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ANALYSES ON THE VARIATION IN NOISE POLLUTION OF LAND USE TYPES AND TIME PERIODS OF THE DAY ACROSS THE NIGER DELTA REGION

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Abstract

Noise pollution is recognized as a major problem globally, hence this study tend to analyse the vibration in Noise pollution of land use types and time periods of the day Across the Niger delta Region. The study adopted the cross sectional and quasi experimental research design. The study adopted the use of questionnaire, noise meter and air pollutant counter as the instrument for data collection. Taro Yamane formula was used for sample size determination of 400 respondents. Results showed that electricity generating plants was the major source of noise pollution across the study area and that noise level is higher in the city centers and decreases as one moves farther away. The result indicates areas of high noise levels in the different land uses in the sampled state capitals in the Niger Delta. Also the mapping of the different land uses spatial distribution maps were generated across land uses in the state capitals; the map showed places of high and low noise zones in the study area.

Keywords: Noise Pollutions, Noise Level, Air Pollutant

1.0 Introduction

A major challenge is the documentation of the effects of noise pollution on the population. Growth in terms of economic, social development and population increases the tendency towards increasing noise generation. Considering the connectivity of vicinity, transport routes could result to an increase in noise volume generated. Noise is considered a growing health threat, and if, left unchecked could result to hazardous conditions (Adejobi, 2012). Noise pollution is recognized as a major problem for the quality of life in urban areas all over the world. The increase in the number of cars and noise of industrialization has increased noise pollution. People residing far from noise sources and from almost silent secondary roads within cities are currently very much above average living standard because it has been labeled as choice locations for the rich or wealthy. People prefer to live in places far from noisy urban areas (Ozer,Yilmaz and Yesil, 2009). Many surveys addressing the problem of noise pollution in many cities throughout the world have been conducted (Yilmaz and Ozer, 2005), and have shown the scale of discomfort that noise causes in people‘s lives (Tansatcha, Pamanikabu, Brown,and Affum,2005). Depending on its duration and volume, the effects of noise on human health and comfort are divided into four categories; physical effects, such as hearing defects; physiological effects, such as increased blood pressure, irregularity of heart rhythms and ulcers; psychological effects, such as disorders, sleeplessness and going to sleep late, irritability and stress; and finally effects on work performance, such as reduction of productivity and misunderstanding what is heard (Quis, 2001). City noise levels can be investigated in three different ways as traffic and transportation; industrial activities; Sport, marketing and entertainment facilities increases (Dursun, Ozdemir, Karabork, Kocak, 2006). In comparison to other pollutants, the control of environmental noise has been hampered by insufficient knowledge of its effects on human and lack of defined criteria. Noise pollution is a significant environmental problem in many rapidly urbanizing areas. This problem is properly not recognized despite the fact that it is steadily growing in developing countries. It is well established now that noise is a potential hazard to health, communication and enjoyment of social life. It is becoming an unjustifiable imposition upon human comfort, health and quality of life. In Nigeria, there is no legal frame work upon which noise pollution can be abated. Federal Environmental Protection Agency (FEPA) in Nigeria only provided daily noise exposure limits for workers in industry (i.e 90 dB(A) for 8h exposure). The Government and her citizenry appear not to be conscious of the present and future impacts of noise induced health hazards in their environment. Unless measures are taken to control the level of noise in the ongoing urbanization and industrialization in many cities, this may complicate the problem so much that it becomes unbearable. Generation of noise in a Metropolitan setting can be viewed in the light of city planning disorderliness and the increasing number of vehicular traffic in the face of urban growth and development. The planning, development, and establishment of noise control strategies are very important consideration in noise control (Bond, 2000). There is need for abatement plans for noise generation areas like areas around major transport facilities especially at bus stops along traffic routes having economic activities and major market areas. The noise pollution situation in the capital cities of the Niger Delta States is similar to that in many urban areas or cities in Nigeria. The state capitals are relatively large, having rapid increase in population growth rate. The capital cities have expanded continuously in all directions in the past two decades. Many significant changes have been experienced in terms of urbanization, industrialization, expansion of road-network, and infrastructure. The ability to measure ambient noise levels and represent them on a map should provide a powerful tool for spatially identifying noise sources, its spread and its impact and make decisions relating to its control and management (Stanfeld, Haines, Brown, 2000).

2.0 Literature Review

Noise pollution has been linked to a number of auditory and non-auditory effects on exposed persons. Exposure to high noise level can actually lead to different negative impacts depending on the category of exposed persons. Haines, Brentall, Stansfeld and Klinchberg (2003) identified and put children in high risk group, who are vulnerable to the following negative impacts of noise pollution-performance retardation and annoyance. Some health related effects and learning effects such as lack of concentration and tiredness by noise pollution has been established (Ana, Dereek, Shendell, Brown, and Stridhar , 2009). While analyzing Land use –based noise pollution levels in selected urban centres in Nigeria, Baloye and Palamuleni (2015) identified that harmful noise poses health risk to residents of their study communities. Noise pollution put the exposed population on a major health risk (Olayinka 2012).These variables have been identified and established by various researchers in different places and locations. Georgiadou,Kourfidis and Ziomas (2004) in a study on noise pollution and its effects have provided better understanding of noise pollution problems and control. The study asserts that depending on its magnitude and duration, the effects of noise on human health and comfort could be divided into four categories; physical effects, such as hearing defects, physiological effects, such as increased blood pressure, irregularity of heart rhythms and ulcers, psychological effects, such as disorders, sleeplessness, irritability and stress; and finally effects on work performance, such as reduction on productivity and misunderstanding of what is heard (Quis2001). City noise levels can be investigated in three different ways as traffic and transportation; industrial activities; sports marketing and entertainment facilities in South Africa by (Dursun, Ozdmir, Karabork and Kocak,2006). In comparison to other pollutants, the control of environmental noise has been hampered by insufficient knowledge of its effects on humans and lack of defined criteria. Noise pollution is a significant environmental problem in many rapidly urbanizing areas. This problem is properly not recognized despite the fact that it is steadily growing in developing countries. It is well established now that noise is becoming an unjustifiable imposition upon human comfort, health and quality of life. In Nigeria, the problem of noise pollution is wide spread. Several studies report that noise level in Metropolitan cities exceeds specified standard limits.

A study by Ugwuanyi, Ahemen , and Agbendeh (2004), conducted in Makurdi, Nigeria found that the noise pollution level in the city was about 3 dB(A) to 10 dB(A) above the recommended upper limit of 90dB(A). Moreso, Anomohanran (2013), found that the peak noise level at road junction in Abraka, Nigeria to be 100 dB(A). This noise level is higher than the recommended level of 60dB(A) for commercial and residential areas. Furthermore, Ighoroje (2016) investigated the level of noise pollution in selected industrial locations in Benin City, Nigeria. The average ambient noise level in Sawmills, Electro-acoustic market and food processing industrial areas was determined to be above 90dB(A). This noise level is well above the healthy noise level of 60dB(A). According to Valentine, Omubo-Pepple, Margaret, Briggs-Kamara , Tamunobereton-ari (2010) established that noise pollution leads to communication interference, sleeplessness and mental performance reduction on exposed persons. More so, Sogebi, Amoran, Iyaniwura and Oyewole (2014) confirmed that noise pollution has these effects- hearing loss, discomfort, anxiety and loss of concentration on exposed persons.

Haines, Brentall, Standeld and Klinchber (2003) in their study on qualitative responses of children to environmental noise opined that children are affected by road traffic noise, which affects their school work and playing life. Environmental Noise pollution is not peculiar to Nigeria; some other countries face similar challenges. Also (Dey, 2002) carried out an investigation and assessment of noise pollution in Dhaka, Bangladesh, pointed out that vehicular traffic, vehicle horns and electric power generators produce noise and are known to be a major source of high level noise in Bangladesh. Noise pollution is one of the physical parameters that may negatively affect human organism. Showing up in industrialized countries, especially those cities with poor urban planning, noise greatly attracts attention as a significant pollution factor.

3.0 Materials and Methods

Cross sectional research design as well as direct field measurement by the use of noise meter, air quality sampling instruments and questionnaire instrument. The temperature in the Niger Delta region is mainly high and almost the same all year round. The average monthly maximum temperature in the region ranges between 28^0C to 33^0C while the average minimum temperature of the area is between 21^0C to $23\ ^0C$ (Niger Delta Development Coperation, 2006). The population of the study from the projected population is 2,727,799. This population however can not be studied as a whole, hence to determine the sample for the study, the Taro Yamane (1967) formula was for sample size determination was used. The Sound Level Meter (SLM) was used to measure noise level, which is a calibrated EXTECH Digital Sound level meter model 407750, with RS 232. The instrument was held at a height of 1.2 meters above the ground level, to the source of the noise for all the locations. The instrument was held in hand. Measurements were carried out at major road junctions, bus stops, motor parks, or other land uses such as (recreation, commercial and industrial) areas prone to vehicular traffic, and residential areas, in the selected state capitals. The measurements of noise were carried out for five days each at different sampling stations and at different periods of day (morning hours 6.30am - 8.00am), afternoon (12.30pm -2.00 pm), and evening hours (5.00pm-7.00pm). Ten (10) field assistants were employed to help in the noise monitoring exercise and this aided the data collection processes which lasted for three months. Noise level measurements were achieved by selecting 10 sampling points in each land use type in each capital city. Thus, a total of 30 sampling points were taken for each land use type in each capital city which makes a total of 180 sampling stations in all the sampled cities of the South South. Figure 3.1 illustrated the study region where the research is carried out.

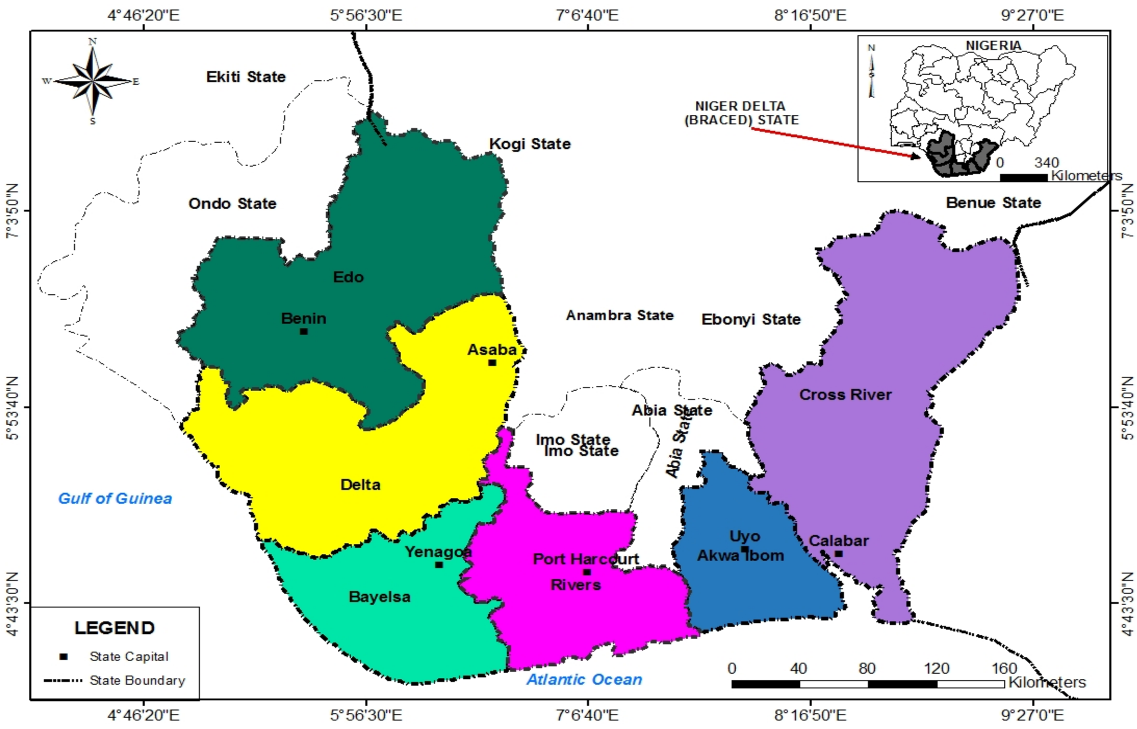

Figure 3.1: The Niger Delta Region (Highlighted /insert- BRACED States (Source: State Boundary from Open street map, 2018**).**

4.0 Results and Discussions

Variation in Noise Levels among Land uses in Uyo, Akwa Ibom State

The information for the variation in Noise levels among land use types in Uyo, Aka Ibom State is displayed on Table 4.12. The information on Table 4.10 was used for this computation while the information on Table 4.11 shows the descriptive statistics of the ANOVA analysis. The result showed that the F ratio of 22.745 at degrees of freedom (Df) of 29 at 0.05 (95%) probability level.

The result therefore showed that there is variation in noise levels among land use types in Uyo since the level of significance of 0.000 was lower than the probability value of 0.05.

Table 4.10: Mean Daily Noise Levels across Land uses in Uyo, Akwa Ibom State

Locations	Land uses (Noise Levels)		
	Residential	Commercial	Industrial
1	59.9	82.3	77.5
2	64.8	82.1	74.9
3	61.5	76.9	76.7
4	68.2	77.0	74.3
5	63.0	75.2	74.3
6	64.7	72.8	74.0
7	69.4	71.5	75.0
8	74.1	76.6	74.6
9	71.2	75.4	73.8
10	71.7	77.0	73.7

Source: Researcher's Computation, 2020

Table 4.11: Descriptive Statistics

					95% Confidence Interval for Mean			
Land uses	N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum
Residential	10	66.850	4.7598	1.5052	63.445	70.255	59.9	74.1
Commercial	10	76.680	3.4470	1.0900	74.214	79.146	71.5	82.3
Industrial	10	74.880	1.2595	.3983	73.979	75.781	73.7	77.5
Total	30	72.803	5.4865	1.0017	70.755	74.852	59.9	82.3

N=30

Table 4.12: ANOVA Analysis

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	547.833	2	273.916	22.748	0.000

Within Groups	325.117	27	12.041
Total	872.950	29	

N=30; p-value<0.05

4.1.13.2 Variation in Noise Levels among Land use Types in Yenagoa, Bayelsa State

The information for the variation in Noise levels among land use types in Yenagoa, Bayelsa State is displayed on Table 4.15. The information on Table 4.13 was used for this computation while the information on Table 4.14 shows the descriptive statistics of the ANOVA analysis. The result showed that the F ratio of 2.064 at degrees of freedom (df) of 29 at 0.05 (95%) probability level revealed a level of significance of 0.146. The result therefore showed that there is no variation in noise levels among land use types in Yenagoa since the level of significance of 0.146 was higher than the probability value of 0.05.

Table 4.13: Mean Daily Noise Levels across Land uses in Yenagoa, Bayelsa State

Locations	Land use Types		
	Residential	Commercial	Industrial
1	58.8	72.5	65.0
2	66.3	69.8	73.6
3	62.5	70.7	62.6
4	69.8	72.0	71.5
5	68.3	69.3	69.0
6	65.3	68.6	69.0
7	69.4	70.1	77.2
8	73.4	74.8	74.5
9	72.3	70.4	72.2
10	73.1	75.1	71.3

Source: Researcher’s Computation, 2020

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Table 4.14: Descriptive Statistics

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean Lower Bound	95% Confidence Interval for Mean Upper Bound	Minimum	Maximum
Residential	10	67.920	4.7604	1.5054	64.515	71.325	58.8	73.4
Commercial	10	71.330	2.2301	.7052	69.735	72.925	68.6	75.1
Industrial	10	70.590	4.3730	1.3829	67.462	73.718	62.6	77.2
Total	30	69.947	4.0903	.7468	68.419	71.474	58.8	77.2

N=30

Table 4.15: ANOVA Analysis

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	64.349	2	32.174	2.064	0.146
Within Groups	420.826	27	15.586		
Total	485.175	29			

N=30; $p<0.05$

4.1.13.3 Variation in Noise Levels among Land use Types in Calabar, Cross River State

The information for the variation in Noise levels among land use types in Calabar, Cross River State is displayed on Table

4.18. The information on Table 4.16 was used for this computation while the information on Table 4.17 shows the descriptive statistics of the ANOVA analysis. The result showed that the F ratio of 63.496 at degrees of freedom (df) of 29 at 0.05 (95%) probability level revealed a level of significance of 0.000. The result therefore showed that there is variation in noise levels among land use types in Calabar since the level of significance of 0.000 was lower than the probability value of 0.05.

Table 4.16: Daily Mean noise Levels across Land use Types in Calabar, Cross River

Locations	Land uses		
	Residential	Commercial	Industrial
1	59.4	73	79.4
2	66.8	76.4	75.9
3	64	72.3	73.5
4	61.6	76	70.2
5	62.3	75.7	70.2
6	63.6	71.7	68.1
7	59.4	71.2	72.5
8	63.8	76.3	74.1
9	62.2	74	72.8
10	61.3	73.7	71.6

Source: Researcher's Field Computation, 2020

Table 4.17: Descriptive Statistics

					95% Confidence Interval for Mean			
	N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum
Residential	10	62.440	2.2411	.7087	60.837	64.043	59.4	66.8
Commercial	10	74.030	1.9732	.6240	72.618	75.442	71.2	76.4
Industrial	10	72.830	3.2056	1.0137	70.537	75.123	68.1	79.4

Total	30	69.767	5.8284	1.0641	67.590	71.943	59.4	79.4

N=30

Table 4.18: ANOVA Analysis

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	812.401	2	406.200	63.496	0.000
Within Groups	172.726	27	6.397		
Total	985.127	29			

N=30; p<0.05

4.1.13.4 Variation in Noise Levels among Land use Types in Asaba, Delta State

The information for the variation in Noise levels among land use types in Asaba, Delta State is displayed on Table 4.21. The information on Table 4.19 was used for this computation while the information on Table 4.20 shows the descriptive statistics of the ANOVA analysis. The result showed that the F ratio of 181.111 at degrees of freedom (df) of 29 at 0.05 (95%) probability level revealed a level of significance of 0.000. The result therefore showed that there is variation in noise levels among land use types in Asaba since the level of significance of 0.000 was lower than the probability value of 0.05.

Table 4.19: Daily Mean Noise Levels across Land use Types in Asaba, Delta State

Locations	Land uses		
	Residential	Commercial	Industrial
1	63.1	70.6	71.3
2	67.9	77.5	74.2

3	63.7	74	75
4	68.6	74.8	71.4
5	70.9	74.2	73.2
6	63.8	70.6	69.3
7	67.3	74	69.4
8	69.7	77.6	74.1
9	59.4	72.8	72.6
10	65.5	73.4	75.3

Source: Researcher's Field Computation, 2020

Table 4.20: Descriptive Statistics

					95% Confidence Interval for Mean			
	N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum
Residential	10	65.990	3.5294	1.1161	63.465	68.515	59.4	70.9
Commercial	10	73.950	2.3755	.7512	72.251	75.649	70.6	77.6
Industrial	10	72.580	2.1725	.6870	71.026	74.134	69.3	75.3
Total	30	70.840	4.4240	.8077	69.188	72.492	59.4	77.6

Table 4.21: ANOVA Analysis

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	362.222	2	181.111	23.811	.000
Within Groups	205.370	27	7.606		
Total	567.592	29			

4.1.13.5 Variation in Noise Levels among Land use Types in Benin, Edo State

The information for the variation in Noise levels among land use types in Benin, Edo State is displayed on Table 4.24. The information on Table 4.22 was used for this computation while the information on Table 4.23 shows the descriptive statistics of the ANOVA analysis. The result showed that the F ratio of 5.803 at degrees of freedom (df) of 29 at 0.05 (95%) probability level revealed a level of significance of 0.008. The result therefore showed that there is variation in noise levels among land use types in Benin since the level of significance of 0.008 was lower than the probability value of 0.05.

Table 4.22: Daily Mean Noise Levels across Land use Types in Benin, Edo State

Locations	Land uses		
	Residential	Commercial	Industrial
1	59.2	61.4	71.9
2	65.5	68.1	76
3	62.1	62.3	64.6
4	72.4	69.2	72.2
5	70.9	74.3	71.3
6	63.5	70.2	66.7
7	67	76.4	70.7
8	62.3	78.2	74.1
9	62.8	75.9	73.6
10	66.8	75.5	74.8

Source: Researcher's Field Computation, 2020

Table 4.23: Descriptive Statistics

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Residential	10	65.250	4.1213	1.3033	62.302	68.198	59.2	72.4
Commercial	10	71.150	5.9261	1.8740	66.911	75.389	61.4	78.2
Industrial	10	71.590	3.5623	1.1265	69.042	74.138	64.6	76.0
Total	30	69.330	5.3621	.9790	67.328	71.332	59.2	78.2

N=30

Table 4.24: ANOVA Analysis

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	250.664	2	125.332	5.803	.008
Within Groups	583.139	27	21.598		
Total	833.803	29			

N=30; $p<0.05$

4.1.13.6 Variation in Noise Levels among Land use Types in Port Harcourt, Rivers State

The information for the variation in Noise levels among land use types in Port Harcourt, Rivers State is displayed on Table 4 27. The information on Table 4.25 was used for this computation while the information on Table 4.26 shows the descriptive statistics of the ANOVA analysis. The result showed that the F ratio of 27.383 at degrees of freedom (df) of 29 at 0.05 (95%) probability level revealed a level of significance of 0.000. The result therefore showed that there is variation in noise levels among land use types in Port Harcourt since the level of significance of 0.000 was lower than the probability value of 0.05.

Table 4.25: Daily Mean noise Levels across Land use Types in Port Harcourt, Rivers State

Locations	Land uses		
	Residential	Commercial	Industrial
1	59.7	75.8	70.9
2	65.5	75.8	79.1
3	69	73.8	76.8
4	67.6	77.3	77.6
5	66.7	77.3	75.7
6	61.6	71.5	71.9
7	65.4	78.1	73.6
8	68.6	79	76.2
9	75.8	75.3	75.4
10	65	75.1	75.6

Source: Researcher’s Field Computation, 2020

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Table 4.26: Descriptive Statistics

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean Lower Bound	95% Confidence Interval for Mean Upper Bound	Minimum	Maximum
Residential	10	66.490	4.3857	1.3869	63.353	69.627	59.7	75.8
Commercial	10	75.900	2.1899	.6925	74.333	77.467	71.5	79.0
Industrial	10	75.280	2.5134	.7948	73.482	77.078	70.9	79.1
Total	30	72.557	5.3405	.9750	70.562	74.551	59.7	79.1

N=30

Table 4.27: ANOVA Analysis

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	553.989	2	276.994	27.383	0.000
Within Groups	273.125	27	10.116		
Total	827.114	29			

N=30; $p<0.05$

For instance the distribution as shown in Uyo revealed that noise pollution levels were considerably higher in the sampled residential, Morning (6.30-8. 00a.m) 45.2 dB(A) and 81.2 dB(A) and highest mean value (73.2 dB(A)) control 34.9 dB(A); Afternoon (12.30-2.00pm) 80.4 dB(A), highest mean value (78.4) dB(A) control 44.9 dB(A), Evening (4.30-6.00pm) highest 79.2 dB(A), lowest minimum value (55.4 dB(A)). Commercial (Morning 60.8 dB(A), highest mean value 88.6 dB(A), (Afternoon 60.8 dB(A), maximum 88.0 dB(A) mean value 83.5 dB(A) (Evening minimum 60.9 dB(A) and maximum 86.4 dB(A) and mean value 81.2 dB(A). Industrial (Morning 46.1

dB(A) -88.4 dB(A), highest value 75.7 dB(A); Afternoon, 55.2 dB(A), 90.2 dB(A), mean value 80.2 dB(A) (Evening 58.6 dB(A), maximum 88.2 dB(A) mean value 80.8 dB(A). The semi-urban was the (control) land use area in the study area. The reasons for the high noise pollution levels across land use types are not far-fetched. The study area is characterized by several socio-economic activities which are factors that constitute to trip generation, trip distribution and re-distribution during the different time periods. The study area also features heavy vehicular movements and use of electrical generating plants. All these activities contribute to noise pollution in the study area. The findings agree with the study in Nairobi by Quis (2001). He asserted that city noise levels can be investigated in three different ways as traffic and transportation; industrial activities; sports marketing, entertainment facilities and residential areas. These were the areas of interest in the study and they all contributed greatly to the noise pollution in this study, especially the commercial and industrial land use types.

5.0 Conclusion

In this study, the major noise source contributors in the sampled state capitals were identified which include electric generating plants and vehicular traffic etc. The result indicates areas of high noise levels in the different land uses in the sampled state capitals in the Niger Delta. Also the mapping of the different land uses spatial distribution maps were generated across land uses in the state capitals, the map showed places of high and low noise zones in the study area.

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