

Solid Waste Management Practice and Challenges in Gashua, Yobe State, Nigeria

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ABSTRACT

This paper presents an overview of the current solid waste management practices in Gashua town and provides a brief discussion on future challenges. Gashua town the headquarters of Bade Local Government Area since 1949. Since then the population has mainly due to the influx of people and its strategic location along the axial route to significant towns in the state. Wastes are generated mainly from residential, commercial and institutional land uses. Waste collection sites are strategically situated as identified by the agency and designated as high waste generating points, metal waste bins and constructed waste bunkers. The contents of these bins are finally disposed of at a location 6kilometres away from the generating points. Spatial data on waste distribution was collected using a global positioning system (GPS). The data was manipulated and processed using a Geographic information system (GIS) to produce the waste distribution map. Findings revealed that the existing solid waste management system is inefficient as the present practice relies on monthly collection and disposal of waste using an open dumpsite.

Keywords: Practice and Challenges, Solid Waste Management, Gashua, GIS, GPS

1.0. Introduction

The generation and management of solid waste is currently a global issue of interest, specifically in the developing nations universally (Chukwuemeka et al, 2012). The recurrent widespread of communicable diseases in both more prominent cities and medium towns are not unconnected with numerous huge garbage littering the streets, dumping of refuse near water bodies and drainage and in vacant plots in Nigeria (United Nations, Department of Economic and Social Affairs, 2014; Birma *et al.*, 2016). Urbanization, population growth, enhanced lifestyle, inadequate planning and inadequate funding are the factors responsible for the increased solid waste management issues (Abila and Kantola, 2013). Nigeria's population growth rate was 3.0%, and the urban growth rate was at about 5.5% while waste generation rate was at 0.49 kg per day as indicated by the National Bureau of Statistics (Afun, 2006). Urban centres in Nigeria are continuously experiencing population increase as well as a steady rise in waste generation due to urbanization (Kula and Gukop, 2012). A city like Abuja, which is the nation's capital, generates a daily waste per person between 0.55-0.58 kg (Metropolis et al, 201). In 1995 0.55-0.58 million tons of waste is generated in Lagos state one of the most densely settled cities in the world and 998.08 tons of municipal solid waste is generated in Lagos in 2000 whereas 90 tons of solid waste was generated per day in Minna, the capital of Niger State among others (Amuda *et al.*, 2014; Adetunji *et al.*, 2015).

Most industrialized nations have adopted the "Waste Management Hierarchy" (minimization, recovery and transformation, and disposal) as the list of options for developing solid waste management approaches (El-Haggar, 2007). The extent to which anyone option is used within a given country however varies, depending on some factors, such as topography, population density, and transportation infrastructure, socioeconomic and environmental code of practice (Babalola *et al.*, 2010). One of the most analytical vital instruments for appropriate land use planning in the current dynamic world is waste monitoring and management (Anestina et al, 2014)

Essentially, solid waste management in Nigeria is under the responsibility of the Local Environmental Protection Agency as stipulated by the 1988 decree which established the Federal Environmental Protection Agency (FEPA) (Agunwamba, 1998; Amasuomo, 2017). The collection of waste in Gashua is carried out by the Yobe State Environmental Protection Agency, (YOSEPA) Sanitary Board and Metropolitan Council. However; these local authorities have been overwhelmed by the increasing rate of waste generation, collection and transportation problems primarily due to overstretched facilities, shortages of the workforce and lean budget (Ogwuleka, 2012).

2.0. Materials and Methods

Gashua is a community in Yobe State located in the northeastern region of Nigeria, on the Yobe River, a few miles below the convergence of the Hadejia River and the Jama'are River. The average elevation is about 299 m. The population in 2006 was about 125,000 (Yobe State Government, 2016). The hottest months are March and April, with temperature ranges of 38°-43° Celsius. In the rainy season, June-September, temperatures fall to 23-28° Celsius, with rainfall of 500 to 800 mm. Gashua is one of the largest and most developed towns in Yobe State. Since 1949 it has been headquarters of the Bade Local Government Area. The Bade language is spoken in Gashua, and an area is fanning out east and south of Gashua. Bade is one of seven languages of the Chadic family indigenous to Yobe State (Abbas, 2016; Yobe State Government, 2016). The town lies near the Nguru-Gashua Wetlands, an economically and ecologically crucial ecological system. The town is the location of the court of Mai Bade, the Emir of Bade (Schuh and Languages, 2015; Djurfeldt *et al.*, 2017).

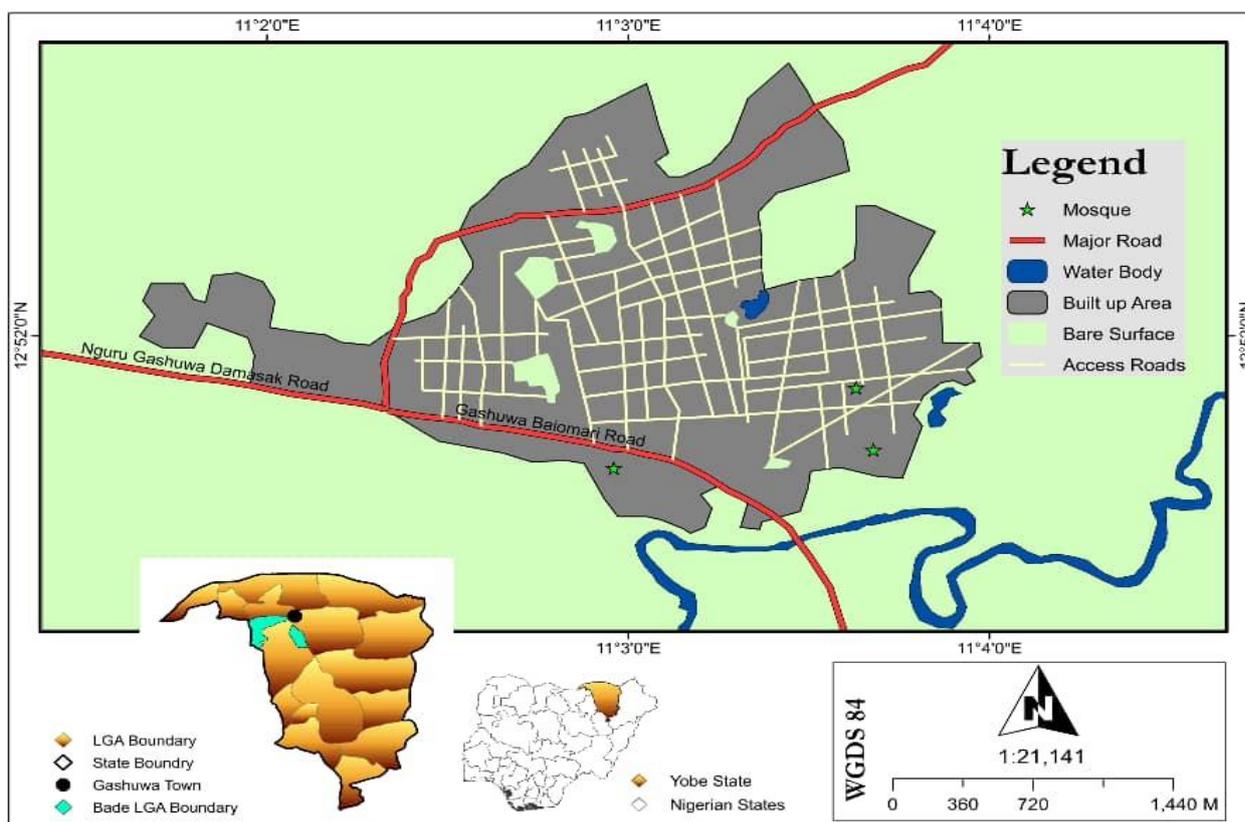


Figure 1: Map of the study area

(Source: Adopted and Modified from the Political Map of Yobe State, 2019)

Gashua town rose from an obscure native authority headquarters to the status of the local government headquarters in 1976. The sudden change in status brought about the increase in population from less than Ten thousand (10,000) persons before 1991 to a Population of about 139, 804 with 73, 709 males and 66, 095 females in 2006 (National population Commission, 2006; WFP, 2016). The rise in the population levels also brought about with it rapid economic growth and consequently the rise in the living standards of the people. Wastes and other contaminants from residential and other land use land uses in Gashua town are highly visible. Currently, domestic solid waste management in Gashua has severe problems, involving low collection rate, unscientific disposal method (open dumping), lack of separation and treatment mechanism in place, and burning of waste dumps without air pollution

control measures in place. For a better understanding of the present solid waste management scenario in the study area, the paper is structured as follows.

Waste collection bins are placed at strategic locations identified by the agency and termed as high waste generating points with wheeled plastic waste bins, metal waste bins and constructed waste bunkers (Uwadiogwu and Chukwu, 2013). The contents of these bins are finally disposed at a location 6 kilometers away from the generating points (Imam *et al.*, 2008). This method adopted shows that the waste collections are sourced specified the approach in which the individual components of the waste stream are sampled, sorted and weighed. This method is useful for defining a local waste stream. The system adopted by the agency is the public bin collection system. This comprises of the collection from different sources like residential and commercial areas and deposited in the public bins located strategically along street corners of the town. Wastes are not treated before disposal at the final dumping sites. Waste minimization and recycling have not gone beyond the practice of picking and sorting through heaps of refuse or garbage. A retrospective study involves the collection of information from (YOSEPA), the agency responsible for the management of solid waste in the town. Other sources of information include personal observations, interviews with staff of the agency. Relevant information was also sourced from reports, books and journals.

Field surveys were carried out in some areas and the existing official dumpsite on the various samples of waste generated. The field survey involved the use of global positioning system to determine the position of dumpsters in the town. After that, the spatial positions of the waste collection points were produced from the integration of Geographic information system (GIS) and global positioning system (GPS) data. The names and locations (Easting and Northing coordinates) were recorded and stored in Microsoft Excel and converted into a database format and after that exported into Arc info GIS which is concerned with the manipulation of spatial and non-spatial data for processing. A layer of these points was created and then combined with a map layer digitized from the satellite imagery of the study area. Figure 1 shows the spatial distribution of waste collection points. Data on monthly waste collection for the period 2012-2018 were also obtained from the agency responsible for waste management. This served as the basis for comparison and testing the hypothesis.

Other method adopted is site Specific Study Approach which involves dumping sites identification, sorting and weighing of the components of waste products. This methodology is useful in defining a local waste especially when larger samples are taken for several seasons (Walling *et al*, 2004).

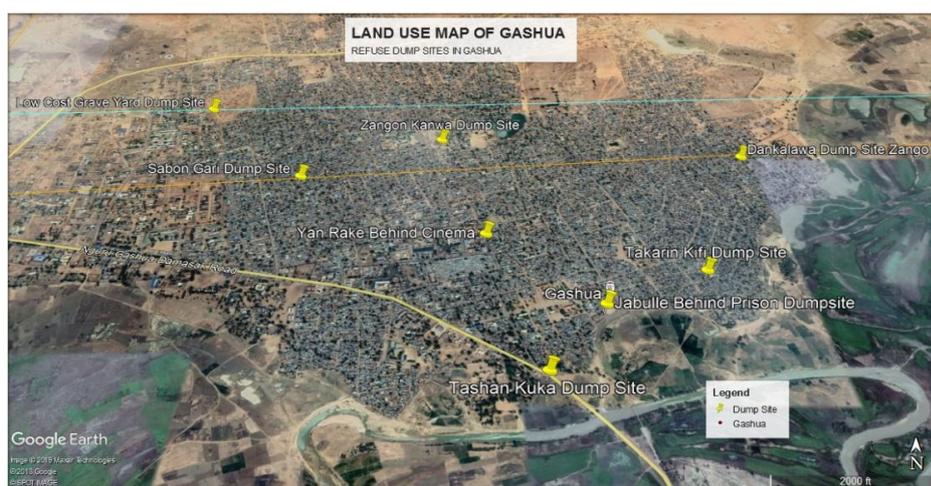


Figure 2: Refuse dump sites in Gashua
(Source: Authors' GIS analysis, 2019)

3.0. Results and Discussion

The waste compositions are as follows: Polythene and Plastic materials, 40% Metal and tins, 5.2% Organic matter, 54.8%. Table 1 below revealed the waste collected in Gashua from 2012-2018. On the whole, the agency collected 132, 685 tons of solid waste between the periods under review, considering the average waste generation of 0.3 kg/person/day. Moreover, the population of Gashua

of 76,000 persons in 2006 (NPC, 2006) and estimated to be 96,448 persons in 2018(NBS, 2018). It can be seen from Table 2 that virtually every month, the agency collected and disposed of waste within the town, but the amount collected remained very little compared to what is seen in the dumpsters. The amount of waste collected stood at 23, 198 tons in 2012 and 21, 483 tons in 2018. This implies that there was a decline in the amount of waste collected over seven years. Table 2 below shows the descriptive statistics used in the calculating mean monthly waste collection of 95% significant level. The analysis of variance (ANOVA) was used to test whether the mean weight of solid waste collected is the same for the year 2012, 2013, 2014, 2015 and 2016, 2017 and 2018. The hypothesis can be written as $[H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5 = \mu_6 = \mu_7 = \mu_8]$ versus $[H_1: \mu: \neq \mu_j]$ $H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5 = \mu_6 = \mu_7 = \mu_8$ all mean weight is not the same while, $H_1: \mu: \neq \mu_j$ for at least one of the mean weight is the same. H_0 is rejected at the level significance of 0.05 since the value of the F statistic (4.038) is greater than the critical value of the F statistic, F critical value (2.219). This indicates that there is a significant difference in the amount of waste collected from 2012-2018 at the 0.05 level of significance. From the preceding, it becomes clear that the agency performed below average as heaps of garbage have taken over the access road and thereby causing traffic problems in some parts of the town while the drainage system has been blocked as a result of poor management practices.

Table 1: Solid waste collection from 2012-2018 in Gashua town

Month/years	2012	2013	2014	2015	2016	2017	2018
January	260	287	182	111	287	285	182
February	239	342	116	302	216	321	202
March	122	435	132	175	229	213	185
April	204	200	245	112	110	172	97
May	345	321	125	195	256	562	345
June	376	431	114	201	243	210	132
July	301	298	98	113	265	267	344
August	302	211	112	50	179	180	283
September	237	154	215	85	150	207	152
October	285	114	154	186	115	162	573
November	343	170	176	168	90	321	287
December	300	318	321	211	67	285	287
Total no. of trips	3314	3281	1990	1909	2207	3185	3069
Total tons	23198	22967	13930	13363	15449	22295	21483

Source: Yobe State Environmental Protection Agency, 2012-2018. Note 1trip = 7 tons

Table 2: Descriptive statistics on solid waste collection from the year 2012-2018

Years	No of collection months	Mean Monthly collection	Standard deviation	Standard Error	Sample variance	95% CI for mean	
						Max.	Min.
2012	12	276.16	486.0206	134.7979	236216.1	376	122
2013	12	273.41	492.7567	136.6661	242809.2	435	114
2014	12	165.83	516.5365	143.2615	266810	321	98
2015	12	159.08	518.8718	143.9092	269228	302	50
2016	12	183.91	513.2545	142.3512	263430.1	287	67
2017	12	265.41	496.8987	137.8149	246908.3	562	162
2018	12	255.75	504.1783	139.8339	254195.7	573	97

Source: Yobe State Environmental Protection Agency, 2012-2018

Table 3: Output generated by the ANOVA

Source of variance	Sum of Squares	df	Mean Squares	F	P value	F Crit.
Between Groups	204861.7	6	34143.62	4.038473	0.001432	2.218817
Within Groups	651003.3	77	8454.588			
Total	855865	83				

Source: Yobe State Environmental Protection Agency, 2012-2018

4.0 Conclusions

The analysis of waste collected shows that there was a decrease in the amount of waste collected from 23198 tons in 2012 to 21483 tons in 2018 during the period under review. The uncontrolled waste generation has led to the loss of the appealing nature of the urban landscape. Gashua town faces the same challenges as many other urban centers in Nigeria regarding infrastructure deficiency, population growth and lack of public awareness on the issue of waste management. This study revealed that inadequate infrastructure and funding are some of the most significant obstacles to successful waste management practices. Even though waste can be recycled to produce new products, these wastes are currently littering every available open space. The biodegradable waste could be composted to organic manure and could be used on the farms as manures. The agency is grossly understaffed as the so-called laborers are hired temporarily. Finally, the public attitude towards waste disposal is not helping matters. Despite the presence of waste collection bins, children especially dump their waste outside these bins. Enlightenment campaigns should be carried to educate the public.

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