

Waste Disposal Practices among Residents of Calabar South Local Government Area, Nigeria

Emri, Samuel Inaku^{1*}, Eze, Sebastine, George² and Wonah, Fidelis Onah³

^{1&3}Department of Urban and Regional Planning, Faculty of Environmental Sciences University of Cross River State, Calabar-Nigeria

²Department of Geography and Meteorology, Faculty of Environmental Sciences Nnamdi Azikiwe University, Awka, Anambra State, Nigeria

*Corresponding Author

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ABSTRACT

Improper waste disposal practices have become a major issue globally, with significant environmental and health implications. The study examined waste disposal practices among residents of Calabar South Local Government Area of Cross River State-Nigeria. Mixed method research was adopted, data were gathered from both primary and secondary sources. Three hundred and ninety six questionnaires were administered to residents in the 12 wards of the study area, the coordinates of the location of the dumpsters were captured and recorded. Data collected were statistically analyzed using Pearson Correlation and ANOVA, the results shows that there is a correlation between population and designated waste disposal sites in the study area with a P-Value 0.109 and Calculated Value of 0.486 the null hypothesis1 was rejected. Similarly, with (F-Value 1.64, P-Value 0.90) the null hypothesis2 was equally rejected, which indicate that there is significance difference in waste disposal practices by residents of the various wards. It was recommended that synergy among Agencies and Ministry of Environment is expedient to provide facilities needed to dispose waste by residents. Effective environmental enlightenment campaigns and enforcement of sanitation regulations/laws are required to ensure residents compliance to dispose their waste appropriately.

Keywords: Disposal, Environment, Practices, Residents, Waste

INTRODUCTION

Waste has always been and will continue to be a bi-product of human activities. Human beings perform various activities such as commercial, industrial, domestic, recreational, agricultural etc. Waste generation is inevitable when various activities are carried out. Wastes are also generated from natural phenomenon such as earthquake, volcanic eruption, flood, hurricane, windstorm etc. Waste generated by human beings occurs deliberately from the task performed to attend to his physiological, security, social and esteemed needs. While waste from natural phenomenon happen naturally sometimes aided/unaided by human beings actions or inactions.

The continues expansion in urban centres due to natural growth, rapid urbanization, industrialization and economic growth rates has resulted in a huge increase in the volume of wastes generated daily in the country and Calabar South Local Government is not isolated. Increase in population and development in places such as Beijing, Shanghai Nanjing, and so on, in China causes a significant impact on the environmental degradation and human health. (Doan, 1998).

According to Omuta, (1988), Emri, Nwafor and Irem (2019), Waste are the unwanted products of human and animal activities that are usually discarded. The process of removing it is undertaken to reduce the effect on health, the environment or aesthetics (Enete, 2010) Waste is noted to includes all items that people no longer have any use for, which they either intend to get rid of, or have already discarded and these include packaging items, garden waste, plastics, vegetables, metals, and so on (Adeboye, 2017).

The concern of this study is preoccupied with how wastes generated are deposited, thereby freeing the space and inhabitants of Calabar South Local Government Area from the consequences of unsafe disposal. Waste disposal practice refers to the different ways/methods and techniques used to get rid of waste from the points they are generated. Waste disposal methods can be broadly classified into two groups, legal and illegal. The legal practice refers to a method recognized and approved by government as a way people could dispose waste generated safely without harming the environment.

Solid waste disposal is inexorable human activity as a result of his dynamic socio-economic and cultural striving interactions for survival. Waste generation can be rooted from the rapid population growth, industrialization, per capita income and urbanization (Okeniyi and Anwan, 2012). In Nigeria, solid waste disposal has been a challenging health and environmental concerns. Solid waste disposal differ at a spatial scale, it differs from developed to developing countries, urban to rural communities, residential to commercial and industrial locations. (Murtala and Mohmad, 2018)

Prediction of solid waste generation has been given concern, in developing countries many reasons are given as causative agents of solid waste generation, in Oyo state Nigeria, Income, Household size, Social status, Educational level, Occupation and Season of the year have explained 88.8% of solid waste generated (Abel and Afolabi, 2007). In another dimension, “binary logit estimates model” suggested determinants of solid waste management by households encompass Income, Travel time to the dump site, Marital status as well as awareness of laws concerning waste disposal and activities of sanitary inspectors (Ezebilo and Animasaun, 2011)

Researches show that solid waste is usually at the higher rate in urban areas than the rural countryside due to the myriads of economic and social activities that take place. Waste can be sub-divided into solid wastes and liquid wastes which can be disaggregated into domestic and industrial wastes. Domestic wastes are wastes generated by different households and they also differ according to household income, while industrial wastes are concerned with wastes from by-products of industrial activities and they include, packaging materials, sludge, metals, glass to mention but a few. Household wastes include; wastes from our homes, such as plastics, paper, food wastes, polythene bags which are dumped in open spaces.

STATEMENT TO THE PROBLEM

The manner in which residents dispose their waste has a lot to tell on the general environmental wellbeing of a neighbourhood. Waste disposal practices among residents are pressing issues. Many researches focused on the management of refuse which involves collection, transportation and deposition of the waste generated at a final disposal site. A cursory investigation into waste disposal practices among residents of Calabar South Local Government Area and why residents chose to adopt a method(s) to dispose their waste is necessary. A preliminary survey of the study area reveals that residents dispose their waste in a number of ways such as burying in the backyard, burning, throwing into the drainage especially when it is raining, some uncompleted structures as well as undeveloped plot were seen littered with waste. On the other hand, the dumpsters are filled to the brim, an indication that some residents do dispose their waste in the dumpsters. More worrisome, is that most of the micro disposal site were the dumpsters are placed, are over run with waste yet to be evacuated.

CONCEPTUAL FRAMEWORK/LITERATURE REVIEW

Concept of Sustainable Waste Disposal

The concept applied to this study is the concept of “sustainable solid waste disposal” it is concerned with the discipline associated with the control of wastes generation, storage, collection, transport or transfer, processing and disposal of solid wastes materials in a way that best addresses the range of public health, conservation, economics, aesthetic, engineering and other environmental considerations. Baum, (2004), asserted that the concept is all embracing and includes; the planning, administrative, financial, engineering and legal functions. He further opined that the solution might include complex inter-disciplinary relations among fields such as public health, city and regional planning, political science, sociology, engineering and material sciences among

others. The concepts is an integrated approach that has been widely used in developing nations of the world in order to address the issue associated with waste disposal, storage, collection, and final disposal of solid wastes so as to improve the health condition of the urban fabric.

The concepts also make use of legal provisions and enforcements of those who may violate waste disposal laws. This concept with advocacy through education of residents of the study area on household waste management practices and control of attitude towards waste disposal would go a long way to enlighten the residents on the best methods of waste disposal and its effects on the built urban environment.

Literature review

Numerous scholars have discussed at length the issue of wastes disposal practices in the past and in recent times because of its negative impacts to the environment and health effects of its inhabitants and other related challenges, it is still trending.

Waste Disposal Methods:

Waste disposal practices refers to the various ways which residents of an area chose to get rid of waste generated from their productive or consumption ventures as well as waste that occurs from the efforts to keep the environment clean through clearing of grasses, pruning of trees and cleaning of the drainages. The various practices includes; burning waste, burying waste, dumping it in undeveloped plots/bushes, throwing it into the drainage channels and dropping waste in the dumpsters which are government approved sites for residents to dispose waste safely.,

Factors influencing waste disposal practices among residents

Waste disposal practices are critical issue that affects the environment and public health. Calabar South, a fast-growing urban area in Nigeria, is no exception to this challenge. The way residents dispose their waste plays a significant role in determining the overall cleanliness and sanitation of the city. There are several factors that influence waste disposal practices among residents, which are cultural beliefs, infrastructure availability, education level, and economic status (Birendra, Vivek, and Rajesh, 2016). Cultural beliefs and practices play a crucial role in determining how waste is disposed of in a community. Traditional beliefs may influence residents' attitudes towards waste disposal. Some residents may believe that certain waste (used clothes, shoes, artificial hair, undies) materials have spiritual significance and must be disposed of in specific ways. This can lead to improper disposal practices and contribute to the overall problems of waste management in the city (Aniket, Aditya, and Prachi, 2017).

Infrastructure availability also plays a key role in influencing waste disposal practices. The availability of waste collection services and disposal facilities can greatly impact how residents choose to dispose of their waste. Inadequate or lack of proper infrastructure, such as micro waste collection points and dumpsters can lead to residents resorting to improper disposal methods, such as illegal dumping or burning of waste. Kinobe, Niwagaba, Gebresenbet, Komakech and, Vinnerås in their study in Kampala indicated that limited coverage of the solid waste collection system is among the key challenges facing the management of solid waste in the city. Ampofo, Kumi and Ampadu in a study in Bolgatanga, Ghana, identified that long travel distance for household waste disposal discourages dumping at designated and authorized places. Waste that is not managed properly can clog drains and waterways, leading to flooding and damage to roads, bridges, and buildings. This diverts resources that could have been allocated to other crucial infrastructure projects, hindering economic development and growth in the long run (Environmental Protection Agency, 2020).

Education level is another important factor that influences waste disposal practices among residents. Residents who have a higher level of education may be more aware of the environmental and health hazards associated with improper waste disposal. They may also be more likely to participate in waste management programs and initiatives aimed at promoting proper waste disposal practices. On the other hand, residents with lower levels

of education may be less informed about the importance of proper waste disposal and may be more likely to engage in irresponsible waste disposal practices (Sudhakar and Sreekanth, 2019).

Economic status is a significant factor that influences waste disposal practices. Residents who are financially disadvantaged may not have access to waste collection services. This can force them to resort to improper disposal methods, such as dumping waste in open areas or burning it. Residents who are more financially stable may be able to afford proper waste disposal services and may be more inclined to dispose of their waste responsibly (Aniket, et al., 2017). Agunwamba (1998) strengthened the fact that low-income countries are characterized by poor methods and low capacities of MSWM. UNCHS (1996) also stated that between one-third and one-half of the solid wastes generated within most cities of low income countries are not collected and the waste generated is dumped at many undesignated sites (Haan Coad and Lardinois, 1998; Bartone, 2001)

Environmental and health impacts of improper waste disposal

According to the United Nations Environment Programme UNEP, (2018), improper waste disposal has become a major issue globally, with significant environmental and health impacts. Improper waste disposal practices have serious environmental consequences. One of the most significant impacts is pollution it has devastating impact on ecosystems, harming plants, animals, and microorganisms (UNEP, 2018). Furthermore, waste that is dumped in the ocean can harm marine life, with plastic waste in particular posing a major threat to marine animals such as turtles, seabirds, and marine mammals (UNEP, 2018).

Waste disposed improperly creates breeding grounds for disease-carrying vectors such as rodents, flies, and mosquitoes. These vectors can spread diseases such as cholera, typhoid, and fever, posing a serious threat to human health. Children are particularly vulnerable to the health risks associated with improper waste disposal, as they are more likely to come into contact with contaminated soil or water while playing (World Health Organization, 2019). It is clear that improper waste disposal practices pose a serious threat to both the environment and public health. This can be ameliorated by working together to reduce waste generation and promote responsible disposal (Environmental Protection Agency, 2020).

Economic implications of improper waste disposal practice

The way waste is managed has serious economic implications that affect various sectors such as healthcare, tourism, agriculture, and infrastructure (World Bank, 2018). When waste is not properly managed, it can contaminate water sources, air, and soil, leading to serious health problems for individuals living in the vicinity. This, in turn, puts a strain on healthcare systems, leading to increased spending on medical treatments and services. In developing countries, where waste management infrastructure is often lacking, the economic burden of healthcare costs due to improper waste disposal can be particularly severe (World Bank, 2018).

Many popular tourist destinations rely on their natural beauty and cleanliness to attract visitors. When waste is not properly disposed of, it can spoil the aesthetic appeal of these destinations, leading to a decline in tourism revenues. Tourists are less likely to visit areas that are polluted and littered with trash, resulting in a loss of income for local businesses such as hotels, restaurants, and tour operators. This can have a ripple effect on the overall economy of the region, impacting job opportunities and economic growth (World Bank, 2018).

If waste is dumped inappropriately, it can contaminate the soil and water sources that are essential for agricultural production. Chemicals and toxins from waste materials can seep into the ground, leading to reduced crop yields and poor quality produce. Farmers may incur additional costs to clean up contaminated land and water, as well as invest in alternative irrigation and fertilization methods. This can lead to higher production costs and lower profits, affecting the livelihoods of those involved in the agricultural sector (Environmental Protection Agency, 2020).

The study area

Calabar South is a Local Government Area of Cross River State, Nigeria. It has Anantigha as the headquarters.

It was created from Calabar Municipality in 1996. It is located on Latitude 40 55’N of the equator and longitude 80 16’E of the Greenwich meridian, it is bounded to the North, South, North East and North West by Calabar Municipality, Atlantic ocean, Akpabuyo and Odukpani Local Government Areas respectively. The area is flanked on its eastern and western borders by two rivers, the Great Qua and Calabar River. The local government is comprised of two major ethnic groups namely the Efiks and Efuts. However, other immigrant ethnic groups reside in the area (Association of Cross River State Local Government Pensioners, 2015). The population of Calabar South in 2006 was 191,515 (NPC), projected for 18 years at 3% growth rate brings the population to 326,035 in 2024

The climate of the area is humid tropical although rainfall occurs throughout the year. The place experiences double maxima, rainfall regime in July and September. The area has a high relative humidity usually between 80% and 100% and vapour pressure in the air averaged 29 millibars throughout the year. High salinity (3.8 ± 0.4%) is limited to the dry season while lower salinity (0.5 ± 0.6%) occurs in the rainy season (Ukpong1995). Politically, the local government has a total of twelve (12) wards for administrative convenience. It has rich mangrove swamp vegetation with variety of hard wood and raffia palm.

METHODOLOGY

The method adopted for this research is the survey design. Both primary and secondary sources were employed to collect data. A combination of quantitative and qualitative research were applied to the study. Primary sources of data employed in the study were observation, interview and questionnaire administration to acquire data from resident on waste disposal practices within the study area. Handheld GPS (Garmin 76CSX) was also used to pick coordinates of the dumpsters. Secondary data such as literatures were gathered from journal, text book, internet, while the population of the study area was acquired from National Population Commission (NPC) and the Office of the Statistician General of Cross River State.

Three hundred and ninety six (396) questionnaires were administered to residents in the twelve (12) wards that make up the Calabar South Local Government Area.

The study sample size was statistically determined using “Taro Yamane” (1967) formula:

$$n = \frac{N}{1 + N(e)^2}$$

Where:

n is the sample size;

N is the finite population,

e is the level of significance (limit of tolerable error), that is 0.05(5%) and

1 is unity (a constant)

Using the sampling frame formula 396 respondents were sampled randomly and administered with questionnaire, from a projected population of 326,035 in 2024.

DATA ANALYSIS

Table1. Population of each ward and questionnaire distributed in the study area

Ward	Population (2024)	Percentage	Questionnaire Distribution
Ward 1	17,899	5.49	22
Ward 2	22,725	6.97	28

Ward 3	29,245	8.97	35
Ward 4	24,355	7.47	30
Ward 5	25,855	7.93	31
Ward 6	32,506	9.97	39
Ward 7	19,497	5.98	24
Ward 8	14,802	4.54	18
Ward 9	48,253	14.80	59
Ward 10	16,236	4.98	20
Ward 11	27,550	8.45	33
Ward 12	47,112	14.45	57
Total	326,035	100	396

Source: Researcher’s compilation 2024

The respondents were randomly selected proportionate to the population of each ward as contained in table 1.

Table 2: Number of Municipal solid waste micro disposal sites per ward:

SN	Ward	Population	Number of Site/Ward	Percentage of Site/Ward
1	CAL S1	17,899	6	2.10
2	CAL S2	22,725	0	0.00
3	CAL S3	29,245	1	0.37
4	CAL S4	24,355	1	0.37
5	CAL S5	25,855	3	1.00
6	CAL S6	32,506	2	0.70
7	CAL S7	19,497	1	0.37
8	CAL S8	14,802	3	1.00
9	CAL S9	48,253	3	1.00
10	CAL S10	16,236	5	1.80
11	CAL S11	27,550	14	5.10
12	CAL S12	47,112	26	9.50
	Total	326,035	65	100

Source: Field Survey-2024

Table 2: shows that sixty five (65) solid waste disposal sites are available in Calabar South Local Government Area for 325,035 residents to dispose their waste. This is an average of 5,000 persons to 1 disposal site. Wards 3, 4 and 7 has one (1) site each, ward 2 has no disposal site located in it. More details in figure 1.

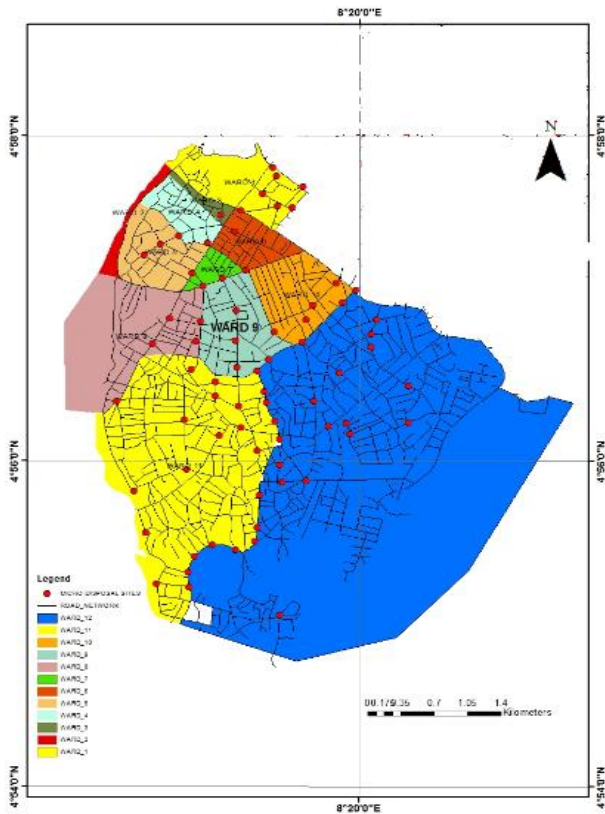


Figure 1. Map of Calabar South showing Disposal sites in the 12 wards.

Table 3: Waste Disposal Practice by Residents:

Respondent	Dumpster	uncompleted building	Undeveloped plot/Bush	Into Drainage	Burning	Burying	Total
Ward 1	12	1	2	2	1	4	22
Ward 2	0	7	8	4	3	6	28
Ward 3	7	9	6	3	2	8	35
Ward 4	5	6	5	4	3	7	30
Ward 5	9	3	5	4	2	8	31
Ward 6	14	7	4	5	3	6	39
Ward 7	6	4	3	2	4	5	24
Ward 8	5	4	2	0	1	6	18
Ward 9	22	9	8	4	5	11	59
Ward 10	4	2	4	3	1	6	20
Ward 11	14	3	6	0	2	8	33

Ward 12	17	10	19	1	3	7	57
Total	115	65	72	32	30	82	396
Percentage	29.0	16.4	18.2	8.1	7.6	20.7	100

Source: Field Survey -2024

Table 3 shows that 115(29%) do empty their refuse into the dumpsters, 65 representing (16.4%) dispose their waste in an uncompleted buildings, 72 (18.2%) dispose their waste indiscriminately in undeveloped plots/bush around them, 32(8.1%) respondents do dump their waste into the drainage, 30 (7.6%) are in a habit of burning their waste, while 82(20.7%) do burry their waste

DISCUSSION OF FINDINGS

Further discussions with residents reveal that the choice of waste disposal is influenced by factors such as availability of disposal site and belief. Most respondents interviewed, understand that the best way to dispose waste is by dumping it in the dumpsters but are constraint by the distance they have to move to get to the dumpsters. At moment a drop by try-circle (Keke) is #200 and that they can afford spending #400 to and fro to dispose waste, hence the alternative way which is less costly is adopted. The belief that used undies and cloths can be used diabolically is the reason why residents of the study area do practice burning as a way of disposing their waste.

Two hypotheses were set in the course of this research. 1. There is no relationship between population and the numbers of designated disposal sites. 2. There is no significant difference among the ways residents dispose their waste in Calabar South Local Government Area.

The data in table 2. Were subjected to further test to see if there is any significant relationship between population and the micro disposal sites. While data on table 3. Were tested to see if there is any significance difference in the manner in which waste are disposed in the study area. Using Minitab to run Pearson Correlation to test hypothesis 1 and ANOVA to test hypothesis 2.

Correlation: C2, C1

Pearson correlation of C2 and C1 = 0.486

P-Value = 0.109

One-way ANOVA: C4 versus C5

Method

Null hypothesis All means are equal

Alternative hypothesis At least one mean is different

Significance level $\alpha = 0.05$

Equal variances were assumed for the analysis.

Factor Information

Factor Levels Values

C5 17 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 17, 19, 22

Analysis of Variance

Source DF Adj SS Adj MS F-Value P-Value

C5 16 67.74 4.234 1.64 0.090

Error 55 142.26 2.587

Total 71 210.00

Model Summary

S R-sq R-sq(adj) R-sq(pred)

1.60828 32.26% 12.55% *

Means

C5 N Mean StDev 95% CI

0 3 3.00 1.73 (1.14, 4.86)

1 5 4.200 1.304 (2.759, 5.641)

2 8 3.875 1.126 (2.735, 5.015)

3 9 3.889 1.269 (2.815, 4.963)

4 11 3.455 1.440 (2.483, 4.426)

5 7 3.286 1.890 (2.068, 4.504)

6 8 4.125 2.100 (2.985, 5.265)

7 5 3.40 2.41 (1.96, 4.84)

8 5 4.800 1.643 (3.359, 6.241)

9 3 1.667 0.577 (-0.194, 3.528)

10 1 2.000 * (-1.223, 5.223)

11 1 6.000 * (2.777, 9.223)

12 1 1.000 * (-2.223, 4.223)

14 2 1.000 0.000 (-1.279, 3.279)

17 1 1.000 * (-2.223, 4.223)

19 1 3.000 * (-0.223, 6.223)

22 1 1.000 * (-2.223, 4.223)

Pooled StDev = 1.60828

Result of the test of hypotheses1 reveals that there is a correlation between population and designated waste disposal sites in the study area with a P Value 0.109 and Calculated Value of 0.486 the null hypothesis was rejected. Similarly, with FC (1.64) greater than FT (0.90), HO: was rejected that there is no significance difference in waste disposal practices by residents of the various wards as stated by the 2nd hypothesis.

CONCLUSION AND RECOMMENDATION

It is apparent that residents of Calabar South Local Government Area are aware that it is safer to dispose waste appropriately at locations earmarked by government. However, dissidents among them found reasons why they should get rid of waste in an improper way. In spite of challenges of inadequate disposal sites or total lack of it in some areas, distance to the site being too far and beliefs, the right attitude should be imbibe as it concern waste disposal. The Cross River State Ministry of Environment, Calabar Urban Development Authority (CUDA) and Cross River State Waste Management Agency should designate more micro disposal sites for a population of 326,035 to make use of 65 locations to dispose their waste is grossly inadequate. The need for enforcement to ensure compliance of residents to the waste disposal practice adopted by the state is necessary. In addition, education and awareness campaigns are important in promoting responsible waste disposal practices among the public.

REFERENCES

1. Abel, O. A. and Afolabi, O. (2007). Estimating the Quantity of Solid Waste Generation in Oyo, Nigeria. *Waste Management & Research*, 25, pp371-379
2. Adeboye, M. (2017). Households' willingness to pay for improved solid waste management in Ibadan North local government area of Oyo state, Nigeria. *Journal of Environmental Extension*, (1)(6), 57-63
3. Agunwamba, J.C., 1998. Solid waste management in Nigeria: Problems and issues. *Environ. Manage.*, 25: 849-856.
4. Ampofo S, Kumi E, Ampadu B (2015) Investigating solid waste management in the Bolgatanga municipality of the Upper East region, Ghana. *CCSE* 10.5539/ep.v4n3p27.
5. Aniket, G., Aditya, S., & Prachi, S. (2017). An integrated approach to solid waste management in urban areas: A case study. *International Journal of Waste Management*, 35(1), 85-92.
6. Association of Cross River State Local Government Pensioners (2015). *Cross River State at A Glance* Master Business Associates Nigeria
7. Bartone, C.R., 2001. The Role of the Private Sector in Municipal Solid Waste Service Delivery in Developing Countries: Keys to Success. In: *Challenge of Urban Government: Policies and Practices*, Freire, M. and R. Stren (Eds.). World Bank, Washington, DC., USA., pp: 199-214.
8. Baum, R. A. (2004). Environmental risk and protective measures in waste disposal. *Environmental Science and Policy*, 9(3), 245-255.
9. Birendra, K., Vivek, S., & Rajesh, M. (2016). Municipal solid waste management practices and challenges in developing countries: A study of India. *Journal of Environmental Management*, 182, 487-496.
10. Emri. S. I., Nwafor, S. E. and Ernest, B I, (2019): Analysis of Solid Waste Collection and Management in Calabar South, Cross River State-Nigeria. *International Journal of Agriculture, Environment and Bioresearch*. Vol 4. No 06 pp 461-472: <http://doi.org/10.35410/IJAEB>
11. Enete, U. (2010). Urban solid waste management in Nigeria in G.E.K. Ofomata and P. O PhileZE (eds). *Geographic perspective on environmental problems in Nigeria* Nsukka Department of Geography, University of Nigeria Nsukka
12. Environmental Protection Agency (EPA). (2020). *Solid waste management: Trends, challenges, and solutions*. Washington D.C.: U.S. Environmental Protection Agency.
13. Ezebilo, E. and Animasaun, E. 2011. Households' Perceptions of Private Sector Municipal Solid Waste Management Services: a binary choice analysis. *International Journal of Environmental Science & Technology*, 8, pp 677-686.
14. Haan, H.C., A. Coad and I. Lardinois, 1998. Involving micro- and small enterprises in Municipal solid waste management: Guidelines for municipal managers. *International Training Center of the ILP, SKAT, WASTE*, Turin, Italy, pp: 90.
15. Kinobe JR, Niwagaba CB, Gebresenbet G, Komakech AJ, Vinnerås B (2015) Mapping out the solid waste generation and collection models: The case of Kampala City. *Journal of the Air & Waste Management Association*. 10.1080/10962247.2014.984818.

16. Murtala R. and Mohmad A. (2018) Spatial Distribution of Solid Waste Disposal Methods, Predictions and Risk Susceptibility Using Multiple Regression Model in Nigeria American Journal of Geographic Information System p-ISSN: 2163-1131 e- ISSN: 2163-114X 7(1): pp40-47
17. Okeniyi, J. O. and Anwan, E. U. 2012. Solid wastes generation in Covenant university, Ota, Nigeria: Characterisation and implication for sustainable waste management. J. Mater. Environ. Sci, 3, 419-424.
18. Omuta, O. A. (1988). Waste to wealth: a case study of the Ondo State Integrated waste recycling and treatment project, Nigeria. Euran Publisher.
19. Sudhakar, S., & Sreekanth, D. (2019). Advances in solid waste management practices: A review of case studies in India. Journal of Environmental Research and Development, 14(2), 301–313.
20. Ukpong, I. E. (1995). Mangrove Soils of the Creek Town, Calabar River Swamp, South Eastern Nigeria, Journal of International Society for Tropical Ecology 36 (1): 103- 115.
21. UNEP (United Nations Environment Programme). (2018). Global trends in solid waste management: Challenges and opportunities. UNEP Report.
22. World Bank. (2018). What a waste 2.0: A global snapshot of solid waste management to 2050. Washington, DC: World Bank Group
23. World Health Organization (WHO). (2019). Health risks associated with poor solid waste management. Geneva: WHO