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Analysis of Spatial Distribution of Solid Waste Disposal and Collection Points in Urban Ghana; The Case of Ejisu Municipality

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Abstract

The paper analysed how solid waste disposal and collection points are spatially distributed in the peri-urban Ejisu Municipality of the Ashanti Region of Ghana. Solid waste disposal and collection has become a major problem that many developing countries are battling with, because of its associated health and environmental risks. Managing solid waste sustainably requires waste bins to be located at vintage places designated for waste disposal and collection; to ensures easy access by users. Using Geographic Information System (GIS) as a quantitative tool to analyse the distribution of spatial events such as solid waste disposal and collection points, six-communal container positions were recorded using a mobile Global Positioning System (GPS) device. This data was subjected to the Nearest Neighbour Analysis embedded in the ArcGIS V.10.5 software. Results revealed that the nearest neighbour index of 2.244 for the disposal and collection points in the Ejisu township indicated that the communal containers are well spread in the town. Meanwhile, improved management of solid waste disposal practices requires the Ejisu Municipal Assembly (EMA) to provide waste disposal and collection sites to households that are located far from the existing containers. This will prevent indiscriminate practices of waste disposal in the municipality.

Keywords: GIS; Solid Waste; Nearest Neighbour Analysis; Waste Management; Container Distribution

Introduction

Solid waste management has become an overwhelming problem facing both developing and advanced economies in the world. The phenomenon is a consequence of the outrageous growing population and rapid urbanization of cities.[1] noted in high-income nations like North America that rates of the waste collection are almost excellent (100%), about 51% in the nations with middle-income, and about 39% in the nations less economically endowed (low-income), with uncollected solid waste in developing countries managed mainly by households; usually dumped openly, burned, or unusually composted. Therefore, there is a critical need to ameliorate waste collection services that foreshorten contamination and henceforth improve healthy living [1].

As countries and cities get highly populated and prosperous, they produce more goods and services for their people [2]. They also engage in trade and exchange internationally and are faced with huge quantities of waste generated from high levels of consumption, to be managed through proper methods of handling and disposal [3]. Since management of solid waste involves activities related to generation, collection, transport, treatment, recovery, and disposal of solid waste [4-5] Geographic Information System (GIS) has proven to be a useful tool that fast-tracks solid waste management [6-7]. GIS is a broad collection of Information Managing Techniques for storing and analysing data to contribute to the betterment of planning and resource allocation/management [8]. Tremendous changes have resulted from GIS usage in the manner and degree by which geographically referenced data are produced, updated, analysed, and distributed, to facilitate the production of geographic data and its analysis efficiently [8].

The capability of GIS in storing, retrieving, and analysing a large amount of data and spatial output visualization within a defined period [6] has been established. The technique is also applicable in minimizing the cost of waste collection through distance route and collection point optimization [7,9–11]. The GIS and Global Positioning Systems (GPS) software provide a means to capture, map, and analyse solid waste management problems spatially [12]. Generally, there is a vast literature on the use of GIS in managing solid waste in different sectors of the solid waste management system.

To effectively and efficiently develop policy implementation strategies for solid waste management, Municipal Authorities need to know how the temporary solid waste storage sites (communal containers) are distributed spatially within their area of jurisdiction. Solid waste collection points at the various strategic locations in a town where containers/bins are placed for public or individual waste disposal and collected to the main landfill site by a waste collector.

In the waste management system, the collection of Municipal Solid Waste (MSW) is a vital component. Ghana's solid waste collection system uses two key methods that include collection by the door to door, provided by informal and formal private service providers, and the communal collection method, usually provided by various District Assemblies to their localities [13]. Nonetheless, this system is associated with issues of waste container overflow, dumping on the ground at collection sites, and dumping indiscriminately at non-authorized sites [12]. To curb this, there is a need to design a collection system that ensures efficient management and minimizes costs using GIS which has proven to be a cost-efficient tool for decision-makers. [6] used GIS in their study to find routes with minimum costs and least time travel to a collection point by the waste collectors. [11] added that GIS is an essential tool to optimize the collection of solid waste through vehicle route planning costs analysis. This, however, is not different from the assertion of [14] that GIS helps in route optimization for solid wastes collection from transfer points to disposal sites, hence, reducing down costs of managing solid waste.

Distribution of solid waste collection containers to residential areas with spatial equity in a municipality is a herculean challenge to the Municipal Waste Management Authority. Solid waste collection points are usually located within a municipality where most of the waste is thought to be generated. The study of [15] conducted in Kano in Nigeria found that the middle part of the metropolis was characterised by agglomerated waste collection points than the hinterlands. The study by [16] in Urban Katsina in Nigeria also found the amount of indiscriminate dumping increased from less to high-densely populated areas.

Meanwhile, highly populated areas have more authorized collection points than less settled areas [16]. [12] study shows that solid waste container locations in Wa were highly concentrated in the center, characterized by ground dumping at container sites, and a higher number of open-dump sites in the downtown that showed deficiency in the system of collection of solid waste. [17] argue in the concluding part of their study that skips allocation must be based on how populated an area is, and not on the size of the area since waste generation and population have a significant positive relationship between each other in a particular environment.

[18] 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. [17] in a study in Bolgatanga, Ghana, identified that long travel distance for household waste disposal discourages dumping at designated and authorized places. From the literature, we find that where there is an imbalance in the distribution of containers for collecting solid waste in an area, the inhabitants adopt indiscriminate waste disposal methods that lead to environmental contamination [19].

The Ejisu municipal is fast growing in terms of the human population. In this regard, the attending spate of consumption and associated solid waste generated is also increasing tremendously. It has become a seeming challenge for the municipal authorities to manage the solid waste situation in the area. Despite the efforts made in containing the waste menace, little seems to have been achieved in dealing with the collection and disposal of the waste. This challenge has been attributed to the inadequacy of the collection bins in the municipality. However, in a situation where some communal bins have been provided, most of the people fail to utilise the containers, for various reasons, including their proximity to their settlements. It is imperative to assess the spatial distribution of these waste bins, using an accurate technique of GIS methodology, which were hitherto not employed in earlier assessments of the communal waste bins utilisation.

It is, therefore, worthwhile to undertake this study to analyse the spatial distribution of existing containers/bins for collecting solid waste in the Ejisu Municipal Assembly. This study contributes to the literature in offering alternative approaches by assessing spatially, how solid waste collection system could be managed, from an integrated perspective that combines social and geospatial methods in urban jurisdictions.

Materials and methods

Study area

Ejisu Municipality is located in the Ashanti Region in the transitional /semi-deciduous forest region of Ghana. It stretches over an area of 582.5km^2 constituting about 10% of the entire Ashanti Region. The geographical extent of Ejisu is 1° 15' W, 1° 45' W, 6° 15' N, and 7° 00' N with an elevation range between 240m and 300m above mean sea level and 582.5 km2 land size. The Ejisu Municipal is located in the centre-most section of the Ashanti Region and is bordered on northeast and northwest parts by Sekyere East and

Afigya Kwabre independently. It is also bounded on the South by Bosomtwe and Asante Akim South districts as well as the East and North by Asante Akim North and Kumasi Metropolis accordingly [20]. This Municipality as a part of the wet semi-equatorial forest zone experiences two rainfall patterns with an intense rainfall period beginning in March to July and culminating in July with 1.2cm – 1.5cm average annual rainfall. The lesser rainfall periods also start in September and gradually tip-off in November with 0.9cm-1.12cm average annual rainfall. More often than not, warm, dry, and dusty conditions are experienced from December up to February. Ejisu experiences minimum average annual temperatures of about 25°C in August and with about 32 °C in March as the highest average. The humidity of this area is relatively moderate but a little higher in the rainy season.

It has a diverse fauna and flora made of varying forms of economic and aesthetic plant types, and different animals and wildlife. Meanwhile, the Bobiri Forest Reserve is the most popular forest in the municipality with butterfly species, foliage, and different fauna and flora. Figure 1 is the map of the study locality [20].

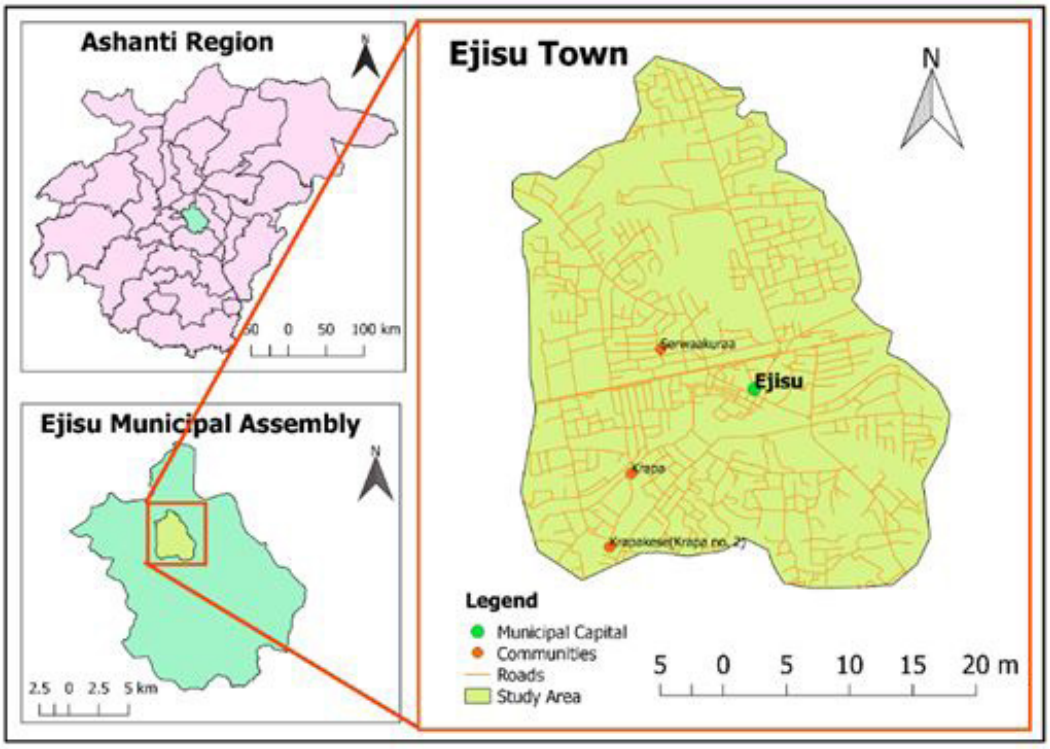

Figure 1: Map showing the study area

Sampling design, instruments, and analysis of data

The multistage simple random sampling was employed to select Ejisu community from a list of the major communities of about 20 and household respondents from a list of the household population size of about 3,191 in the municipality. This approach was adopted due to the homogeneous nature of the communities in terms of human activities. With this type of approach, biases are reduced and general conclusions are drawn.

[21] formula was used to compute for the household sample to participate in the study in order to set the base for generalization. This resulted in a total of 192 households being selected for the study.

Two procedures were used in this study. Firstly, partly coded and pre-coded questions were administered to the study participants during data collection. Frequency, crosstabulations and Chi-square correlation tests tools of the Statistical Package for Social Sciences (SPSS) were used to analyse the data collected from the field survey. Moreover, descriptive and explanatory techniques were the procedures by which the qualitative data from respondents were thematically analysed.

Secondly, a mobile GPS device was used to record the geographic locations of all the communal disposal and collection sites within the entire Municipality through the leadership of the Environmental Management Officer of the Assembly. This was done through the use of the Kobo Collect database system in a pre-coded form. The data was subsequently downloaded in comma-separated value formats and imported into ArcGIS software for subsequent processing. The nearest neighbour tool of the software was used for analysing the type of distribution exhibited by the communal disposal and collection points in the study area.

Results and Discussion

This section of the paper begins with a presentation of the demographic characteristics of the study respondents, followed by a detailed presentation on the distribution of solid waste collection and disposal points in the Ejisu Municipality in a spatial context, and outcomes of the research questionnaire.

Respondents sociodemographic characteristics

The data on socio-demographic features gathered include gender, age, educational level, household size, and income level of respondents. A total of 192 household heads formed the study respondents with a corresponding 192 questionnaire administered to them. The presentations that follow are the details of the demographic data of respondents shown in Table 1 below.

The respondents' age characteristics of the study ranges between 25-above 54 years with results from Table 1 indicating that majority 30.2% (58) of respondents fall within the age group of 25-29years. Households heads that were within the age groups 30-34, 35-39, 40-44, 45-49, 50-54 and Above 54 years represented 21.4 (41), 13.0 (25), 14.1(27), 4.2 (8), 6.8 (13), and 10.4 (20) respectively with lowest household respondents within the ages 45-49years. This suggests that majority of the respondents fall within the productive population range (15- 64) according to the 2010 Ghana Statistical Service report of the Ejisu-Juaben District.

Regarding gender, results from Table 1 indicates that male respondents formed 24.5% (47) whilst the remaining 75.5% (145) represented female respondents. This difference is evidenced because of the predominant engagement of females in managing home waste and related activities in the study area. [22] reported similar observations in their study in the Ejisu-Juaben Municipality (EJMA) and [13] in their study in Kumasi that majority of respondents managing home solid waste are females. This can be attributed to the unskilled nature of waste handling by feeble members in the household such as women and children [23]. Therefore, it can be argued that educating women on household waste handling will improve the sanitation behaviour of society since women are directly engaged in activities of household solid waste management

	Frequency	Percentage
Age categories		
25-29 Years	58	30.2
30-34 Years	41	21.4
35-39 Years	25	13.0
40-44 Years	27	14.1
45-49 Years	8	4.2
50-54 Years	13	6.8
Above 54 years	20	10.4
Total	**192**	**100.0**
Gender of respondent		
Male	47	24.5
Female	145	75.5
Total	**122**	**100.0**
Level of education of respondents		
No formal education	24	12.5
Primary school	37	19.3
Junior High School (JHS)	65	33.9
Senior High School (SHS)	41	21.4
Tertiary School	25	13.0
Total	**192**	**100.0**
Household size of respondents		
Less than 5 people	96	50.0
Between 6 and 10 people	79	41.1
Greater than 10 people	17	8.9
Total	**192**	**100.0**

Source: Field Survey (March 2020)

Table 1: Respondents sociodemographic characteristic

Pertaining to respondents' education levels, results in Table 1 indicate that majority 33.9% (65) had up to JHS education level. This is followed by 21.4% (41) representing respondents with SHS education level, primary education level respondents 19.3% (37), tertiary education level respondents 13.0% (25), and respondents with no formal education representing 12.5% (24) respectively. This confirms the study by [22] where they acknowledged the positive association of education with household waste management. It is henceforth, fascinating to observe that little or no education could mean limited knowledge and understanding for the respondents engaged in managing solid waste and related issues in the area.

In terms of household size of respondents, Table 1 depicts that 50.0% (96) respondents have household sizes with less than 5 people in the community and the least 8.9% (17) respondents have household sizes greater than 10 people. Only 41.1% (79) have household sizes between 6 and 10 people. This could be due to the heterogeneous nature of the Ejisu community made of different settlers. This aligns with the findings of [22] that majority of households had less than 5 persons in the EJMA.

Communal containers spatial distribution in the Ejisu Municipality

From the map below are the total number of 20 communal containers provided to the people of the Municipality by the EMA in collaboration with Zoomlion Ghana Limited. Of these 20 communal containers, 6 of them are located in the study area (Ejisu Township). These are presented respectively in Figure 2 and Figure 5.

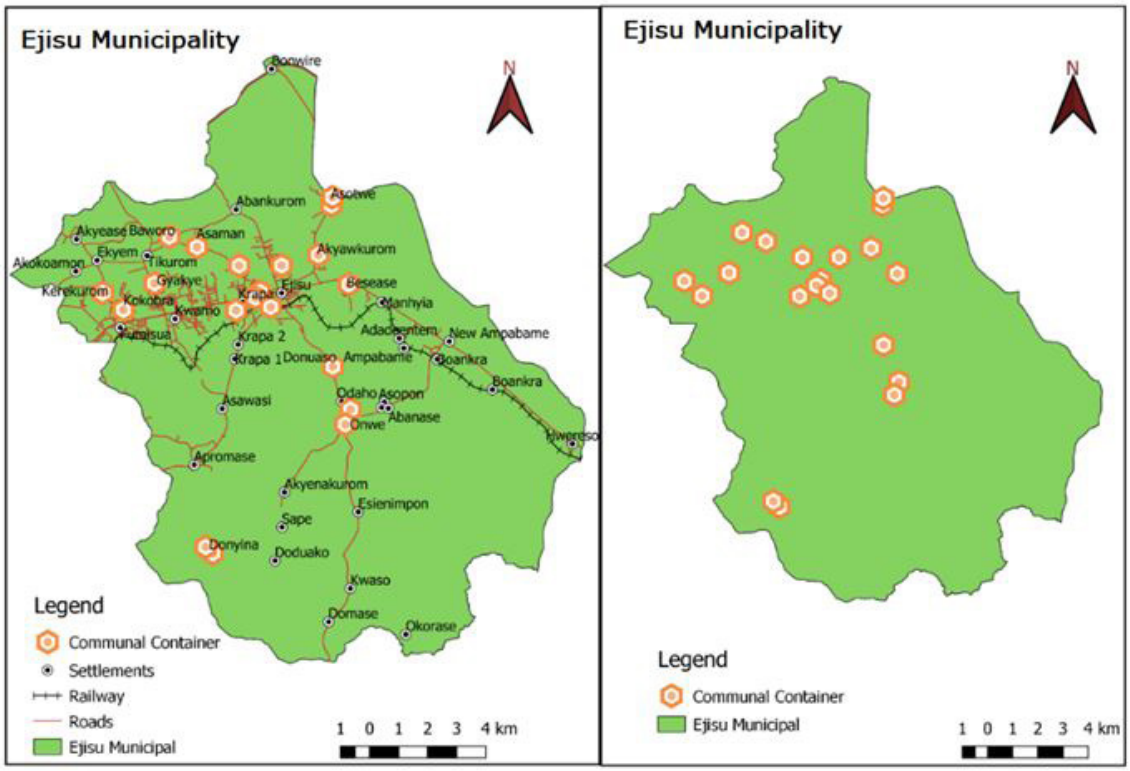

Figure 2: Spatial distribution of communal waste containers in the Ejisu Municipality

In analysing the spatial distribution pattern of the communal waste containers, the observed mean distance among the 20 spatially distributed containers in the entire municipality was calculated to be 811.040m (Table 2) with an expected mean distance of 1069.681m. All the locations of the containers had a deviation of -2.502 (Z-score) below the mean distance. According to [24], values of the nearest neighbour index (NNI) start from 0 (where there is no travel whatsoever) through to 1.0 (in which spacing of distribution is least hence distributed uniformly). An index of 0 implies exclusively clustered distribution, absolute random distribution has 1.0 index value and above 1.0 indicate a propensity to disperse. Therefore;

S/N	Description	Value
1	Number of points	20
2	Observed mean distance	811.040 Meters
3	Expected mean distance	1069.681 Meters
4	Nearest neighbour index (ratio)	0.758
5	Z-Score	-2.069
6	P-value	0.039

Source: Field Survey (March 2020)

Table 2: Nearest Neighbour Analysis of communal containers in the Municipality

- NNI = 0: indicates a cluster point distribution
- NNI= 1: indicates a random point distribution
- NNI = 2.15: indicates a regular or uniform or dispersed point distribution

However, the nearest neighbour index computed to know the type of distribution pattern exhibited by the communal containers in the entire municipality was 0.758, indicating a cluster distribution pattern (Figure 3).

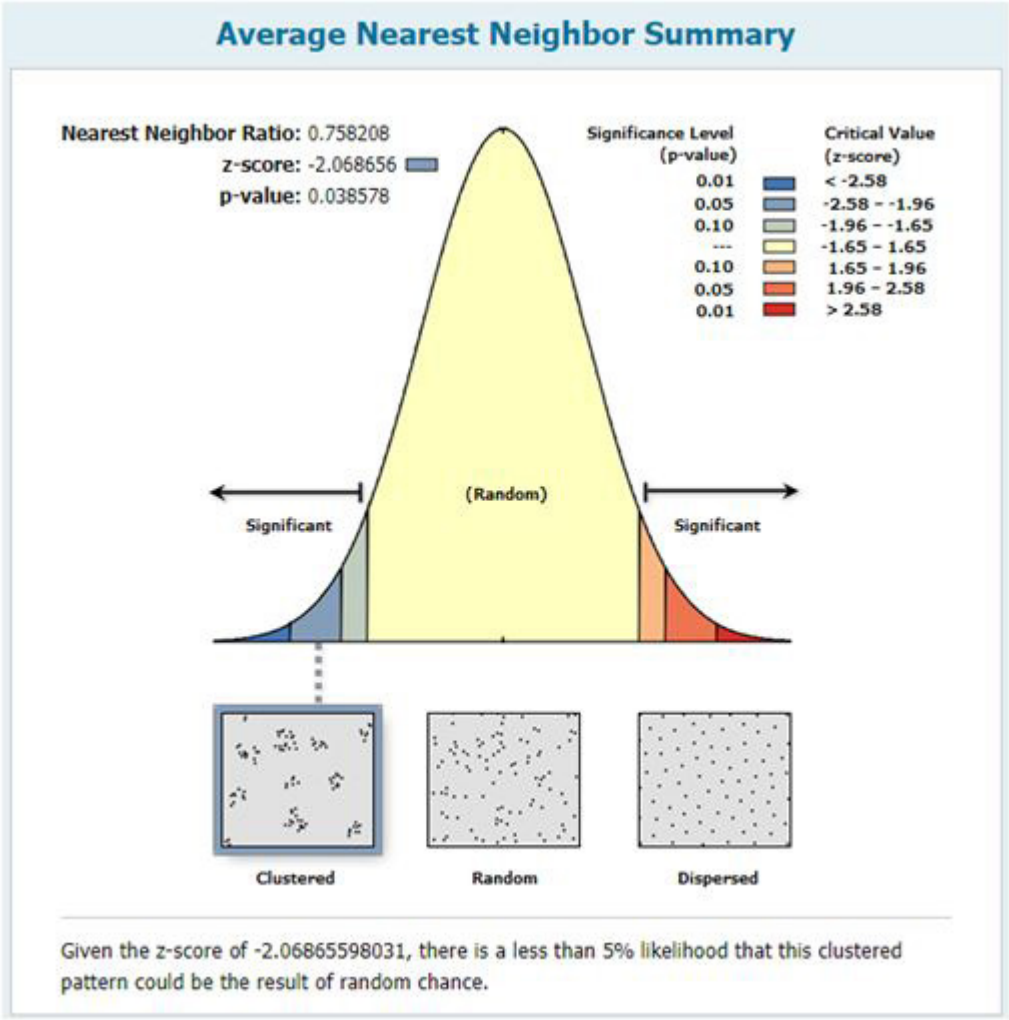

Figure 3: Average nearest neighbour summary curve of waste container distribution in the Municipality

Henceforth, it can be argued that the pattern exhibited by the distribution of communal containers in the municipality is a cluster approaching random type. This is justified by a P-value of 0.039 which implies that given the current z-score value of -2.069, there is a less than 5% likelihood that this pattern could be the result of random probability. Visually, the majority of the containers in our study area are clustered to the northwest part of the Municipality. This could be attributed to its urbanizing form, and the high population numbers of inhabitants living in the northern part of the area, which is ostensibly served by the major Accra-Kumasi highway, as well as other utility services. This concurs with the findings of the study by [15] conducted in Kano in Nigeria that found waste collection points in the middle of the metropolis more agglomerated than in the hinterlands because of dense population. However, this finding contrasts with the finding of [16] in their study in Urban Katsina of Nigeria where they discovered that the densely populated part of the city had only fewer collection points with more hips of refuse, due to lack of space to locate appropriate collection points. Meanwhile, respondents using more time to walk to the disposal sites, which are usually locate in the downtown [15] find other ways of disposing-off their solid waste to minimize travel and solid waste disposal costs [17].

Spatial distribution of communal waste containers in the study area (Ejisu Township).

The map in Figure 5 displays six disposal containers spatially distributed in the study area. The average nearest neighbour index (nearest neighbour index) is determined by dividing the observed mean distance against the expected mean distance in a distribution [24]. The observed average distance of the disposal containers in the study area was 713.6 meters (Table 2) with 318 meters as expected average distance among the container sites. Holding all factors constant, respondents who may want to access the next disposal point in a case where the first point of contact is already full will have to travel not less than 713.6 meters, about 15 minutes on average walking distance. However, we can infer from Table 3 that the nearest neighbour index (2.244) computed for the distribution of the

six communal containers in the study area reveals a maximum dispersed pattern; an indication of well-spread communal waste containers in the study area.

S/N	Description	Value
1	Number of points	6
2	Observed mean distance	713.612 Meters
3	Expected mean distance	318.050 Meters
4	Nearest neighbour index (ratio)	2.244
5	Z-Score	5.828
6	P-value	0.000

Source: Field Survey (March 2020)

Table 3: Nearest Neighbour Analysis of communal containers in Ejisu Township

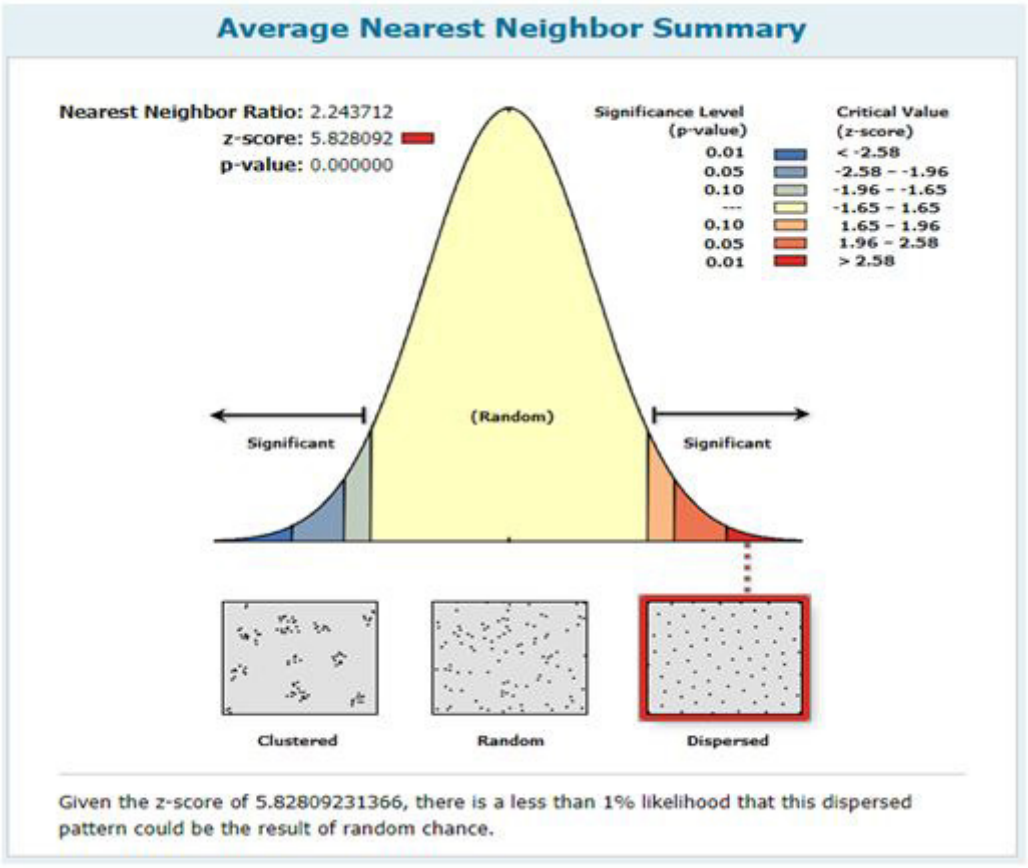

Figure 4: Average nearest neighbour summary curve for the Ejisu Township waste container distribution

This distribution is further justified by the nearest neighbour summary curve in Figure 4 above. It implies that at a z-score of 5.828, there is a less than 1% likelihood that the dispersion of the communal containers in the Ejisu township is a result of random chance.

The solid waste disposal/collection points in the Ejisu Township although shown to be dispersed in terms of its spatial distribution, some communities/areas within the town do not still have access to waste disposal containers given a specified distance range (200m, 400m, 600m, 800m, and 1050m). Meanwhile, to the Environmental Management Officer at the Ejisu Municipal Assembly, all areas within the Ejisu Township had access to a disposal container to empty their waste. In a situation like this, a person who goes to dispose at a certain disposal communal site travels an observed average distance of 713.612m to access the closest communal container. However, this was expected to be 318.050m. Dispersal of the waste collection sites simply means that the traversing distance among the collection sites is very high and not moderate. Walking distance of 713.6m (about 15minutes or more brisk walking) to access a disposal container can be very daunting to households who want to practice proper waste disposal methods [25]. This forces majority of the residence to either adopt door-to-door collection systems or inappropriate disposal systems such as burning and burying.

This aligns with the study of [26] which indicated that inadequate waste bins at the appropriate places lead to habitual littering of the environment. However, this finding is in contrast to the finding of [12] which shows that solid waste container locations in Wa were highly concentrated in the centre of the town, although characteristics of ground dumping at container sites were still prevalent. This ground dumping at the container site was raised as a problem facing the communal container caretakers as

people sneak to the disposal sites at night to empty their waste after being told or seen the container full to the brim. Meanwhile, the inconveniences resulted from one being asked to return home with his/her waste after travelling a long distance from home, which is what most of the respondents tried to avoid, make them litter around the sites. [17] noted in their study that long travel distance for household waste disposal discourages dumping at designated and authorized places, therefore making people dump indiscriminately in their surroundings.

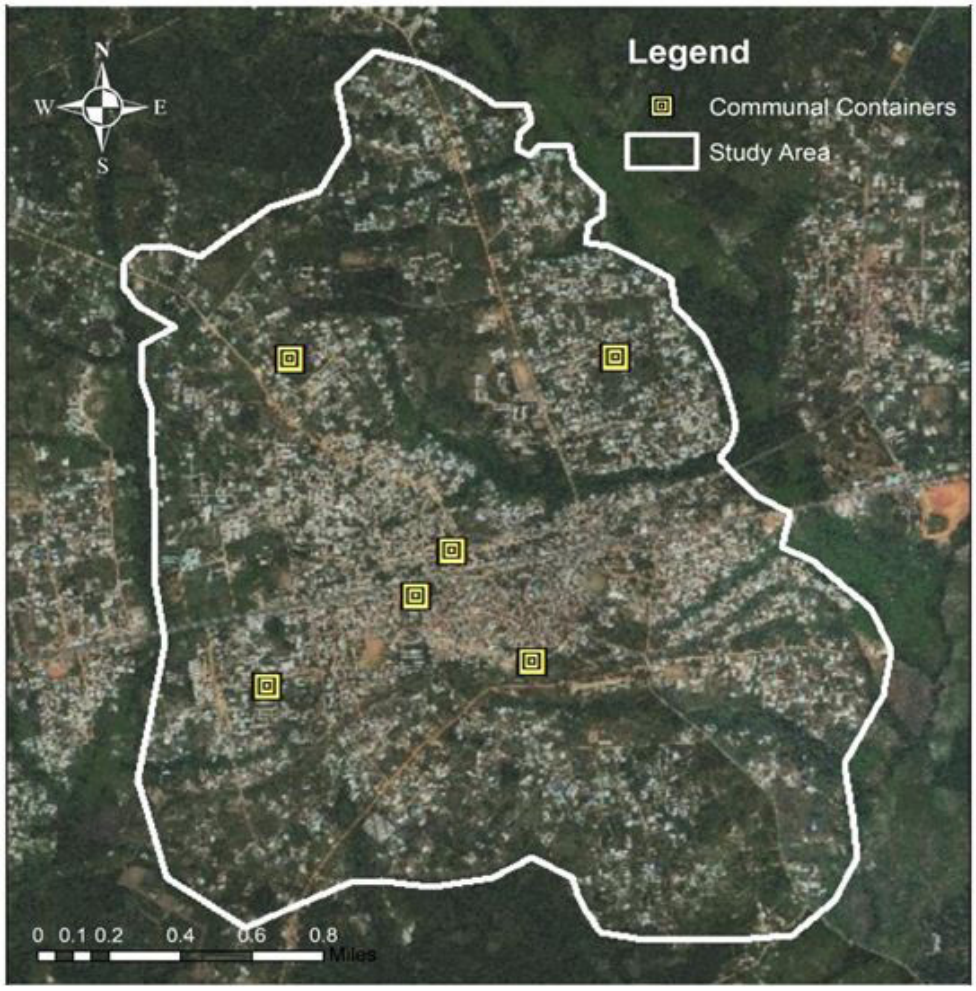

Figure 5: Spatial distribution of communal waste containers in the Ejisu Township

Disposal and collection sites of respondents

Figure 6 provides data analysed on respondents who dispose-off their waste in the area. In this connection, most respondents (145) used the public containers for solid waste disposal, 34 respondents used personal dust-bins, 19 burned their solid waste, two bury their waste, and only five participants used other methods of solid waste disposal. From this presentation, we can infer that

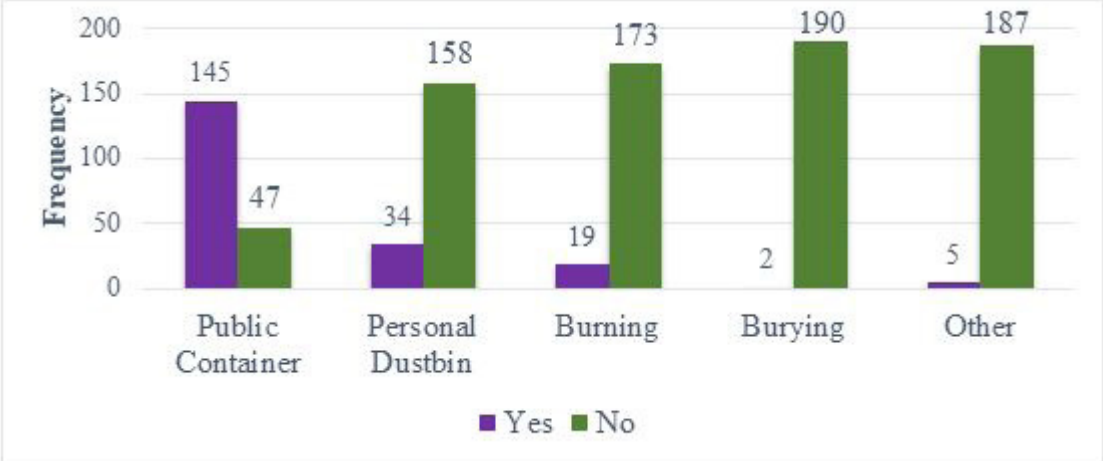

Figure 6: Disposal and collection sites of respondents

majority of households depend on communal containers as a means of disposing-off their waste. This confirms the study by [27] that majority of residents emptied their waste in communal containers with 24.8% practising open-pit burning. However, use of personal dustbins is uncommon in the study area. The most available solid waste collection system in many cities in developing countries is the communal waste container [13]. Despite the predominant use of communal containers in the urban centres, people still dispose-off their waste indiscriminately in nearby bushes and in the open due to inadequate storage receptacles including communal storage receptacles, and long-distance to dumping sites [17].

Proximity of disposal site/point to respondents' residence

Approximately 162 of 192 respondents considered the proximity of the disposal facility to their homes before opting to dump at a particular disposal point. Respondents who did not recognize the closeness of the disposal site to their homes represented 16 percent while those who Considered the closeness to the disposal site represented 84 percent. The form of disposal practices predominant in the community can therefore be argued based on the availability and proximity of disposal and collection points to residents. Most people tend to dump in areas very close to their homes rather than in places far away, confirming the study by [18].

In terms of the time taken by respondents to reach their chosen points of collection or disposal as shown in Table 4, 86 of them used less than 5 minutes to reach the disposal site, where 93% (80) said the distance to the disposal site was not far away from their home. Just seven percent said it was moderately far to go to the disposal point in less than five minutes. Of the 33 people taking about 5-10, 36.4% (12), who didn't live far from the disposal site, 6.1% (19), while 6.1% (2) claimed that the disposal site was very distant from the disposal site. A total of 21 respondents used 10-15 minutes to reach the dumping site where 5.9% (1) of them did not live far from the disposing point, 76.5% (13), but 17.6% (3) were very far away from the disposal point. Twenty-one respondents use 15-20 minutes to get to the disposals nearest, of which 23.8% (5) were said to be living moderately far, 66.7% (14) Lived very far from the disposal point and some ten percent are extremely distant from the disposal site.

Those respondents who reached the closest disposal point in more than 20 minutes were 35. From these 35 interviewees, 2.9% (1) said they were moderately far, 22.9% (8) said that they were far from the point where they disposed-off with 74.3% (26) extremely far from the point of disposal. The minimum distance was approximately 200m for a 10-minute brisk-walk. The majority (83) of respondents lived within a 5mintes walking distance (i.e., approximately 200 meters) from the nearest disposal point and 18.23% (35) of respondents lived outside the disposal site at more than 1000 m (above 20 minutes). The independent Chi-square test given a p-value of 0.000 showed that the distance from residents' homes and the decision of a solid waste disposal/collection site was statistically important. Henceforth the study rejects the null hypothesis which states that the respondents' residence and preference to choose a disposal point are not statistically significant. Meanwhile, the inconveniences in walking over longer distances to dispose-off solid waste at a certain location by households tend to be a greater barrier to frequent and proper solid waste disposal practices [28]. Also, since most of the respondents could access the disposal containers in town, container overflows were experienced in these areas [12].

Residents faced a dilemma with the problem of unavailability of alternative containers. In view of the varying distances that access to the communal containers covered, it was troubling to learn that residents had to return home with their solid waste if the containers were filled up and not emptied in due course. This was reported by a female respondent who complained about the issue;

"Usually, when I send my solid waste to the communal container and it is full, I am asked by the lady in charge to take the solid waste back home, which is very frustrating. It is not easy to leave my work and walk from a distant place to come and dump solid waste and all I could be told is the container is full take your solid waste home and bring it tomorrow. So, I now burn the plastic part of the solid waste, and when the tricycle riders are passing, I pay them for them to dispose-off the solid wastes that cannot be combusted, for me. That is what most of us do in this area."

Time	**Distance**				
	Not far (%)	**Moderately far (%)**	**Very far (%)**	**Extremely far (%)**	**Total (%)**
Less-than 5mins	80	6	-	-	86
	93.0%	7.0%	-	-	100.0%
5-10mins	12	19	2	-	33
	36.4%	57.6%	6.1%	-	100.0%
10-15mins	1	13	3	-	17
	5.9%	76.5%	17.6%	-	100.0%
15-20mins	-	5	14	2	21
	-	23.8%	66.7%	9.5%	100.0%
Above 20mins	-	1	8	26	35
	-	2.9%	22.9%	74.3%	100.0%
Total	93	44	27	28	192
	48.4%	22.9%	14.1%	14.6%	100.0%
P-value		0.000			

Source: Field Survey (March 2020)

Table 4: Crosstabulation of time taken by respondents to reach their preferred disposal/collection site and distance of disposal site from respondent's homes

The consequences of locating solid waste collection points in the centre of a town may include ground dumping, burning, disposal in bush etc. [12, 17]. This could impact the level of interaction between the households and the communal containers. However, almost all communal containers in the study area overflew their brims due to overdependence of nearly all the respondents closer to the communal containers, thereby exerting pressure on the limited communal containers in the area.

Conclusions and recommendations

Generally, the spatial distribution of the solid waste collection points in the entire municipality and the Ejisu Town are shown by the nearest neighbour indexes to be clustered and dispersed respectively. However, the dispersed pattern of communal containers in the Ejisu town makes it difficult for some households to access especially when the one closer to them is full. This forces some of them to dump waste around the containers in the night during which time the caretakers of the communal containers have closed from work, making waste management at the site cumbersome for the caretakers.

As best known to us, this is the first time focusing on mapping the spatial distribution of peri-urban communal solid waste containers in Ghana using the nearest neighbour index in a GIS environment to contribute to the existing literature on waste management.

For the EMA to improve the management of solid waste that will prevent indiscriminate practices of waste disposal in the area, they should provide waste collection containers closer to households that find it difficult to access the existing ones. This will minimize the frustration of carry-your-waste-back-home (CYWBH) and prevent households from indiscriminately dumping, burning, and burying waste that will have significant environmental repercussions. Policymakers should also make sure that additional communal containers are provided and strict measures must be instituted to prevent recalcitrant night waste disposers from doing so to avoid payment or carry the waste back home.

Further research may be conducted to explore deeply into waste collection point selection criteria in the municipality and why some people try to dispose-off their waste at night when communal container caretakers have already closed from work.

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