using **Decibel X**, a modern application in android infinix note 3 phones.

III. STUDY AREA

Location: The study area covers Port Harcourt metropolis in Rivers State. It is located within latitude 04^{o} 42' and 04^{o} 55'N and longitude 06^{o} 52' and 07^{o} 10'E (Amadi, 2018) and is surrounded by seven local governments, which are Ikwerre, Etche, and Oyigbo on the northern part, Eleme on the eastern part, Okrika and Degema on the southern part and finally Emohua on the western part of Port Harcourt metropolis as shown in figure 1.

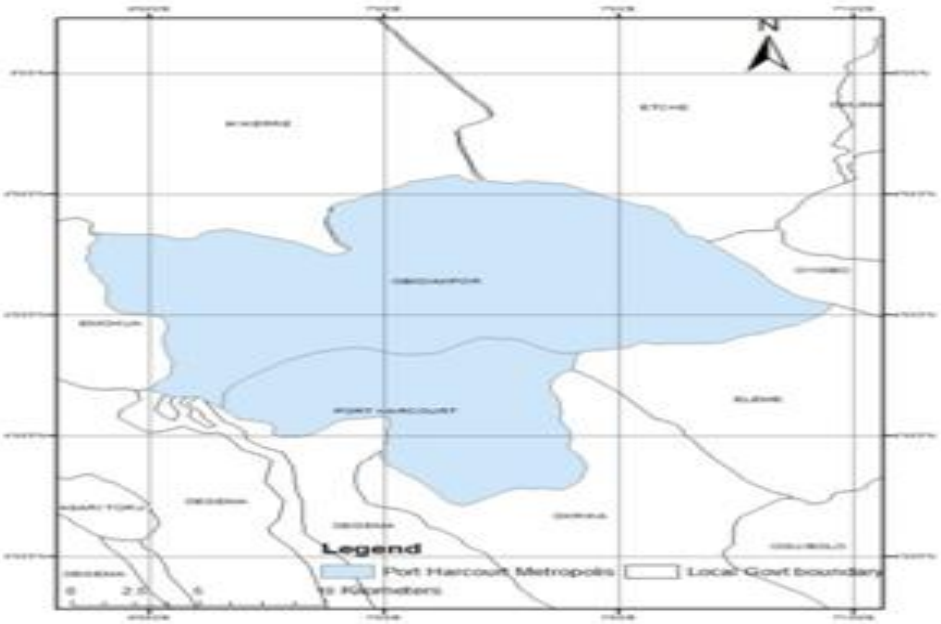

Figure 1.Map showing Port Harcourt Metropolis

IV. METHODOLOGY

The study comprises 25 land use types which serves as the population size and the sampling technique used for this study is stratified random sampling technique and all the twenty five (25) land uses was carried out in this work and in each three (3) points were sampled making a total of seventy five (75) sample points.

The data for this study compriseprimary and secondary data; the primary data come from the coordinate's points of the various land use, which was captured using handheld Garmin 78sc Global Positioning System (GPS) receiver for precise obtaining of positional locations of the noise sample stations in Port Harcourt metropolis. The GPS were configured to UTM Zone 32N based on WGS 1984 global datum which matches the location of the study area. Furthermore, another primary data was noise level of various land uses using a modern application known as decibel X in an infinix note 3 smart phone and with respect to research objectives in mind to measure the differences of noise pollution in different land use compared with the 'National Environment (Noise Standards And Control) Regulations, 2003 sections 28 and 107 of the National Environment Act Cap 153) standards' within the study area as stated below:

Table 1: Allowable Noise Limit Standards

Land use zone types	Allowable limit of noise levels in the morning hours (decibels)	Allowable limit of noise levels in the evening hours (decibels)
Industrial	85	65
Commercial	75	50
Residential	60	40
Silence	60	50

Source: 'Federal Republic of Nigeria Official Gazette Vol.96, 2009'.

Silence zones are areas comprising not less than 100 meters around educational institutions, Court and hospitals. The observation of noise was made by standing at a location in different periods of time, with noise meter measurement and the noise assessment was conducted in the morning hours 6-12am and evening 1- 6pm across the land uses. One of the secondary data for the study is Orthorectified IKONOS image of 2017, which was used as baseline data, as well as delineation of land uses in the study area as Raster dataset and was converted to vector dataset using one of the geospatial software known as ArcGIS 10.4 developed by Environmental Science Research Institutes (ESRI).

V. ANALYSIS

The hypothesis was tested using one way analysis of variance (ANOVA) at the 0.05 significance level while the second analysis was based on the use of geostastistical perspective with interpolation model known as Inverse Distance Weighting (IDW) in morning and evening noise surface prediction modeling using an Environmental Science Research Institute (ESRI) software ArcGIS 10.4 version.

Inverse Distance Weighting (IDW) according to Akintuyi, Raji, Adewuni, and Wunude (2014) 'explicitly implements the law of geography, which is pivoted on a hypothesis that closer things are more related than those farther apart. For its prediction, IDW utilizes the given values surrounding the predicted location. It predicts that each given point has a local influence that shrinks with space; thereby giving greater weights to points closest to the prediction location, based on distance decay effect'.

VI. RESULTS

The result of the systematic raw data collection reflects the Mean noise level distribution across the land use types in the morning and evening as represented in the figure 2, 3 and 4 below, with respect to the allowable noise limits standard as reflected in the table 1.

Table 2: Mean summary distribution of noise pollution in different land use types in Port Harcourt metropolis

Land use zone types	Mean noise level in the Morning (dB)	Allowable noise limit in the morning (dB)	Mean noise level in the evening (dB)	Allowable noise limit in the evening (dB)
Industrial	82.2	85	62.5	65
Commercial	76.6	75	66.4	50
Residential	68.9	60	60.4	40
Silence	63.5	60	57.9	50
Grand mean	92.8		61.8	

Sources: Researcher's calculation from the raw data 2018

The table above revealed that the morning grand mean noise level for all the land use types is 92.8 dB while that of evening is 61.8dB. The result in the table above indicates that the industrial area morning mean noise level is 82.2 dB, the evenings mean is 62.5 dB while the commercial area land use type morning mean noise level is 76.6 dB and the evening mean noise level is 66.4 dB. Furthermore, the morning mean noise level of residential is 68.9dB and the evening is 60.4 dB while the silence morning mean is 63.5 dB and the evening mean noise level is 57.9 dB. The table also indicates that the majority of the land use is dominated with the mean noise pollution both in time periods of morning and evening as compared to the standards as also reflected in figure 2 below. It is obvious that noise pollution occurred in the three land uses of commercial, residential

and silence zones except in the industrial area which may be as result of industrial area compliance to the national regulation standard.

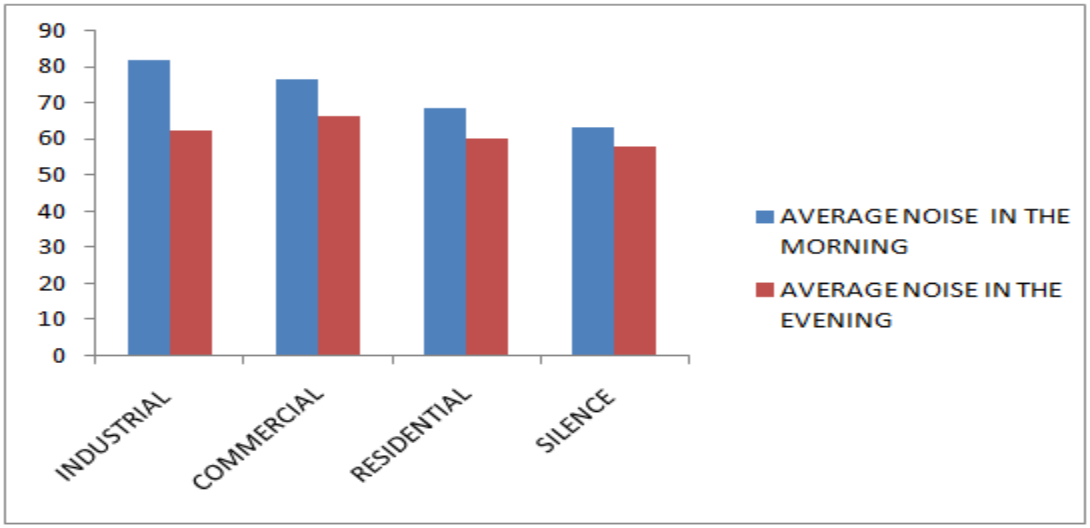

Fig 2. Clustered column chart average noise in the morning and evening

It is obvious from the clustered column chart that there are variation of noise pollution in the time periods and variation of noise pollution across different land use categories. Looking at the chart, it is clear that in the morning hours across the land uses categories has the highest noise pollution than the evening time period, as it is the period of high rate of rush in activities for man's survival.

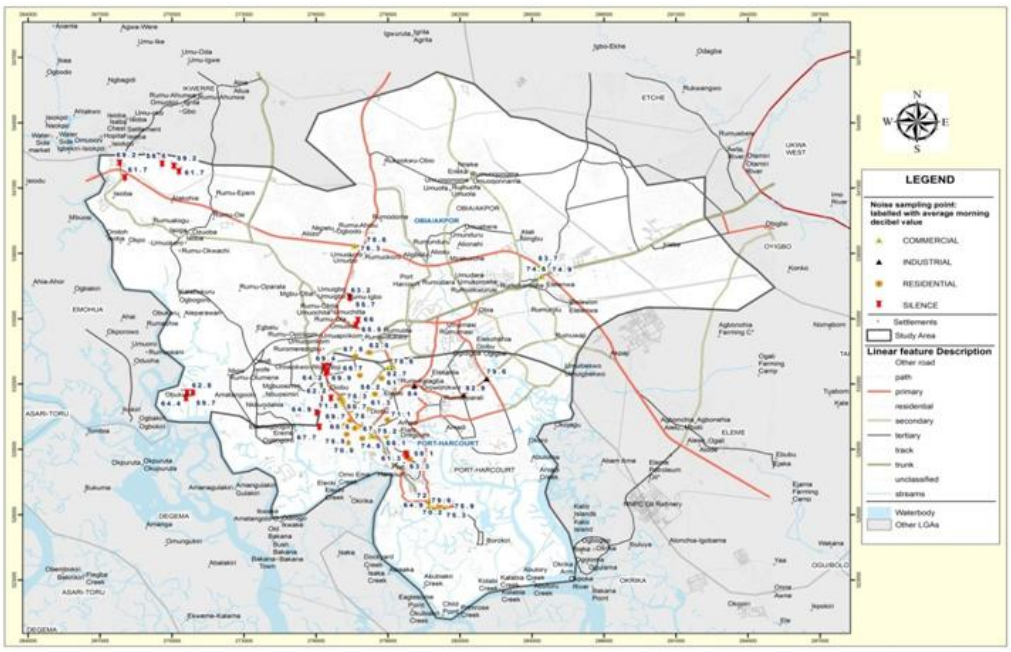

Fig 3: Sample points distribution of morning mean noise levels in the study area.

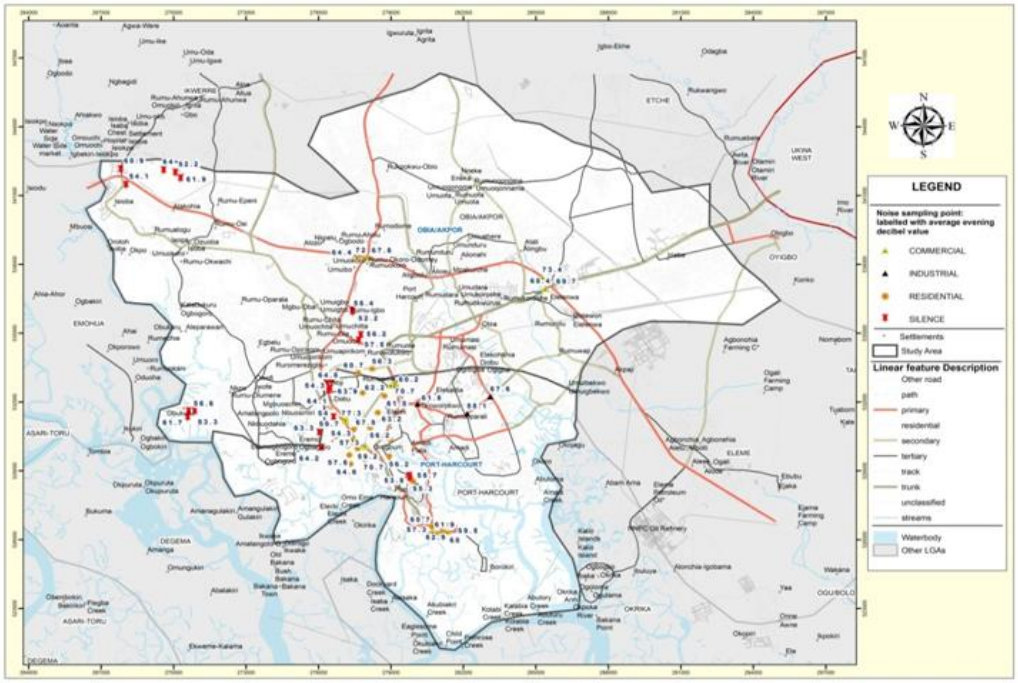

Fig 4: Sample points distribution of evening mean noise levels in the study area.

The two models reveal that the sample points are more clustered in Port Harcourt City while in Obio/Akpor, the sample points are dispersed. The silence zones have the lowest average instantaneous decibel readings not less than 52.2 dB in morning and evening time periods.

VII. HYPOTHESES TESTING

The technique for testing the hypothesis for this study is one way analysis (ANOVA) which was tested and analyzed at 0.05levels of significance.

The Null Hypothesis ($H0_1$): There is no significant variation of noise level across the landuse types in Port Harcourt metropolis.

Alternate Hypothesis (Ha_2): There is significant variation of noise level acrosslanduse types in Port Harcourt metropolis. The result is presented below:

Table 3: Summary of the Result of ANOVA Noise Level across the Four Landuse Types in Port Harcourt Metropolis.

Source of variation	Sum of squares	DF	Mean Square	F-Ratio	F-Critical	Alpha level	Result	Decision
Between groups	484	1	484					
Within groups	1.32	6	0.22				Not	
Total	485.32	7		2.200	5.987	0.05	significant	Accepted

Sources: Researcher's Fieldwork Results (2018).

The ANOVA mean noise distribution across the four landuse types (Residential, Commercial, Industrial and Silence areas) in Port Harcourt metropolis. The four landuse types have between groups, sum of squares of 484, 1 degree of freedom and 484 mean square. The within group sum of squares is 1.32 with 6 degrees of freedom and 0.22 mean square. The total sum of square is 2.200 while the F-critical value is 5.987. Since the calculated F- value of 2.200 is less than the critical F- value of 5.987, we accept the null hypothesis of no significant variation in mean noise level distribution among the land use types in Port Harcourt metropolis and reject the alternate hypothesis. The result is not significant at 0.05 level, at F (1, 6) = 2.200 P< .05.

The Spatial Interpolation Models (IDW) in the Morning and Evening

The Inverse Distance Weighting (IDW) made use of ArcGIS 10.4 version of Environmental Science Research Institute (ESRI) software to model surface predictions in the morning and evening mean noise pollution level Port Harcourt metropolis. This is represented in figures 5 and 6.below.

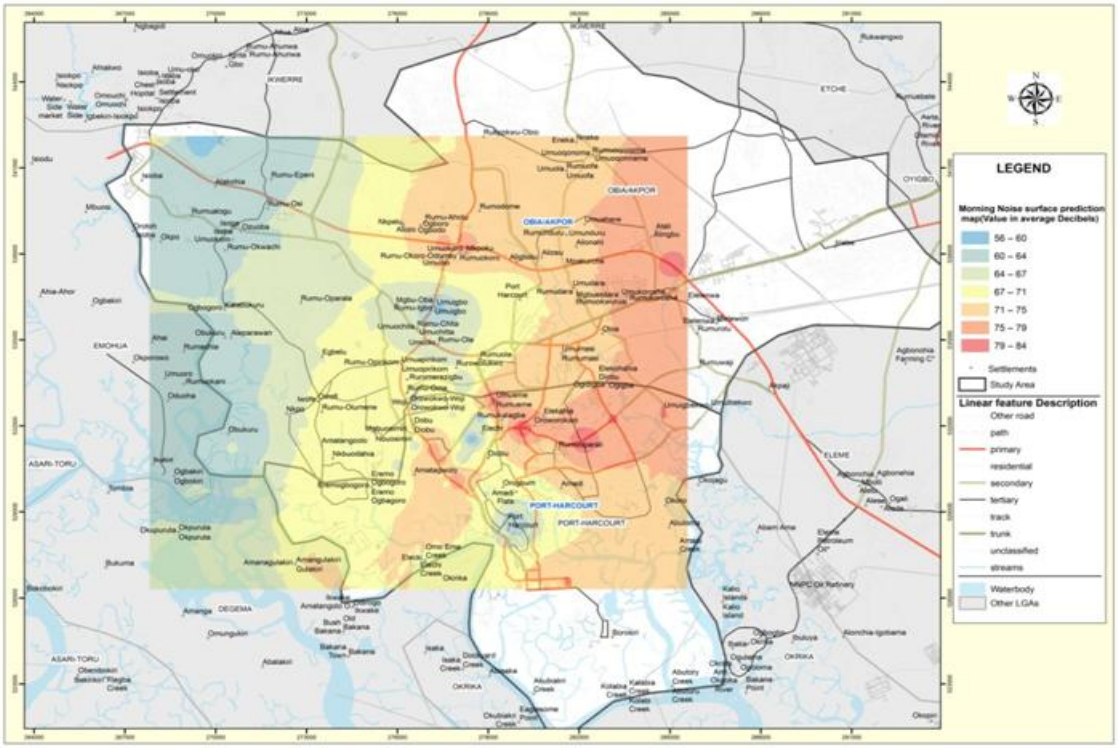

Fig 5: Morning surface Mean Noise Pollution Prediction Map

Result of the morning noise prediction shows that areas with shades of blue (Mgbuoba, Rumigbo, Isoba, Rumualogu, Rumu-Okwachi among others) with decibels ranging from 56 to 64 are least noisy while the areas in patches of yellow (Egbelu, Mgboshimini, Rumuolumeni, Ogbogoro among others) are moderately noisy while with shades of orange (Rumueme, Rumuokoro, among others) are the noisiest areas. The surface prediction would be more precise in at the centre as that area was data rich in the data gathering and less precise in the data poor regions.

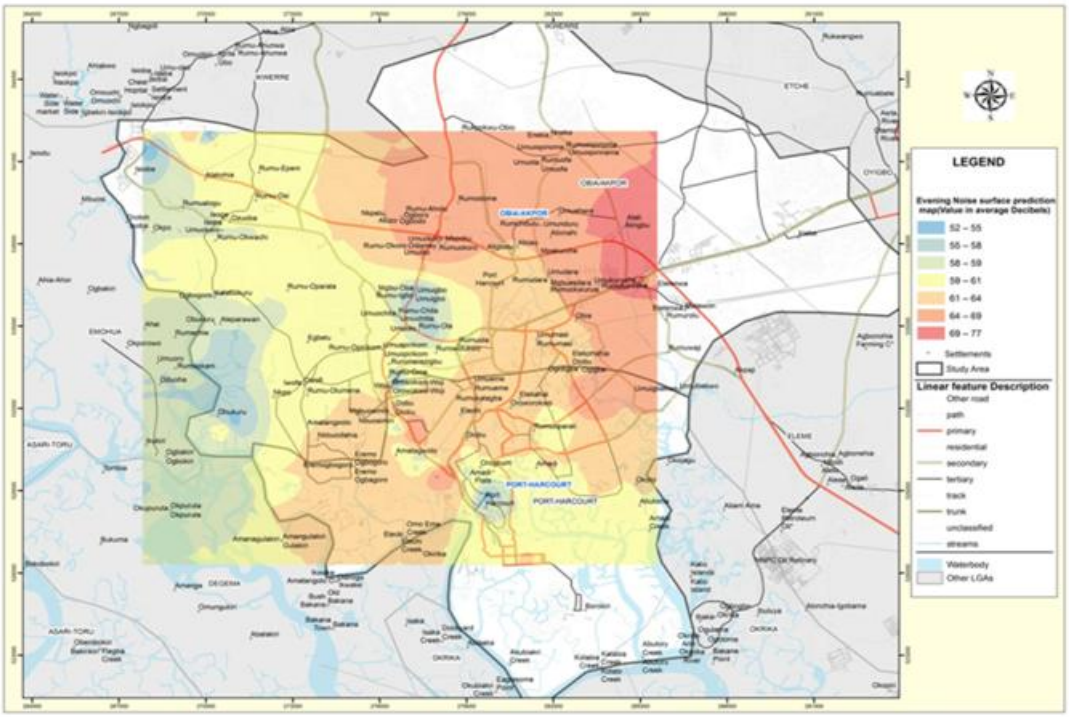

Fig 6: Evening surface Mean Noise Pollution Prediction Map

Result of the evening noise pollution prediction shows that area with shades of blue (Mgbuoba, Rumuigbo, Isoba among others) are least noisy while the areas in patches of yellow (Egbelu, Mgboshimini, Woji among others) are moderately noisy. Finally, the areas with shades of pink (Rumueme, Rumuokoro among others) are the noisiest areas. From the two prediction maps, it is clear that noise pollution are spreading within the study area, especially from the center where data sampling points are more, but with noisiest occurring and spreading more inObio/Akpor local government area than Port Harcourt city local Government area of Rivers State.

Morning and Evening Sampling Points Error Level (MESPEL)

In the cause of sampling, Interpolation precision was done using a cross attestation operation to compare interpolated predictions against the attestation dataset and the result of the output were used to calculate root mean square error (RMSE).The root mean squared errors are scoring rule that measures the average magnitude of the cell error. It is the square root of the average of squared differences between prediction and actual observation of points. The surface resulting from refined IDW parameter configuration in the morning and evening Root mean square prediction error set an improvement of 0.7decibel over Root mean square prediction error in the evening. Below are the result tables in ArcGIS 10.4 environment

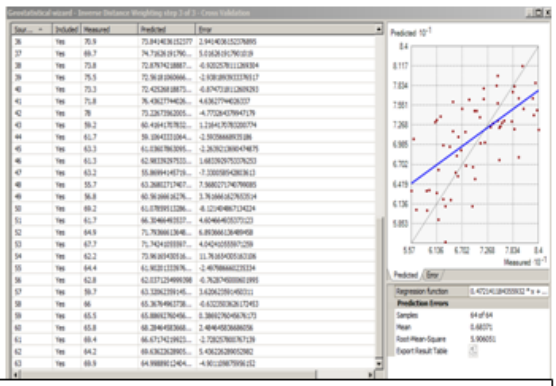

Table 4: ArcGIS 10.4 interface attribute analysis of Root mean square (RMS) prediction error in the morning

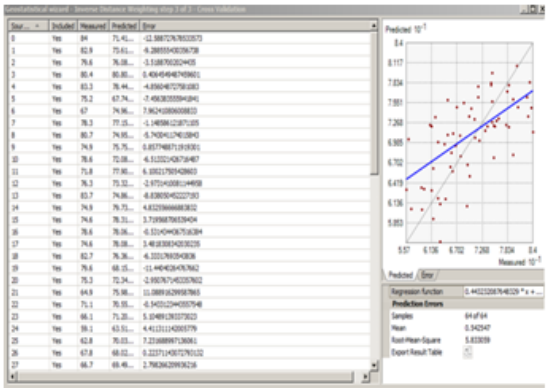

Table 5: ArcGIS 10.4 interface attribute analysis of Root mean square (RMS) prediction error in the evening.

The two periods of the day root mean square errors differs, the morning is 5.90 as compared to the evening RMS with 5.83. These high errors are as a result of dispersed nature of the sampling points.

VIII. DISCUSSION OF FINDINGS

This discussion of findings is anchored on the results of the study and other literatures viewed. The result of the findings are in line firstly, with a study by David and Lobina (2015) on 'quantified magnitude and level of noise pollution associated with different land uses in Ibadan and Ile-Ife urban settlements in Southwestern Nigeria using Geographical Information Systems (GIS)'. Their findings revealed that urban noise is influenced by land use types. Thus, in this study noise level varies on land use.In a similar vein, the result of this study agrees with the findings of Omubo-pepple, Briggs-kamara and Tamunobereton-Ari (2010) on noise pollution in Port Harcourt metropolis. According to their findings, noise pollution is on the increase inPort Harcourt and is above the recommended National standards regulation which is also the same with this study as can be seen from the mean noise distribution across the four land use types across Port Harcourt metropolis.The results of this study also concord with the result of Tandel and Macwan (2012) who carried out an assessment and modeling of urban traffic noise at a major arterial road of Surat, India. Just as road traffic noise is high in this study and recognized as one of the main sources of urban environmental noise pollution in the City of Port Harcourt is the same with that of Surat in India.

Furthermore, the finding of this study agree with the work of Enock and Galcano (2015) that carried out a research on noise pollution mapping using GIS in central business district of Nairob, Kenya. The results of their study revealed that noise levels varies among the land use patterns in the City just as we have in Port Harcourt metropolis. In the same vein, the findings of this work are also in line with the work of SerkanOzer, Murat Zengin and HasanYilmaz (2014) on determination of the noise pollution on University Campuses Ataturk, Turkey. Their study find out that noise pollution is among environmental problems associated to

proximity to school campuses with the increase in vehicular noise levels and it implication in learning performance. Background noise level of commercial zones ranges between 66.4 – 76.6 dB.

IX. Conclusion

The study assessed noise pollution levels in various land uses types in Port Harcourt metropolis Rivers State which was categorized into four as industrial, Commercial, Residential and silence zones. Urban noise cannot be eradicated but rather, can be managed through Government policies and implementation. From the results, it was revealed that there are noise pollution in the three categories of the land uses; Commercial, Residential and silence zones compared to the available noise standard.

Furthermore, the noise pollution was discovered to be mostly caused by vehicular traffic horns, commercial activities, and public address system among others, which were observed to be the major factors contributing to the nose pollution. Nonetheless, the residential and silence zones were relative reduction of noise pollution as compared to industrial and commercial land use. The pertinent thing with this work is that it will enable the citizens as well as the government bodies and non-governmental organizations to gain awareness of an insight into the problem of urban noise pollution in terms of where and when the occurrences are more.

X. RECOMMENDATIONS

The results from the analyses conducted during this study indicate that there is noise pollution in the study area as there is need for a well-planned expansion of the city to sub-urban so as to decentralize the current trend of unplanned urban areas.

1. There should always be checks of human activities within and around land use areas. The Reason is to maintain orderliness of planning activities in each of the categories of land use and also planting of trees mostly in the residential and silence areas so for noise mitigation.
2. This could be achieved through the use of Geospatial science and technology so as to ascertain situational areas to study.
3. It is needful to decongest the two local governments area Port Harcourt city and Obio/Akpor, as they stand to be the only city in Rivers State; so that associated problems caused by noise pollution will be reduced.
4. There is need to protect the environment of the metropolis through afforestation, not just to reduce noise pollution and also to sustain life as they (plants) produces oxygen which is a vital life force to all humans.

REFERENCES

[1]. Ahamad, J .A, Abbas, A., and Reem, S (2006).Evaluation of traffic noise pollution in Amman. Jordan. Journal of environmental monitoring and assessment, **120:499**-525.

[2]. Akintuyi, A. O., Raji, S. A., Adewuni, D. and Wunude, E. O (2014). GIS-Based Assessment and Mapping of Noise Pollution in Bariga Area of Lagos State, Nigeria.Sokoto Journal of the Social Sciences Vol. 4: No.1

[3]. Anomoharan, O., and Iserhein, E (2004).Environmental noise assessment study of Agbor metropolis in Delta State.Adv. Nat. Appl. Sci. Res., **2:168**-174.

[4]. David O. B. and Lobina G. P. (2015), A Comparative Land Use-Based Analysis of Noise Pollution Levels in Selected Urban Centers of Nigeria. Int. J. Environ. Res. Public Health.12, 12225-12246.

[5]. Ebeniro, J.O. and Abumere, O.E (1999).Environmental noise assessment of industrial plant.Nig. J. Phys., 11: 97-105.

[6]. Enock .A.W, and Galcano C. M. (2015): Noise Pollution Mapping Using GIS in Nairobi Kenya. Journal of Geographic Information System, 486-493.

[7]. Eriksson (2013).Environmental noise and health.The Swedish Environmental Protection Agency, Print: Arkitektkopia AB, Bromma.

[8]. Federal Environmental Protection Agency, FEPA (1991): Guidelines and Standard for Industrial Noise, FEPA, pp 52. Abuja.

[9]. Mansouri, N. P and Ghasenkhani, M (2006). Road traffic Noise in Down Town area of Tehran. Iran J. Environ. Health, Sci. Eng., 3(4): 267-272.

[10]. Omubo-Pepple, V.B., M.A. Briggs-Kamara, and I. Tamunobereton-ari. 2010. "Noise Pollution in Port Harcourt Metropolis: Sources, Effects, and Control". Pacific Journal of Science and Technology. 11(2):592-600.

[11]. Oyedepo, S. O (2012). Noise Pollution in Urban Areas; the Neglected Dimension.Environmental Research Journal. 6(4):259-271.

[12]. Ozer S, **Zengin** M, Yilmaz H (2014): Determination of the Noise Pollution on University (Education) Campuses Atatürk University Turkey. Article Ekoloji.

[13]. Tandel, B.N and Macwan, J.E.M 2012 'Assessment and Modeling of Urban Traffic Noise At Major Arterial Roads OfSurat, India', Journal of Environmental ResearchAnd Development, vol. 7, no. 4A, pp. 1703-1709
[14]. Ugwuanyi, J. U. I. Ahemen and A.A. Agbendeh, 2004.Assessment of Environmental Noise Pollution in Markurdi Metropolis, Nigeria.Zuma J. Pure Appl. Sci, 6(2): 134-138
[15]. WHO (2005) Occupational noise: assessing the burden of disease from work-related hearing impairment at national and local levels. Environmental Burden of Disease Series, No. 9, World Health Organization, Switzerland.

IOSR Journal OfHumanities And Social Science (IOSR-JHSS) is UGC approved Journal with Sl. No. 5070, Journal no. 49323.

Bright Chikaajoku."Analysis of Noise Pollution Levels Across Landuse Types in Port-Harcourt City Meteropolis, Rivers State. " IOSR Journal of Humanities and Social Science (IOSR-JHSS).vol. 24 no. 10, 2019, pp. 22-31.