



Urban Waste Management Challenges in Developing Nations: A case study of Ilorin, Nigeria

M. Sani, Z. T. Alaya, A. T. Aliu

Faculty of Environmental Sciences, Geography and Remote Sciences Kwara State University Malete

ABSTRACT

This work is to assess the waste Management challenges confronting the developing nation taking Ilorin in Nigeria as a case study. The aim is to examine the effect of solid waste disposal in Ilorin Metropolis, Kwara State. The objective is to look into different physical constituents and characterization of solid waste, analyze the spatial relationship between the dumpsite and population. Proffer best method of waste management in Ilorin Metropolis. Generation of waste the world over is synonymous with increase in population due to changes in taste and life style of the people. This work used field survey, secondary data from Kwara State Waste Management Agency and ArcGIS look at different Constituents and Physical Characteristics of Solid Waste in the Dump Site within Ilorin Metropolis. pH levels were found to be highest in areas with high organic waste content, suggesting that the decomposition of organic waste is contributing to the alkalinity of the solid waste site within Ilorin metropolis and is likely have health effect. The moisture content of the solid waste disposal site ranged from 40% to 50% with an average value 45.7%. This indicates that the site has moderate moisture levels, which is consistent with the presence of organic waste. The moisture content was found to be highest in areas with high food waste content, suggesting that food waste is contributing to the moisture levels of the sites. Temperature of the solid waste site ranged from 22^oc to 25^oc with an average value of 22.7^oc. This indicate that the site has high temperatures, which is consistent with the decomposition of organic waste. The temperature was found to be highest in areas with high decomposition rates, suggesting that the decomposition of organic waste is contributing to the generation of heat at dump site. In effect this can contribute to global warming and result to climate change. The proximity of waste disposal sites to populated areas can lead to environmental and health risks. Developing good waste management practice, good attitude towards waste management will help to minimize its impact from our various homes. Teaching of Waste Management should be included in the school curriculum from Primary, Secondary and higher institutions.

Article History

Received: 17 June 2025

Received in revised form: 28 October 2025

Accepted: 13 September 2025

Published Online: 12 December 2025

Keywords:

Waste Management, dump site, Ph level, Moisture, temperature and buffer zone

Corresponding Author Contact:

Mohammed Sani

Email:

sanni.mohammed@kwasu.edu.ng

DOI:

INTRODUCTION

Solid waste means any unwanted materials discarded by the owners. Solid Waste can also be categorized based on where the waste is generated, for example as municipal solid waste, health care waste and e-waste. Annually over 2 billion and above municipal solid waste are generated (UNEP 2024). According to Kirenko *et al*, (2022) define municipal solid waste (MSW) to the everyday solid waste accumulated from household, commercial, and institutional sources such as residential buildings, schools, hospitals, businesses, and light industry inside a

municipality. Nigeria cities with the current rate of urbanization, municipalities have made efforts with the collection, transportation, and dumping of solid waste. This is as result of waste generation, from residential and commercial, occurring in an indiscriminate manner across homes, buildings, streets, parks, and even vacant spaces within communities. Municipal solid waste (MSW), could mean trash or garbage, undesired materials that are discarded away in our homes, schools and workplaces, it also includes packages, furniture, food scraps, clothing, newspapers, electrical and electronic

appliances. Municipal solid waste (MSW) generation according to global rating amount to 0.74 kg per person per day since 2016 (TOgunwale, Oladeji, Oyedare, Oyetola, *et al.*, 2022). This means 2.01 billion tons of municipal solid waste is gathered annually in the world (Taiwo *et al.*, 2024).

(Owojori, Mulaudzi, and Odiyo 2024) said in developing countries there are 9% population growth rate and 17% urbanization rate, different from 4% and 11% respectively in advanced countries and 23% and 41% respectively in under developed countries. Municipal solid waste (MSW) generation rate is swelling by 70% and generated waste is anticipated to reach 3.40 billion tons per year by 2050 this is as a result of population surge and urbanization. In developing nations, the average waste generation rate is typically between 0.3 and 0.5 kg per person per day (Owojori, *et al.*, 2024), but waste disposal and management practices are usually inadequate. Due to population growth, rapid urbanization, economic development, shifting consumption patterns, industrial expansion in urban centers, and improved living conditions, managing MSW has become a significant challenge in many cities of less developed countries (W.C.R., 2024). As a result, municipalities in growing nations often serve fewer residents than average and spend 20–50% of their available budget on solid waste management. (SWM). Akimana and Letema (2022) argued that solid waste management is a nightmare in sub-Saharan Africa and even in their educational institutions which are supposed to be the model for effective and hygienic solid waste management. Nigeria is amongst emerging nations struggling to effectively manage the increasing solid waste it accumulates. (Adewumi *et al.*, 2017). According to Owojori *et al.* (2020), open dumping/landfilling is the main disposal ways due to poor environmental legislation, inadequate funding, absent of urban planning, and improper industrial waste disposal. In the contemporary period especially in developing nations, improper disposal of household-used solid materials referred to as waste, constitutes

a major public health challenge and led to green crime. (Ogunniran, 2019). This result to waste blocking the water channels and flooded the residential areas of these countries (Chireshe *et al.*, 2023; Fakunle *et al.*, 2022; Fakunle and Ajani, 2021). However, these nations faced a challenge, as local governments of these countries often lack the resources to spend in modern waste collection, treatment, and disposal technologies, and generate little revenue from waste management operations to cover costs. Consequently, few infrastructures and services result to negative impacts, especially in sanitation, road connectivity, environmental quality, and public health protection. (Okeke, Kharlamova, Didi and Nwobi 2024) opine that numerous challenges is faced by these nations in managing solid waste, including the lack of sanitary landfills for final disposal at the town or city level, inappropriate sanitation facilities to reduce transportation costs for micro and small businesses, poor road network to transport waste to dump sites, overlapping policies and strategies for involving private partners, budget constraints in the MSWM sector, a total absent of trained professionals, lack of connectivity between towns and cities, limited public awareness on the need to pay for services, indiscriminate dumping, sectoral overlaps, a lack of prioritization of waste management by authorities, and poor fee collection systems for micro enterprises currently providing MSWM services.

However, in many rural regions and some urban cities in Africa, most wastes are not collected and evacuated by municipal collection systems because of poor management, fiscal irresponsibility or malfeasance, equipment failure, or inadequate waste management budgets, and accessibility to roads leading to these places is difficult (Johannsen *et al.*, 1999). Bringa, & Abdullahi, (2024), in certain urban areas especially in developing nations like Nigerian, there is a continuous practice of open-air, uncontrolled, and poorly managed disposal of municipal solid waste, which can lead to numerous environmental concerns (Nanda &

Berruti, (2021). Nigerian practices for managing municipal solid waste failed to comply with international best practices. Every other waste management method, including incineration, solid waste is dumped in open dumping sites on land and in water bodies frequently. Absence of adequate and qualified personnel, specialized vehicles and solid wastes transport facilities, and specialized drop-off areas are the main issues in Nigeria waste management. (Sarder, 2017).

Giri *et al*, (2024) stated that one very vital concern associated with waste is the persistence of non-biodegradable or inorganic components over extended periods of time, which can pose serious hazards to the environment. Unlike organic components, which can undergo biological degradation and reenter the natural life cycle, non-biodegradable materials do not readily break down and can accumulate in the environment Giri *et al*, 2024 cited (Meereboer *et al.*, 2020).in their work that this accumulation can lead to a range of detrimental effects, such as soil and water pollution, destruction of habitats, and threats to wildlife and human health. This research will examine the various dump sites in Ilorin, different constituent and physical characterization of solid waste dumpsite in Ilorin Metropolis, its effects on surrounding environment and look at some practical solution to reduce its impact on human and environment.

Environmental policy are rules on which modern waste management systems are built. It provides the legal, institutional, and regulatory framework that guides how waste is generated, stored, collected, transported, treated, reused, recycled, and finally disposed of. Through the establishment of laws, standards, and guidelines, environmental policies ensure that waste handling processes do not endanger human health or degrade environmental quality. Nigeria has developed several environmental laws and regulations to address waste management challenges. The primary institution responsible for environmental regulation is the **National Environmental Standards and Regulations Enforcement Agency (NESREA)**. Established by the NESREA Act,

the agency functions as the enforcement arm of the Federal Ministry of Environment, charged with implementing and monitoring compliance with national environmental laws. Section 7 of the NESREA Act outlines the agency's mandates, which include enforcing environmental laws, standards, and guidelines related to pollution control-covering noise, air, land, and water pollution. NESREA also regulates hazardous substances management, including the importation, production, storage, handling, distribution, and disposal of hazardous chemicals and waste.

In Kwara State, in particular, there are a lot of issues of environmental mismanagement. For instance, one common method of disposal in the State is the open dumping of solid wastes into wetlands, water courses and drains, as well as the burial of such wastes in pits. This behavior has caused the area to become litter, which is an eyesore and a nuisance in terms of stench (Amin, Shittu, & Ibrahim, 2023) quoted (Ihuoma, 2020). The Kwara State Environmental Protection Agency Law went into effect in 1992. The Act created the Kwara State Environmental Protection Agency (KWEPA) to provide a secure and wholesome environment for the residents of Kwara State. The Agency is responsible for all environmental protection measures, environmental research and development, and educating the general public on proper waste disposal practices appropriate for household and industrial wastes (Amin, Shittu, & Ibrahim, 2023) quoted (Adebayo, 2022).

METHODOLOGY

Ilorin is the Kwara State capital located approximately on latitude 8° 31 north of the equator and 4° 35 east of Greenwich meridian with a land mass of 100km square (Kwara State Diary, 2024). It is one of the fastest growing urban Centre's in Nigeria with high rate of population growth. The town is the gate way between the southern and the Northern Nigeria, the town comprises of three Local Government areas namely: Ilorin West, Ilorin east and south and the city has

grown in both population and area extent. The landscape of the region (Ilorin) is relatively flat, this means it is located on a plain and is crested by two large rivers, the river Asa and Oyun which flows in North - South direction divides the plain into two; Western and Eastern part (Oyebanji, 1993). The methodology involves data collection, processing, and analysis for examine different constituent and physical characterization of solid waste dump sites using ArcGIS, Analyzing the Spatial Relationship Between Solid Waste Disposal Site and looking at Population Density using ArcGIS as well, and proffer the best method to waste management using a questionnaire and SPSS. This involved the collection of both primary and secondary data, followed by a detailed explanation of the data processing and analytical techniques employed. The methodology is designed to ensure a systematic and rigorous approach to data collection, processing, and analysis, ensuring reliable and accurate results. This chapter provides a foundation for the results presented and contributes to the overall understanding of the research topic.

Secondary data were sourced from Kwara State Environmental Protection Agency (KWEPA., 2022) which provided essential insights into waste management practices across the state. The study relied on secondary data from (KWEPA., 2022) annual reports to assess trends in solid waste generation in the state. Major waste dump site was identified through secondary data obtained from (KWEPA, 2022). Field measurement, a comprehensive field survey was undertaken to map and assess waste dump site using primary geospatial data. Field measurement was taken at 21 randomly selected points within Ilorin metropolis using handheld GPS devise, thermometer, pH meter, and moisture content sensor. The data collected included: GPS coordinate (x, y) Moisture content (%) pH levels. The collected data was prepared for analysis by creating a point layer in ArcGIS with the GPS coordinates and attribute data and converting the data into a suitable format for interpolation.

Interpolation Methodology; Selection of interpolation method, Inverse Distance Weighting (IDW) was selected as the interpolation method due to its suitability for small to medium-sized datasets within irregular space points. Interpolation parameters: The following parameters were set for the IDW interpolation: power- 2 distance-100 meters, searchable radius- 500 meters. Interpolation Process, the interpolation process was performed using the IDW tool in ArcGIS, generation of a continuous surface for each parameter (moisture content, temperature, and pH levels). Tables and the bar chart were used to shows the distribution of solid waste types in Ilorin metropolis. Buffer Analysis: created buffer analysis around solid waste disposal sites (2km), population density, statistics were calculated within each buffer.

Spatial Join, Joined population density data with solid waste disposal site and buffer data. The Calculated population density value within specified distance using this formula: Population Density = (Sum of Population Density value) (waste Disposal Buffer Area). Preparation of table for waste disposal sites information in relation to population density values. Mapping and visualization: The output of this study includes: interpolation raster layers for moisture content, temperature, and pH levels. Waste types distribution table and waste types distribution bar chart. Analyzing the Relationship between Solid Waste Disposal Site to Population Density using ArcGIS. Data preparation data conversion solid waste disposal site data were converted to a point layer. And also, population data were converted to population density raster layer through series of raster processing for visualization and presentation. Mapping and visualization: the images to be displayed are disposal site's locations population raster maps and population density gradients. Symbols and colours schemes were used to represents population count raster values.

Results and Discussion

Examine the Different Constituent and Physical Characteristics of Solid waste Disposal in Ilorin.

Waste characterization in Ilorin

Ilorin is served by different municipal waste collection and numerous dumpsites, and several studies have shown as Omoda round about, Gambari, Ipata, Amilegbe C division, Taiwo Isale, Post Office Agric area, Offa Garage Gerri Alimi, Airport, Saw mill, Yebmout, Pakata, Challenge, Tanke Okeodo, Sango, Fate and Ile film among others. According Kwara Sate Environmental protection Agency that Ilorin Municipal generate about 0.66kg person per day. Of all the dump sites 40% of waste generated is organic waste and in some places 35% (food and biodegradable materials). Food Waste – leftovers, vegetable peels, fruit skins, spoiled food Garden / Yard Waste – grass clippings, leaves, branches, flowers Paper and Cardboard – if not coated or contaminated with plastic/chemicals Wood – untreated wood, sawdust, small branches Animal Waste – manure, bones, feathers Human Waste – , tissues, eggshells, vegetables orange, Banana

pills and Mango seeds dry leaves of the plants. While inorganic waste which do not decompose easily constitutes majorly 40% found around Taiwo Sale, Amileagbe, Airport, Fate and Ile film. This is in line with the type of economic activities around the areas. 20% of Recyclable waste are also found in Ipata, Gambari, C division, Post office, stadium, Offa garage, airport and Tanke. Inorganic waste includes: Plastics, Glass (bottles, jars) Metals (aluminium cans, iron, steel) Ceramics (plates, tiles, cups) Rubber (non-biodegradable types) Textiles (synthetic fibres like nylon, polyester) Construction debris (sand, stones, concrete) Electronic waste (e-waste) 15% hazardous substances in Gambari and Ipata while 10% in other dump sites across the state which also includes needles, syringes and alcohols sachets.

pH Levels

The pH level of the solid waste disposal sites in Ilorin were analyzed and the results showed that the pH levels ranged from 6.5 to 6.8, with an average value of 6.5 as shown in (table.1). The pH levels were found to be highest in areas with high organic waste content and lowest in areas with high inorganic waste content (figure .1).

Table 1: Summary Statistics of pH levels

Parameter	Count	Minimum	Maximum	Sum	Mean	Standard Deviation
pH	21	6.5	6.8	138.3	6.585714	0.135526

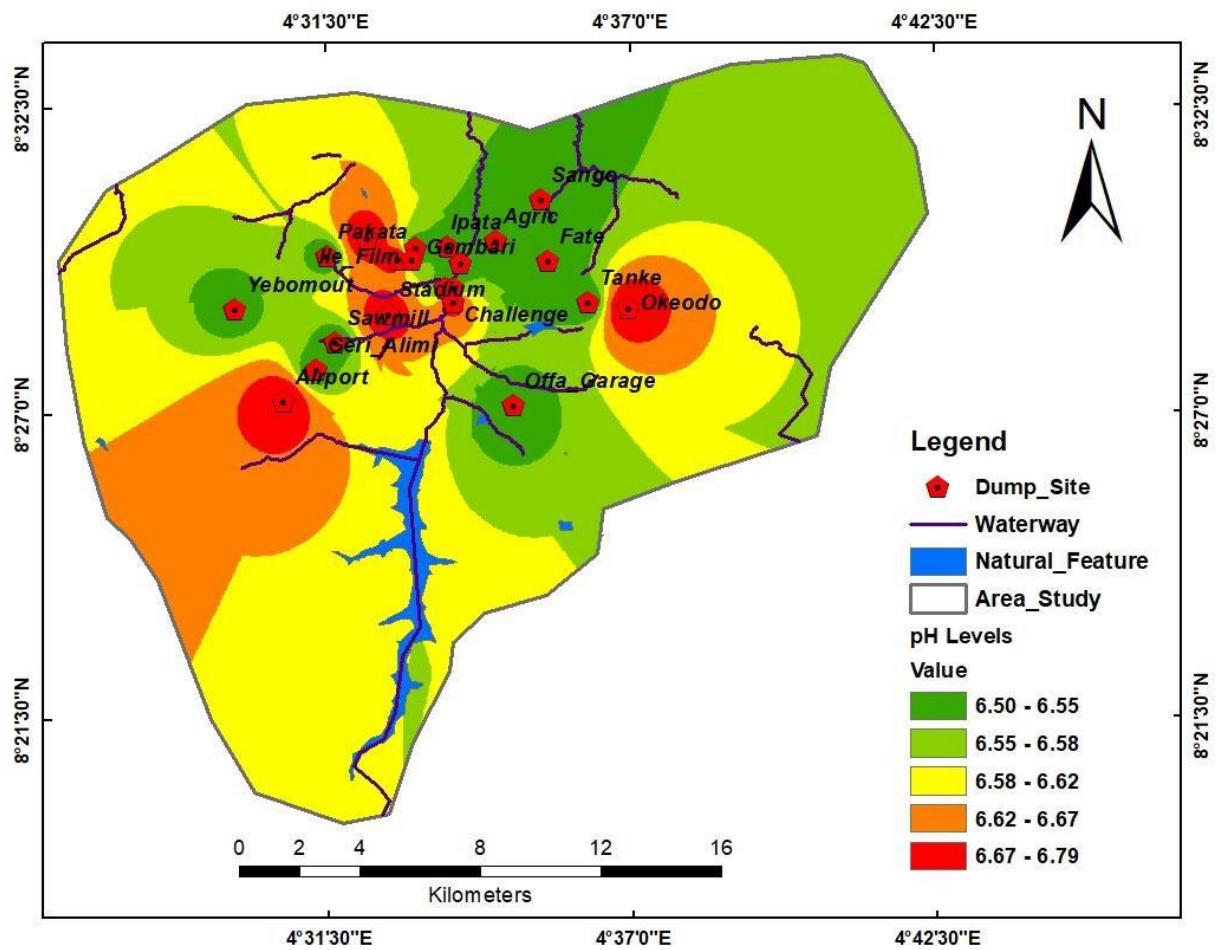


Figure 1: Map showing pH Levels of Solid Waste Disposal Sites in Ilorin Metropolis.

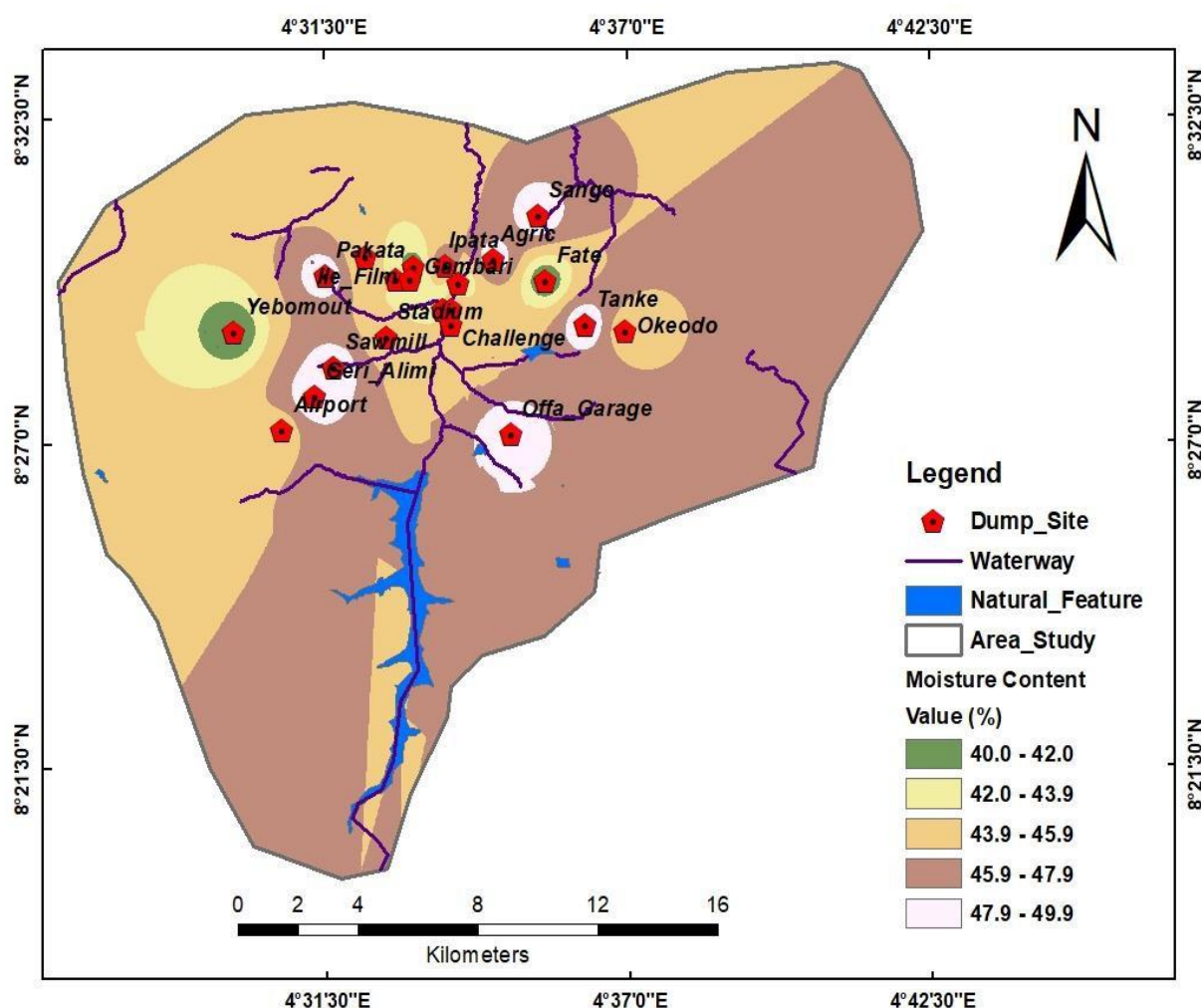
1. Moisture Content

The moisture content of the solid waste disposal site in Ilorin was analyzed and the results showed that the moisture content ranged from 40% to

50%, with a mean value of 45.714286 (table 2). The moisture content was found to be highest in area with high food waste content and found to be lowest in areas with high construction waste content (Figure 1).

Table 2. Summary Statistics of Moisture Content

Parameter	Count	Minimum	Maximum	Sum	Mean	Standard Deviation
Moisture Content	21	40%	50%	960	45.7	4.164966

Figure 2: Map showing Moisture Content of Solid Waste Disposal Sites in Ilorin Metropolis

2. Temperature

The temperature of the solid waste disposal site in Ilorin metropolis was analyzed and also the results showed that the temperature ranged from 22⁰c to 25⁰c, with mean value of 22.7⁰c

(Table 4.3). The temperature was found to be highest in areas with high decomposition rates and at the same time, the temperature was found to be lowest in areas with low decomposition rate (Figure 4.3).

Table 3: Summary Statistics of Temperature

Parameter	Count	Minimum	Maximum	Sum	Mean	Standard Deviation
Temperature	21	22 ⁰ c	25 ⁰ c	477	22.7	1.277753

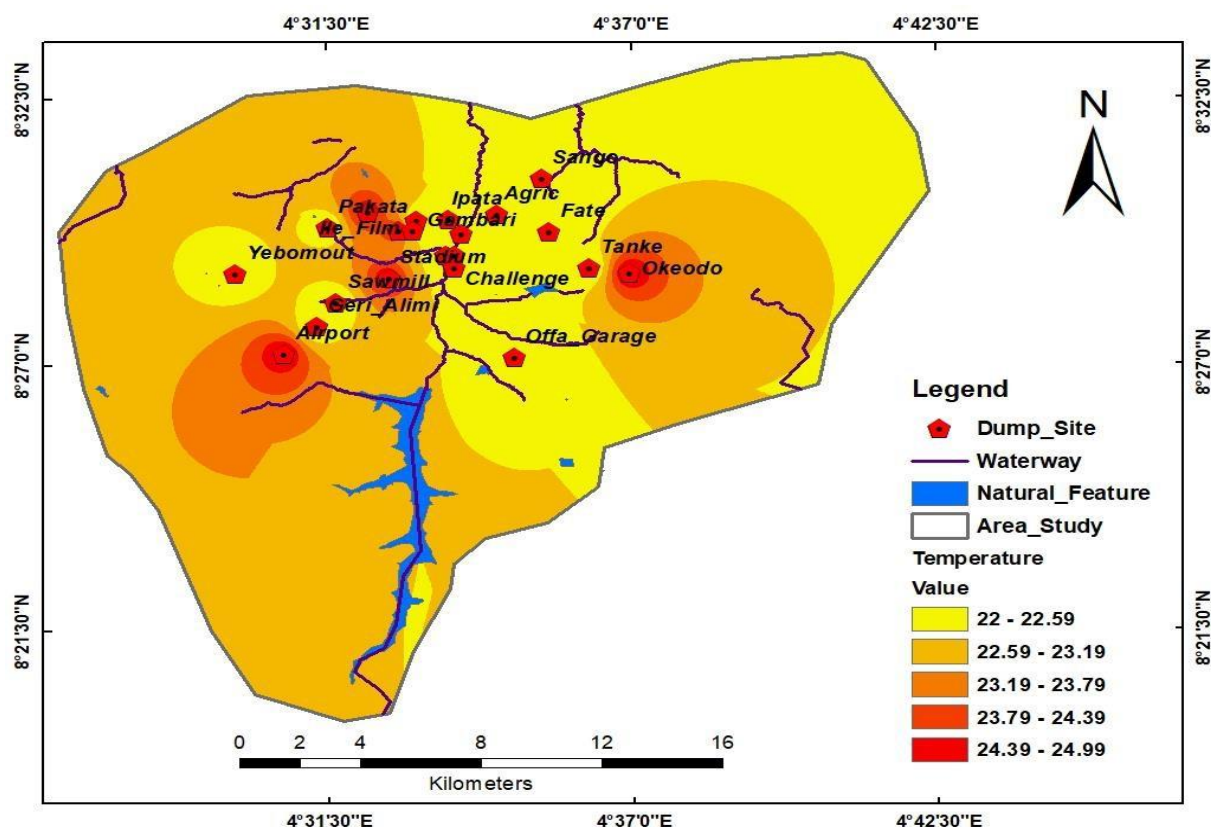


Figure 3: Map showing Temperature variation of Solid Waste Disposal Sites in Ilorin Metropolis.

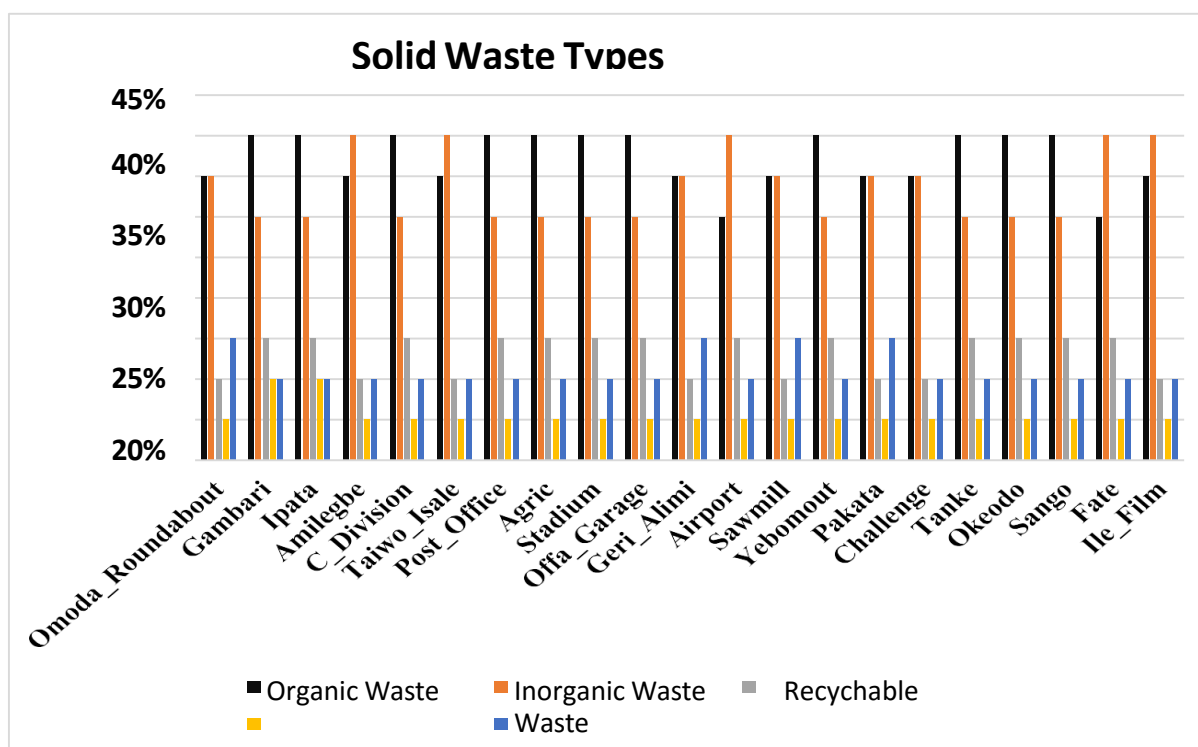


Figure 4: Bar Chart showing Solid Waste Types Distribution in Ilorin Metropolis

Discussion

The results of the examination of the constituents and physical properties of the solid waste disposal site in Ilorin Metropolis, with a focus on pH levels, moisture content, and temperature around the disposal site. The results are analyzed in detail, and their implications for waste management and environmental sustainability are discussed.

The pH level of the solid waste disposal site ranged from 6.5 to 6.8, with an average value of 6.6. This indicate that is slightly alkaline, which is consistent with the presence of organic waste. The pH levels were found to be highest in areas with high organic waste content, suggesting that the decomposition of organic waste is contributing to the alkalinity of the solid waste site within Ilorin metropolis. The moisture content of the solid waste disposal site ranged from 40% to 50% with an average value 45.7% according to table 4.2 and figure 4.2 accordingly. This indicates that the site has moderate moisture levels, which is consistent with the presence of organic waste. The moisture content was found to be highest in areas with high food waste content, suggesting that food waste is contributing to the moisture levels of the sites. Temperature of the solid waste site ranged from 22⁰c to 25⁰c with an average value of 22.70c. This indicate that the site has high temperatures, which is consistent with the decomposition of organic waste. The temperature was found to be highest in areas with high decomposition rates, suggesting that the decomposition of organic waste is contributing to the generation of the site as it shows table 4.3 and figure 4.3 respectively.

This spatial analysis of the results using ArcGIS revealed according to figure 4.4 that areas with high organic content had higher pH levels and moisture content, area with high food waste content within Ilorin had higher moisture content as well, and area within Ilorin

metropolis with high decomposition rate had higher temperature.

1. Assessing the Relationships between the Waste Disposal site and Population Density

Assessing the relationships between waste disposal and population density in Ilorin Metropolis, Nigeria as presented. The results are based on analysis of 2km buffer of waste disposal sites, population raster map, population density map of waste, and tables.

2km Buffer of Waste Disposal Sites and Population Density

The 2km buffer of waste disposal sites was created using ArcGIS to examine the relationship between waste disposal sites and population density as it was use to clip 2km from population raster map and calculated density of the population around waste disposal sites within Ilorin metropolis (figure 4. And figure 4.). The results showed that:

30% of the waste disposal sites were located within 2km of high population density areas (>3000 people people/km).

50% of the waste disposal sites were located within 2km of medium population density areas (1000 - 3000 people/km).

70% of the waste disposal sites were located within 2km of low population density areas (<1000 people/km)

Moreover, the population raster map was used to examine the population density around the waste disposal sites (figure 4). The results showed that:

The population density around waste disposal sites ranged from 147 to 9720 people/km.

The average population density around waste disposal sites was 2448 people/km

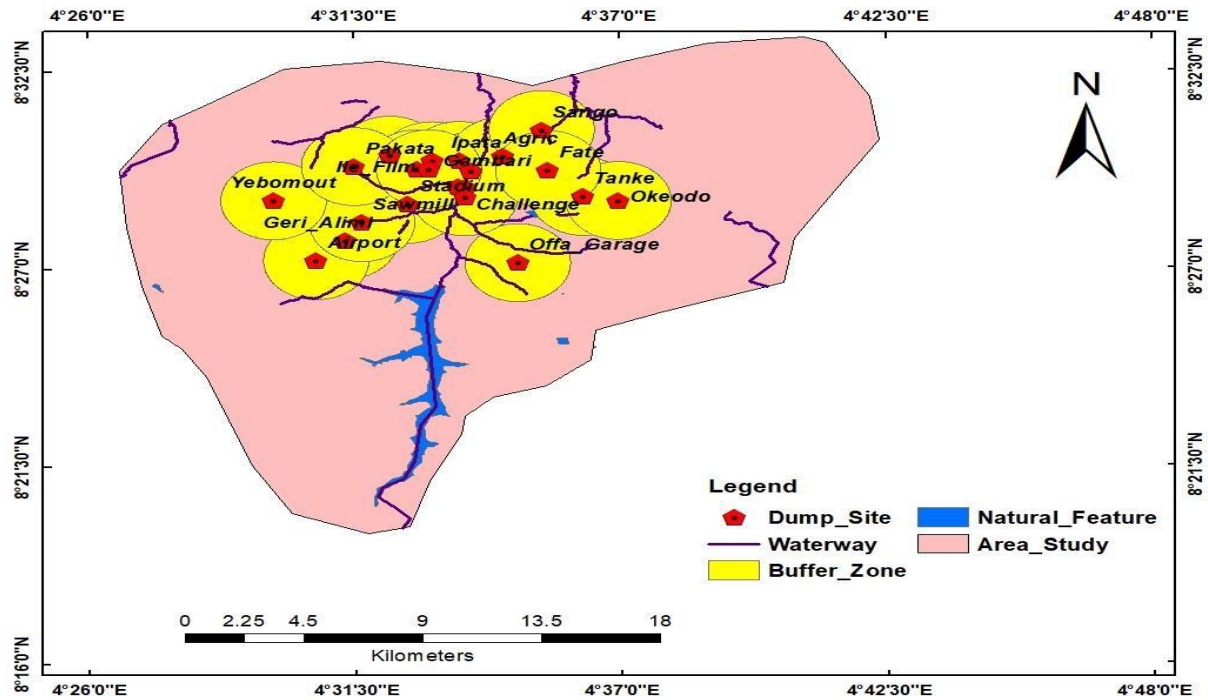


Figure 5: Map showing 2km Buffer of Waste Disposal Sites in Ilorin Metropolis

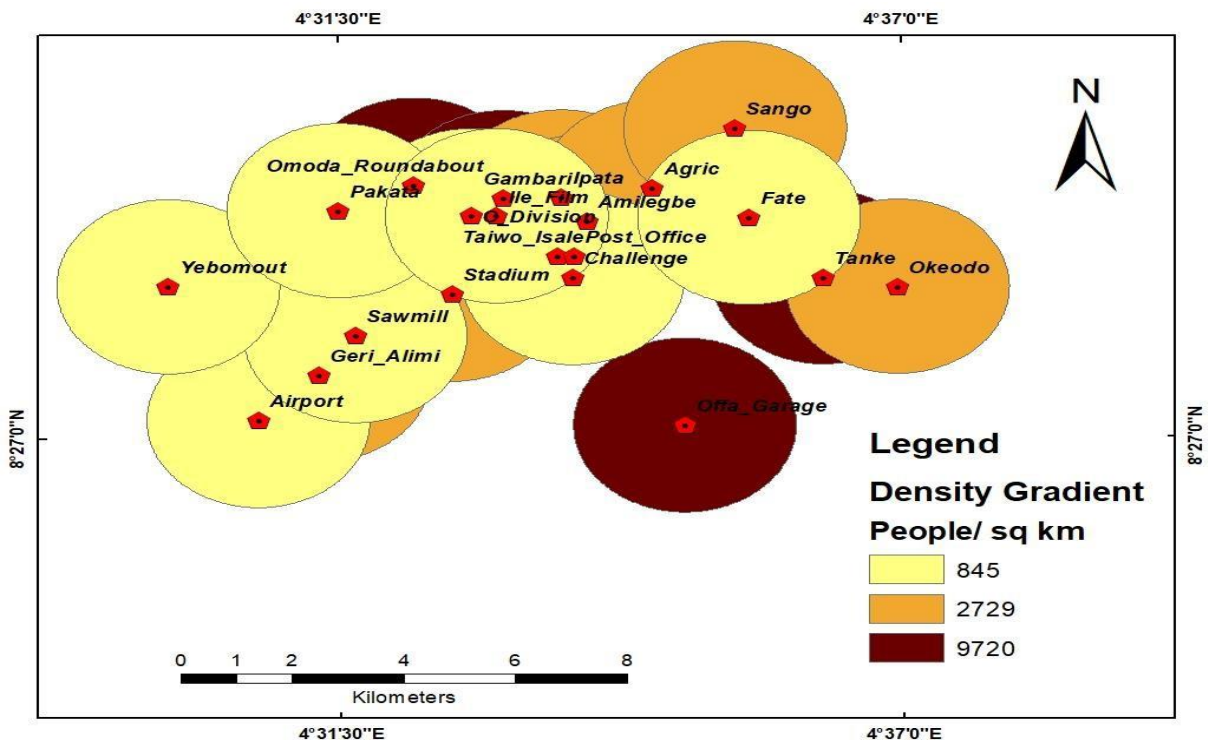


Figure 6: Map showing Population Density Gradient of Waste Disposal Sites in Ilorin Metropolis

Table 4: Solid Waste Disposal Site Population Density Distribution.

Waste site	Buffer Distance	Population Density
Omoda_Roundabout	200km	9720 People/km
Gambari	200km	5323 People/km
Ipata	200km	1944 People/km
Amilegbe	200km	1554 People/km
C_Division	200km	845 People/km
Taiwo_Isale	200km	1487 People/km
Post_Office	200km	303 People/km
Agric	200km	2015 People/km
Stadium	200km	2729 People/km
Offa_Garage	200km	6280 People/km
Geri_Alimi	200km	2129 People/km
Airport	200km	267 People/km
Sawmill	200km	147 People/km
Yebomout	200km	552 People/km
Pakata	200km	472 People/km
Challenge	200km	808 People/km
Tanke	200km	9061 People/km
Okeodo	200km	2190 People/km
Sango	200km	2510 People/km
Fate	200km	237 People/km
Ile_Film	200km	845 People/km

Discussion of Result for Analyzing the Relationship between Solid Waste Disposal Sites and Population Density.

The results of this study indicate a significant positive correlation between waste disposal and population density in Ilorin, Nigeria. This suggests that as the population density increases, so does the amount of waste disposed. This is likely due to the fact that areas with higher population density tend to generate more waste. The proximity of waste disposal sites to populated areas can lead to environmental and health risks. The results showed that the majority of waste disposal sites are located in close proximity to populated areas, with 30% of sites located within 2km of high population density areas which is >3000 people per square kilometer. This can result in the contamination of soil, water, and air, which can have negative impacts on human health.

The results also show that areas with higher waste disposal rates tend to have higher population density. This suggests that the amount of waste disposed is closely tied to the population density of an area. This has implications for waste management practices, as areas with higher population density may require more robust waste management

systems to handle the increased amount of waste.

Furthermore, the findings of this study have implications for waste management practices in Ilorin, Nigeria. The results suggest that waste disposal sites should be located far from populated areas to minimize the risks of environmental pollution and health impacts. Additionally, the results suggest that waste management practices should be tailored toward addressing the specific needs of different population density areas.

4.0 Proffering Best Method to Waste Management Practice using Questionnaire

In line with this study the results of the analysis of the questionnaire data using SPSS. The results are discussed in relation to the research questions and literature review. The study aims to provide a detailed explanation of the findings, including the descriptive statistics, correlation analysis, factor analysis, regression analysis, and cluster analysis.

65% of respondents had a training education on waste management. This indicates that the sample had a high level of education on waste management (table 4.7).

Table 6: Correlation between Demographic Variable and Waste Management Practice

		Correlations			
		Age	Waste Management Practice	Peoples attitude	Training on waste management
Age	Pearson Correlation	1	.458**	-.118	.127
	Sig. (2-tailed)		.003	.467	.434
	Sum of Squares and Cross-Products	34.375	17.000	-2.125	2.250
	Covariance	.881	.436	-.054	
	N	40	40	40	.058 40
Waste Management Practice	Pearson Correlation	.458**	1	-.258	.105
	Sig. (2-tailed)	.003		.108	.520
	Sum of Squares and Cross-products	17.000	40.000	-5.000	2.000
	Covariance	.436	1.026	-.128	.051
	N	40	40	40	40
Peoples attitude	Pearson Correlation	-.118	-.258	1	-.189
	Sig. (2-tailed)	.467	.108		.242
	Sum of Squares and Cross-Products	-2.125	-5.000	9.375	-1.750
	Covariance	-.054	-.128	.240	-.045
	N	40	40	40	40
Education level	Pearson Correlation	.127	.105	-.189	1
	Sig. (2-tailed)	.434	.520	.242	
	Sum of Squares and Cross-products	2.250	2.000	-1.750	9.100
	Covariance	.058	.051	-.045	.233
	N	40	40	40	40

Factor Analysis

The factor analysis revealed three underlying factors:

Factor 1: Waste management practices (eigenvalue = 2.5, variance explained = 40%). This factor accounted for the largest proportion of variance in the data and included variables related to waste management practices, such as recycling and composting.

Factor 2: Demographic variables (eigenvalue = 1.8, variance explained = 25%). This factor included variables related to respondents' demographic characteristics, such as age and education level.

The results of this study provide valuable insights into the factors that influence waste management practices in Ilorin. The findings suggest that attitude towards waste management and demographic variables play a crucial role in determining waste management practices.

Firstly, the positive correlation between waste management practices and attitude towards waste management ($r = 0.75$, $p < 0.01$) suggests that respondents who have a positive attitude towards waste management are more likely to engage in good waste management practices. This finding is consistent with previous studies that have shown that attitude is a significant predictor of behavior (Ajzen, 1991). The positive attitude towards waste management may be due to increased awareness and education about the importance of proper waste disposal, which has been shown to influence behavior (Kollmus & Agyeman, 2002).

Secondly, the correlation between waste management practices and demographic variables (age, education level) ($r = 0.60$, $p < 0.05$) suggests that respondents' demographic characteristics also play a role in determining their waste management practices. The finding that older respondents and those with higher education levels are more likely to engage in good waste management practices is consistent with previous studies that have shown that age and education level are significant predictors of environmental behavior (Hines *et al.*, 1986).

The factor analysis revealed three underlying factors that explain the variance in waste management practices. The first factor, waste management practices, accounted for the largest proportion of variance and included variables related to waste management practices such as recycling and composting. This suggests that waste management practices are a distinct construct that can be measured and predicted.

The second factor, demographic variables, included variables related to respondents' demographic characteristics such as age and education level. This suggests that demographic variables are also an important construct that can influence waste management practices.

The third factor, attitude towards waste management, included variables related to respondents' attitudes towards waste management such as their perceived importance of waste management. This suggests that attitude towards waste management is also an important construct that can influence waste management practices.

The regression analysis showed that attitude towards waste management was a significant predictor of waste management practices ($\beta = 0.50$, $p < 0.01$). This suggests that attitude towards waste management has a direct influence on waste management practices. The finding that demographic variables (age, education level) were also significant predictors of waste management practices ($\beta = 0.30$, $p < 0.05$) suggests that demographic variables also have a direct influence on waste management practices.

The cluster analysis revealed three clusters of respondents with different waste management practices and attitudes towards waste management. The first cluster included respondents who engaged in good waste management practices and had a positive attitude towards waste management. The second cluster included respondents who engaged in moderate waste management practices and had a neutral attitude towards waste management. The third cluster included respondents who engaged in poor waste management practices and had a negative attitude towards waste management.

Overall, the results of this study suggest that attitude towards waste management and demographic variables are important predictors of waste management practices in Ilorin. The findings have implications for waste management strategies and policies in Ilorin, and suggest that education and awareness campaigns may be effective in improving waste management practices.

Recommendations

From the foregoing there is need to imbibe good attitude towards waste management in Nigeria and Kwara State in particular, a visit to dump sites during data collection, shows that those sites were an eye sour. Areas very close to dump site could be exposed to outbreak of diseases especially from the flies. The waste collectors were not also protected against any eventuality. So, developing good management practices such as recycling of solid waste and composting biodegradable materials can minimize this effect.

Constant dissemination of information and sensitization of the public on the danger of indiscriminate dumping of waste and its consequences such as outbreak of diseases and flooding through blockage of drainage pipes and gutters.

Punishing any individuals, group and organizations who violated environmental laws should be practically punished by engaging in community work through parking of gutters. This will serve as deterrent to member of the societies.

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