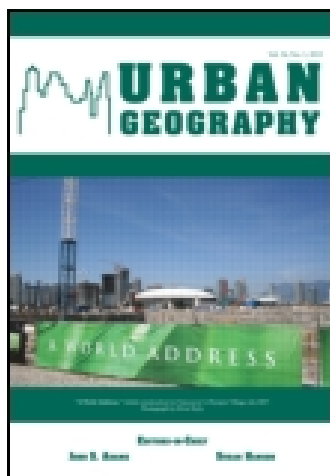


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Publisher: Routledge

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Urban Geography

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/rurb20>

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Published online: 11 Aug 2014.



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To cite this article: George Owusu, Edward Nketiah-Amponsah, Samuel Nii Ardey Codjoe & Robert L. Afutu-Kotey (2014) How do Ghana's landfills affect residential property values? A case study of two sites in Accra, *Urban Geography*, 35:8, 1140-1155, DOI: [10.1080/02723638.2014.945261](https://doi.org/10.1080/02723638.2014.945261)

To link to this article: <http://dx.doi.org/10.1080/02723638.2014.945261>

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How do Ghana's landfills affect residential property values? A case study of two sites in Accra

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(Received 24 April 2013; accepted 5 February 2014)

Like many countries in sub-Saharan Africa, Ghana lacks well-engineered sanitary landfill sites. Increased urbanization and concomitant real estate growth lead landfills to compete with residential land use, resulting in closer proximity between landfill sites and residential neighborhoods. The effects of landfills on the property values of nearby residential communities have been the subject of much debate in the developed world, where state-of-the-art and environmentally well-engineered landfills are common. However, academic and other research is inconclusive on the effects of landfills on property values in the developed countries. This paper addresses this knowledge gap by exploring the effects of landfills on residential property values in Ghana, using the Oblogo and Mallam landfills in Accra as a case study. Our analysis indicates that while landfills do depress nearby residential property values, the effects are contingent on property location relative to the level of urbanization in a community, and year of completion and total costs of property development.

Keywords: Accra; landfills; property values; hedonic pricing models; OLS regression

Introduction

Engineered landfill sites are rare in many parts of the developing world, where the rapid pace of urbanization and urban growth have outpaced municipal authorities' waste and sanitation management capacity (Fobil, Armah, Hogarh, & Carboo, 2008; Owusu, Oteng-Ababio, & Afutu-Kotey, 2012). A significant proportion of solid and liquid waste generated may be left uncollected or, when collected, disposed in open dump sites (Chaplin, 1999; United Nations Population Fund [UNFPA], 2007; World Bank, 1999). According to the World Bank (1999), while decision-makers in most developing countries (including sub-Saharan Africa) recognize the need to upgrade open dumps to sanitary and engineered landfills, achieving this has been difficult in practice. As such, at both national and municipal levels, few developing countries have taken steps to construct, operate, and maintain sanitary landfills.

Like much of the developing world, Ghana is undergoing rapid urbanization with serious consequences for the provision of basic services, including sanitation and proper waste management, particularly in large cities and towns (Environmental Protection

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Agency [EPA], 2002; Institute of Statistical, Social and Economic Research [ISSER], 2007; The New Legon Observer [NLO], 2009). As a result of poor infrastructure and weak capacities of municipal authorities, municipal solid waste (MSW) management has become a critical problem in Ghana, especially in the largest city and national capital, Accra (Ayee & Crook, 2003; Crook & Ayee, 2006; Mensah & Larbi, 2005; NLO, 2009).

Landfilling, which is described as the most feasible option of waste disposal due to its costs and environmental impact, has been widely advocated in developing countries such as Ghana (Lim & Missios, 2007; Parker, 2003; World Bank, 1999). If even society reduces, reuses, and recycles waste at source of waste generation, safe and sanitary landfill will still be needed (Al-Jarrah & Abu-Qdais, 2006; Fort & Scarlett, 1993; Parker, 2003). However, landfills that meet engineering and environmental requirements are rare in Ghana (EPA, 2002; Mensah & Larbi, 2005). In fact, Ghana's EPA, the public agency in charge of setting environmental standards, noted not even a single well-engineered landfill existed in Ghana in 2002 (EPA, 2002). It is only more recently that cities such as Kumasi, Sekondi-Takoradi and Accra have constructed engineered landfills. However, the capacities of the landfills are very small relative to the quantity of wastes generated daily in these cities.

Landfills in Ghana are usually not well engineered, and their operations tend to fall below the environmental and health standards. As a result, the siting of landfills has engendered conflicts and protests from both residents and civil society organizations (Owusu et al., 2012). These protests usually stem from the perception that landfills will cause negative health and environmental impacts on adjacent neighborhoods. Furthermore, the sites proposed for landfills tend to be in peri-urban areas, where there is already intense competition over land use.

Unlike the developed countries, where the impact of landfills on residential property values has been given serious attention and researched, this issue is rarely studied in urban Ghana or other sub-Saharan African cities. Ghana's EPA landfill guidelines document, which aims at improving landfill standards and serves as the blueprint for the development of these sites, does not consider residential property values (see EPA, 2002). The present paper seeks to bridge this knowledge gap by examining the effects of landfills on property values, using two landfills (Mallam and Oblogo) in peri-urban Accra as case studies. The goal of this research is to generate knowledge to be used for effective siting of landfills and waste disposal, as well as to help decision-makers who seek to ameliorate any negative impacts on property values in large Ghanaian cities.

In the next section, we turn to the theoretical underpinnings of our study. This is followed by our research methodology and then a summary of existing knowledge on the growth of Accra and its waste management challenges. We continue with a brief overview of the Mallam and Oblogo landfills, followed by a regression analysis of the effects of our case study landfills on property values in their two host communities. We conclude with some implications for the siting of landfills near residential and other properties in Accra and urban Ghana.

Theoretical perspectives: landfills and property values

Holding the physical characteristics (e.g. size, age, and construction materials) of a property constant, the literature on land and housing values indicates that environmental features can increase or decrease property value (Nelson, Genereux, & Genereux, 1992). These environmental features include noise level (especially from vehicular, rail, and air traffic), ambient air quality, and perceived general landscape conditions. According to Nelson et al. (1992, p. 359), the possibility that some land uses may negatively impact

other uses drives planners to use zoning to physically separate land uses with prescribed distances, setbacks, and buffers (also referred to as green belts).

In broad terms, landfills are generally regarded by both planners and the public as a form of nuisance. Hence, as Parker (2003) notes, landfills exist according to “the first law of garbage: *everybody wants it picked up, but nobody wants it put down anywhere near them.*” According to Nelson et al. (1992) and Lim and Missios (2007), prospective residential property owners or renters tend to equate landfill proximity and size with diminished environmental and life quality in nearby neighborhoods. However, researchers have not taken the effect of landfills on nearby property values as a given; rather, it is a subject of intense debate. Some studies indicate negative effects, while others indicate no significant effects or even positive effects on property values (Bleich, Findlay, & Michael Phillips, 1991; Mundy, 1992; Nelson et al., 1992; Parker, 2003). Bleich et al. (1991, p. 252) concludes that landfills, if well designed and managed, can be a good neighbor and have no statistically measurable negative impact on surrounding property values. In this direction, Parker (2003) has cautioned that sweeping generalizations (whether positive or negative) about the economic effects of a landfill on a community should not be extrapolated as a universally applicable fact.

Within the debate on landfills and property values, researchers have been drawn to three key interrelated issues: landfill and distance, landfill size, and nearby communities’ level of exposure to or enclosure by landfills. Regarding distance, some research has established a price–distance relationship between residential property and landfills. Here, the view is that houses or properties located closer to a landfill will sell at a lower price than similar houses located farther away (Ready, 2005). This reflects landfills’ possible property–price depressing effects. However, other studies have found no statistical relationship between landfill proximity and house price (see Bouvier, Halstead, Conway, & Manalo, 2000; Parker, 2003). Expanding on the price–distance relation in terms of class and degree of urbanization, Reichert, Small, and Mohanty (1992) introduced another dimension, noting that landfills will likely have adverse impacts on housing values if located within several blocks of an expensive housing area. However, for less expensive housing areas, the impact of landfills on housing values is less pronounced or even absent, and it essentially has no effects on properties in predominantly rural areas. Nevertheless, Ready (2005) concludes that there has not yet been a study which uses empirical evidence to conclusively demonstrate small or negligible property values impact on lower-value housing markets.

Second, various studies on landfills have concluded that a landfill’s size is generally significant to its impacts on nearby property values. The underlying logic here is that larger landfills tend to be associated with greater external effects, resulting from a higher volume of waste trucks, larger parcel of land used, and a longer period of post-closure stabilization—all consistent with greater negative impacts of landfills on the natural environment and human health (Lim & Missios, 2007). On the other hand, smaller landfills are perceived to be associated with smaller external effects, which therefore result in limited or possibly no impact on the values of nearby properties. However, a key difficulty of this theoretical proposition of landfill size and land values is its silence on what specifically constitutes a “small” or “large” landfill. Furthermore, Lim and Missios (2007) have questioned whether all types of landfill externalities are considered equally (or are even perceived) by housing consumers. Again, this complicates how specific landfills externalities impact residential property values.

Third, some studies have considered whether property value effects are a function of nearby communities’ level of enclosure by or exposure to a landfill. In this regard, it has been noted that property values tend not to be affected when a community is separated

from the landfill by a natural or an artificial barrier, if trucks moving to and from landfill do not pass through the host community, and if community residents do not see, hear, or smell the landfill. In short, landfills that are location-restricted, operate out of view of nearby communities, and are well managed (such as having lower levels of odor, blowing debris and seagulls) are unlikely to impact property values negatively. It has been stressed that the reverse of this situation is also true.

Our research question is as follows: to what extent are existing scholarly views on landfills and property values, which are largely captured from studies undertaken in the developed world, applicable to the Ghanaian context? The subsequent sections of this article will attempt to address this and related questions.

Research methodology

The analysis in this study is based on data and information collected from both primary and secondary sources. However, key to our analysis is the primary data collected from the two landfill host communities, Mallam and Oblogo, in June–July 2009, using questionnaires, in-depth interviews, focus group discussions, and direct observation. In addition, global positioning system (GPS) devices were used to map out the two landfills and their host communities, including all houses/plots on which data were collected. We used this technique to determine the exact distances between the two study landfills and the properties/houses on which data were collected.

Using the four compass coordinates (north, south, east, and west), 120 houses and plots of land within a two-kilometer radius of the edge of each of the landfill were mapped and their owners interviewed using a questionnaire. This included 30 houses and plots of land per coordinate direction for each landfill. Based on the houses and plots of land in each direction, respondents were selected on the criterion of interviewing every second house owner. Where there were few properties (either houses or land plots) in a row, we used a 100% sample. Questions asked included the following: length of stay in the area, changes in property values during that time, changes in land use, perceived changes in the aesthetics of the area, effects of the landfill on residents' livelihoods, and perception of the management of the landfill site.

Using similar questions to those in the questionnaires, two focus group discussions for nonproperty/land owners (one for adult males and the other for adult females) were convened in each of the landfill communities. The participants in the focus group discussions were adults who have resided in the area for not less than ten years. In addition, key informant interviews were held with two traditional leaders and two opinion leaders (local government representatives, an assembly person, and an educated/business personality) in the area. Furthermore, direct observations were undertaken at the Mallam landfill (which was still active at the time of fieldwork) regarding the number of trucks tipping per hour, total number of scavengers on-site, equipment being used, and other related characteristics.

Secondary data used in our study included landfill area and population serviced, opening and expected closure date, the size and annual waste intake, waste classification, management of landfill gas and leachate, and site pest and rodent control. Other secondary information requested from the operators included tipping fee (if any) and costs of landfill operation. This information was collected from the Waste Management Department of the Accra Metropolitan Assembly (AMA) and a private waste collection company, Zoomlion.

It must be stressed that our study is limited in terms of the dearth of data on housing and land sales in Accra and in Ghana generally. According to Aryeetey, Al-Hassan, Auming-Brempong, and Twerefou (2007), the housing market in Ghana is not well

tracked, with transactions largely carried out informally. In addition, the operations of real estate agencies and the mortgage market are limited for a number of reasons. These include the high cost of land acquisition due to conflicting and parallel institutional involvement in land transactions and titling; absence of basic infrastructure, placing obligations on private housing developers to provide such infrastructure; high costs of building materials, many of which are imported; and high costs of mortgage borrowing (Mahama & Antwi, 2006; Songsore, 2003). For these reasons, especially high cost of borrowing, many private or individual house owners build their own houses on an incremental basis, taking several years to complete (ISSER, 2013; UN-Habitat, 2011).

In addition, like many local governments in Ghana, the Ga South Municipality (which hosts the two landfills in our study) does not collect property taxes and therefore has virtually no records on the values of individual properties in the study area.¹ As a result of the limitations imposed by the available data, commonly used techniques to evaluate environmental benefits/costs, such as contingent valuation and hedonic pricing models (see Lim & Missios, 2007; Nelson et al., 1992; Ready, 2005; Reichert et al., 1992), could not be used in our study. Instead, we analyzed landfills' effects on nearby property values using proxy indicators drawn from the questionnaire survey. We used a simple econometric method—the ordinary least square (OLS) method of estimation. Variables that are taken into consideration in our OLS model include the following: property location, declared property value should one decide to sell, cost of plot on which property is located, size of land on which property is located, total cost incurred in developing the property (house), and distance between the property and landfill site. Other variables included status of property (completed or uncompleted),² type (use) of property, material used in building and roofing, type of toilet facility, whether the property is fenced or unfenced, year in which property development began, and year in which property development was completed.

The effect of landfills on property values could be generally specified as follows:

$$Y_i = \beta_0 + \beta_i X_i + e_i \quad (1)$$

where

Y_i is a proxy for property values in our study communities, estimated by the current sales value declared by property owners,

β_0 is a constant to be determined in the model,

β_i is a vector of parameters to be determined in the model,

X_i is a vector of explanatory variables specified in Equation (2) and explained in Table 1.

e_i is an error term which washes away in this case because both the negative and positive errors cancel out in a linear unbiased estimate.

Specifically the equation becomes

$$\begin{aligned} \text{VALUEP} = & \beta_0 + \beta_1 \text{LOC} + \beta_2 \text{CPLOT} + \beta_3 \text{PPRICE} + \beta_4 \text{DISTANCE} + \beta_5 \text{PSTATUS} \\ & + \beta_6 \text{MATROOF} + \beta_7 \text{TTYPE1} + \beta_8 \text{TTYPE2} + \beta_9 \text{BUILDMAT} \quad (2) \\ & + \beta_{10} \text{FENCE} + \beta_{11} \text{LSIZE} + \beta_{12} \text{FDEV} + \beta_{13} \text{SDEV} \end{aligned}$$

Table 1 provides a detailed explanation of the variable used in Equation (2).

Table 1. Variables and definitions.

Variable	Parameter	Definition	Units of measurement
LOC	β_1	Location of property	0 for Mallam and 1 for Oblogo
VALUEP	(dropped due to multicollinearity)	Value of property if one decides to sell	Continuous, Ghana cedi (GHC)
CPLOT	β_2	Cost of plot on which property is situated	Continuous, Ghana cedi (GHC)
PPRICE	β_3	Total cost incurred in putting up the property	Continuous, Ghana cedi (GHC)
DISTANCE	β_4	Distance between property and landfill site	Continuous, (Meters)
PSTATUS	β_5	Property status; captured by a dummy variable coded 1 if property is completed and occupied otherwise 0.	Dummy
MATROOF	β_6	Material used in roofing property (metal sheets/tiles) are coded 1 otherwise 0	Dummy
TTYPE	β_7 and β_8	Type of toilet facility available in the property. Two dummies are used as proxies. Properties with WC are coded 1 otherwise 0 (TTYPE1). All other toilet facilities are coded 1 otherwise 0 with no toilet facility as the reference point (TTYPE2).	Dummy
BUILDMAT	β_9	Material used in developing the property (house). Properties built with blocks and bricks are coded 1 otherwise 0	Dummy
FENCE	β_{10}	Fenced or unfenced. Fenced property is coded 1 and unfenced coded 0	Dummy
YACQUI	(dropped due to multicollinearity)	Year in which property was acquired, coded 1 if property was acquired before 1990 otherwise	Dummy
LSIZE	β_{11}	Size of land on which property is located	Continuous (meters)
FDEV	β_{12}	Year in which development started on property, coded 1 if property was acquired before 1990, otherwise 0.	Dummy
EDEV	β_{13}	Year in which development on the property ended, coded 1 if before 1990 otherwise 0.	Dummy

Accra: urban growth and the solid waste challenge

A key characteristic of the urbanization process in Ghana, like that in much of the developing world, is the skewed distribution of the urban population toward a few large centers, sometimes referred to as urban primacy (Yeboah, Codjoe, & Maingi, 2013). The Greater Accra Metropolitan Area (GAMA) is the largest and densest metropolitan area in Ghana. Currently, GAMA is made up of 12 local government areas: Accra Metropolis, Tema Metropolis, and 10 other municipalities. Table 2 indicates that the population of GAMA rose from over 827,000 in 1970 to about 1.3 million in 1984, reaching over 2.5 million in 2000 and nearly 3.6 million in 2010 (Ghana Statistical Service [GSS], 2012;

Table 2. Population Growth of GAMA,³ 1970–2010.

District	1970	1984		2000		2010	
	Pop.	Growth rate	Pop.	Growth rate	Pop.	Growth rate	Pop.
Accra Metropolis	636,667	3.0	969,195	3.3	1,658,937	1.1	1,848,614
Ledzokuku-Krowor Municipality	—	—	—	—	—	—	227,932
Ga District*	66,336	4.9	132,786	8.9	550,468	5.0	908,053
Tema Metropolis	102,431	4.4	190,917	2.8	298,432	3.0	402,637
Ashaiman Municipality	22,549	5.8	50,918	6.8	150,312	2.4	190,972
Adenta Municipality	—	—	—	—	—	—	78,215
Total	827,983	3.5	1,343,816	3.9	2,501,196	3.8	3,656,423

Note: *Ga Districts include Ga South, Ga Central, Ga East and Ga West Municipalities.

Source: Derived from Population Census reports: 1970, 1984, 2000, and 2010 (Owusu, 2013).

Owusu, 2013). The growth of GAMA is due to the fact that it hosts the national capital, Accra, which is the hub of economic activities in the country. An industrial survey conducted in 2003 revealed that the Accra region accounted for about 44% of all persons engaged in industry and over 69% of manufacturing output (GSS, 2006).

As the national seat of government and nerve center of economic activities, the AMA⁴ possesses the most modern infrastructure and services in Ghana due to significant public sector investments over the years. This has enhanced private sector investment in the city, which has further boosted urban growth and development. In recent years, as a result of the impact of global forces (globalization and market liberalization), Accra has become the headquarters of several multinational companies and international nongovernmental organizations (Grant, 2009; Grant & Yankson, 2003; Otiso & Owusu, 2008). A recent study revealed that the Greater Accra area received about 84% of Ghana's total foreign investments (including agriculture) between 2001 and 2008 (ISSER, 2009). As a result, Accra is growing rapidly and has attracted people from all parts of Ghana, the West Africa subregion, and beyond.

As in most cities, urbanization creates both challenges and opportunities in Accra. A key challenge facing Accra is poor sanitation and waste management. According to the NLO (2009), despite various World Bank and other donor efforts at improving sanitation in Accra and other Ghanaian cities, the situation remains dire. Poor sanitation and waste management in Accra is largely attributed to rapid urban growth and inadequate local government capacity to address urban development and management challenges (Ayeé & Crook, 2003; Crook & Ayeé, 2006; Fobil et al., 2008; NLO, 2009). Sanitation infrastructure in Accra is characterized by choked drains, indiscriminate waste disposal, and overflowing central waste containers, especially in the city's poor neighborhoods. AMA (2006) notes that Accra generates between 1500 and 1800 tons of waste per day; however, only between 66% and 80% of this waste is collected. Thus, between 20% and 34% of waste remains uncollected and ends up in drainage systems, water bodies, and open spaces. According to Agyei-Mensah and Owusu (2010), the proportion of uncollected waste is even higher in low-income residential neighborhoods, where in some cases access to sewage disposal and door-to-door waste solid collection is as low as 5% of households. In these poor neighborhoods, a greater majority of households dispose of waste in open gutters or must simply leave it in open spaces within communities.

Besides these difficulties with uncollected waste, AMA also faces challenges regarding where to dump the collected waste. As a result of rapid urban growth, the peri-urban areas most conducive for waste disposal have been converted into residential developments. Moreover, recent creation of new local government areas has resulted in a fragmentation of the GAMA. In fact, all peri-urban areas of Accra which are conducive for the development of landfills fall under separate and autonomous local government areas. The implication of this situation is that land for waste disposal is becoming increasingly difficult to obtain, as the AMA has to engage with several actors in order to do so.

Increasingly, AMA is faced with the “not in my backyard” (NIMBY) syndrome. This is reflected in the abandonment of the proposed Kwabenya Sanitary Landfill project, which was to be funded by the World Bank (Oteng-Ababio, 2011). The land for this project was secured in the late 1990s for a long-term landfill, but area residents, supported by civil society organizations, took up legal battles with the AMA. The result was abandonment of the project. Due to this and other challenges, such as difficulties in acquiring large dumping sites, the AMA relies on small and short-term waste disposal sites.

In addition, waste trucks must travel far and spend significant time between collection and disposal points due to the sprawling city form and traffic congestion. This has serious implications for the cost of operations and the number of waste containers able to be lifted per day. These factors have affected the overall sanitation and waste management situation; overflowing waste containers left uncollected for days are common sight in the city, especially in poor neighborhoods. The inability of city authorities to deal with waste has led to the proliferation of informal small-scale operators using carts and other nonmotorized means. However, the operations of these small-scale operators are poorly regulated and also saddled with the burden of where to dispose of collected waste (Oteng-Ababio, 2011).

Origin of the Mallam and Oblogo landfills

The Mallam and Oblogo landfills are located in the Ga South Municipal Assembly (GSMA), about 15 km from the center of the Accra metropolis (Figure 1). Communities surrounding the landfills include Mallam, Oblogo, parts of New Gbawe, and MaCarthy Hill (noted for housing the rich and prominent politicians in Ghana). All of these communities are located within the GSMA. Many have long existed as rural communities on the fringes of the AMA, and their growth has been very rapid in recent years largely due to the westward expansion of the metropolis (GSS, 2002, 2012).

Functionally and geographically, the GSMA is an integral part of AMA, but the two are separated by a politico-administrative boundary. As population, rents, and land prices increase, overcrowding and congestion have occurred in the core areas of Accra. Many households have been forced to seek land and shelter in the GSMA and other adjoining municipalities (Doan & Oduro, 2012; Owusu, 2013). Although much of the population growth of the Accra region is now occurring in these adjoining areas, they have seen very little infrastructure development.

Until the late 1980s, as Accra expanded westward, Mallam and Oblogo were major sites for stone quarry. As such, the area is littered with abandoned or closed quarry pits and much of the residential developments in the area has occurred around the quarry sites. As the number of residential buildings increased in the early 1980s, commercial quarry activities ceased, leaving behind small-scale operators who continued to extract stone to serve the numerous residential construction works in the area. Over time, these small-scale

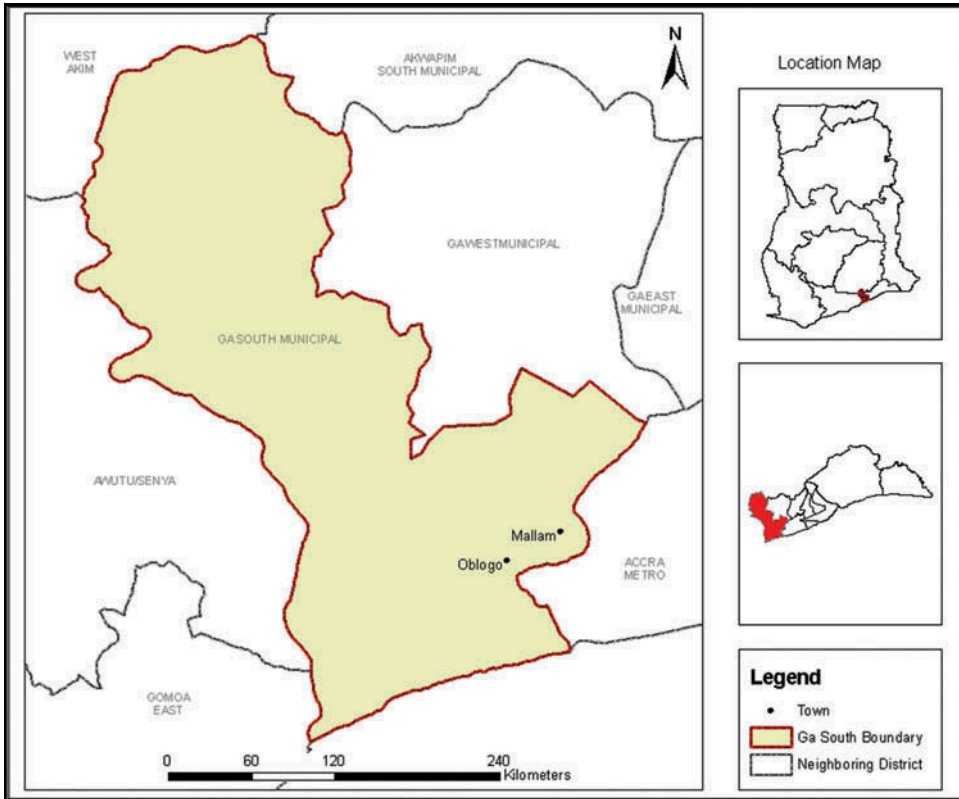


Figure 1. Map of Ga South Municipality showing the locations of Mallam and Oblogo landfills.

operators also eventually ceased their operations, mainly due to the takeover of the quarry sites for residential developments. These were primarily single and two-story houses—targeted at Ghana’s growing urban middle and upper-classes (see Grant, 2009; ISSER, 2013). It is these quarry pits that have been used and continue to function as landfills for waste disposal in Accra. However, the presence of residential houses that predate landfill operations has resulted in very close proximity between the landfills and residential development. In fact, some houses could literally be described as “sitting” on the landfills, as illustrated in Figure 2.



Figure 2. Close proximity between landfills and residential development.⁵

We divide active operations of the Mallam landfill into two phases. The first phase began in the early 1990s and ended in early 2001. During this period, a large abandoned quarry pit was filled in a terrace-like style with waste from the city of Accra and the surrounding area. The site contained compaction equipment, a weighing scale, and a management team which was supported by foreign expatriate personnel. This represented the first attempt to introduce new waste disposal technology in Ghana.

The second phase of the Mallam landfill began in late 2008 and involved the filling of an abandoned quarry pit of about 25,107 square meters. This second Mallam landfill was only a few meters away from the completed landfill and was closed down in early 2010. When it was active, the site received waste intake of about 1,400 tons and 150 waste trucks per day.

The Oblogo landfill was opened in 2001 after the closure of the first Mallam landfill pit. It involved the filling of two large abandoned quarry pits. Similar to the Mallam landfill, the Oblogo landfill had compaction equipment, a weighing scale, and a management team. Until the closure of the site in July 2008, it received an average of 1,200 tons of MSW collected from Accra daily, a monthly average of 3.6 million tons of waste. Here, similar to the Mallam landfill, residential houses are situated very close to the landfill. Even though the landfill is closed, scavengers are still active at the site recovering plastic and other materials for recycling.

We follow the generally accepted definition of landfills as deliberately designed and constructed facilities with layer basins to prevent leaching, sumps to trap leachate, gas escape tubes, compaction and spreading equipment, daily soil cover to reduce odor and waste littering, a weighing scale to measure tonnage of waste discharge, regular spraying to reduce pests/rodents infestation, and fences or other types of facility enclosure. The Mallam and Oblogo landfills do not meet all aspects of this definition. For instance, both landfills lacked well-constructed layer basins, sumps to trap leachate, tubes to trap gas, and daily soil cover (Owusu et al., 2012). As such, the construction and operations of the two landfills can be described as substandard, resulting in the free flow of leachate and poor air quality. In addition, host community benefits (HCBs), which many experts on landfills have found to be very useful in reducing community hostilities toward landfill operations, are limited in both Mallam and Oblogo. This being the situation, this study explores the extent to which the landfills affect nearby property values in the two communities of Mallam and Oblogo.

Results and discussions

Table 3 shows the regression results of the OLS method used in estimating the effects of landfills on nearby property values. For variables that were used in the estimation, the parameter numbers are also listed. Prior to the estimation, all the predictor variables were tested for multicollinearity using their respective and mean variance inflation factors (VIFs). Variables with VIFs greater than or equal to 10 were dropped to avoid multicollinearity (see Long & Freese, 2006). Values that were dropped from the estimation included value of property if one decides to sell (VALUEP) and year in which the property was acquired (YACUI). The goodness of fit for the estimated equation is very high for a cross-sectional data analysis. In particular, the R^2 of 90% indicates that the model explains 90% of the variation in property value. Additionally, the Ramsey RESET test for model mis-specification indicates that the use of OLS is justified and the model does not suffer from omitted variables bias. Moreover, the F -test for joint significance

Table 3. Regression results of the ordinary least square model Equation (2).

Parameters	Coefficient	SE	t-Statistic	Prob.
β_1	-26,235.4	9,838.11	-2.67	0.022**
β_2	0.66	2.72	0.24	0.811
β_3	1.74	0.33	5.20	0.0000**
β_4	-12.71	7.06769	-1.8	0.1000*
β_5	-12,530.86	11,224.74	-1.12	0.288
β_6	15,537.85	8,983.93	1.73	0.112
β_7	-10,222.37	13,141.99	-0.78	0.453
β_8	15,907.09	16,036.46	0.99	0.343
β_9	-4,075.8	20,152.56	-0.2	0.843
β_{10}	-8,518.38	7,493.119	-1.14	0.28
β_{11}	14,507.13	3,262.60	4.45	0.001***
β_{12}	108.2606	1,822.95	0.06	0.954
β_{13}	-2,812.81	1,410.23	-1.99	0.071*

$$\text{Equation: VALUEP} = \beta_0 + \beta_1\text{LOC} + \beta_2\text{CPLOT} + \beta_3\text{PPRICE} + \beta_4\text{DISTANCE} + \beta_5\text{PSTATUS} \\ + \beta_6\text{MATROOF} + \beta_7\text{TTYTYPE1} + \beta_8\text{TTYTYPE2} + \beta_9\text{BUILDMAT} + \beta_{10}\text{FENCE} + \beta_{11}\text{LSIZE} \\ + \beta_{12}\text{FDEV} + \beta_{13}\text{SDEV}$$

Number of observations 212

R^2 0.90

Joint test of significance (Prob > F) 0.00

Mean VIF 4.18

Ramsey RESET test (Prob > F) 0.57

Note: *, ** and ***connote statistically significant at 10%, 5% and 1% levels, respectively.

shows that all the regressors are jointly significant in explaining variation in property value.

Table 3 reveals that the most important variable for our estimation, that is, the distance between properties and landfills (Parameter β_4), is weakly significant at 10% and correctly signed. Nevertheless, the result indicates that moving one meter away from the landfill increases property value by about GhC 12.7 (about US\$9.1).⁶ In other words, within the study's set parameter of 2 km, a house placed at 2 km (2,000 m) away from the edge of the landfill will have an increased value of GhC 25,400 (US\$18,143) compared with similar properties located a meter away from the landfill. This result is consistent with other studies in the literature, where a robust inverse relationship between distance to landfill sites and property values has been established (see Bouvier et al., 2000; Lim & Missios, 2007).

Again, while we acknowledged that distance-based neighborhood variables such as distance to major school, store, health center and so on would have contributed tremendously in improving the model fit of our semi-hedonic pricing model, these variables were not collected in the survey. This is because the area lacks major educational facilities (except private basic schools), hospitals, markets, and shopping malls. As noted earlier, land use in the landfill vicinity is purely used for residential purposes.

However, our model-based conclusion that the two landfills depress nearby property values is inconsistent with the views obtained from key informant interviews and focus group discussions. The conclusion from the qualitative survey was that the landfills have not had a depressing effect on property value or rent. A key informant at Mallam summed it up as follows:

The presence of the landfill has resulted in neither a reduction in land prices nor house rent, but rather a reduction in the number of people coming here [Mallam] to buy land or to rent a place to live. However, anytime a pit is completed and there is a lull in the dumping of waste here, we see a rush to acquire land here leading to increases in land values. In fact, land prices and rents have continued to increase since people started settling here. (key informant, Mallam)

Using basic supply and demand analysis, what we infer from quotes like this one is that land prices and rents could have been much higher than they were, if not for the presence of the landfills in the Mallam and Oblogo communities. In short, we infer that more people would have sought land and shelter in these areas, which would have driven rents and land prices even higher than their present levels. This logic in fact supports the conclusion drawn from our analysis of the quantitative survey of the distance effects of landfills on property values.

Another possible means to deduce the effects of the landfill on property value is to examine the year in which development of residential properties ended, coded 1 for years before 1990 (absence of landfill) and 0 after 1990 (presence of landfill). The ending year of property development has serious implications for property value, as an additional year in terms of when development of the property ended (Parameter β_{13}) causes the value of the property to decrease by about GhC 2,812 (US\$2,008.6) and this is significant at 10%. This could be due to the fact that earlier developers acquired their lands relatively further away from the quarry pits that are now being used as landfills. However, as land became scarce, developers started using land closer to the quarry pits (or landfill). This explanation reinforces our earlier observation of the price–distance relationship of residential property to the landfills. Thus, properties developed before the 1990s, which are located further away from the landfills, will have higher values compared with more properties developed in the 1990s and closer to the landfills.

Other factors such as the location of the property, the amount of money spent in acquiring the property (land), and the size of the land were all significant at the 5% confidence level. Additionally, the time development of the property ended was found to be significant at the 10% confidence level.

The results indicate that the variable *LOC* is negative and significant at the conventional 5% level, buttressing the importance of location in explaining the property value. Thus, in moving from Mallam to Oblogo, property values depreciate by about GhC 26,235 (US\$18,739). This could be explained by factors such as the rate of urban growth, which is more pronounced in Mallam compared with Oblogo, and the vibrant economic activities which tend to accompany population growth. Direct observations and focus group discussions conducted during fieldwork indicated that the level of trade and economic activities was more vibrant in Mallam than in Oblogo and could have caused the differences in property values between the two communities. Mallam is a more mature urban area compared with Oblogo, which is also reflected in Mallam's higher property values.

The *PPRICE* variable is also significant at 5% confidence interval.⁷ From the model, a GhC 1.0 (US\$0.7) increase in the amount of money spent in acquiring a property causes the value of the property to increase by GhC 1.74. One might have expected that an increase in *PPRICE* would cause the value of the property to increase at the same rate. The difference could be accounted for by inflation and the fact that buildings kept in good condition generally appreciate in value over time, especially within rapidly growing urban communities such as Mallam and Oblogo.

Two dummy variables were introduced in the regression to capture the type of toilet facility available in the property (*TTYPE*). All facilities fitted with water-closet (WC) toilet facility were coded 1 otherwise 0 (*TTYPE1*) while all other toilet facilities were coded 1 otherwise 0 (*TTYPE2*). Properties with no toilet facility are the reference point to which comparison is made. Nevertheless, none of these dummies were found to have a statistically significant effect on property value. It is probable that the introduction of other variables into the regression has attenuated the positive relationship between additional toilet facilities and property value increases. It is common sense that additional investment in a water closet toilet facility ensures comfort and safety in terms of environmental sanitation and also increases property value. Clearly, in an environment with no public toilet facilities, provision of such facilities in a private dwelling unit enhances the value of the property in terms of both rent and total value.

Finally, a variable that proved to be statistically significant (at the conventional 5% level) in explaining variations in property value is the size of the land on which the property is located (*LSIZE*). Holding constant all other factors that potentially influence property values, a meter increase in the size of the land on which the property is located increases the market value of the property by about GhC 14,507 (US\$10,362).

Conclusion and development implications

Though discussions about landfills and property values have largely taken place in the developed world, this study has shown that there are implications of such studies for Global South cities such as Accra. The scarcity of land available to be used for waste disposal is largely due to the massive sprawl of urban residential development and the absence of a dedicated planning zone for landfills. Without designated landfill zones, the city has resorted to short-term measures involving the use of abandoned quarry pits as landfill sites. While some level of mechanization and other practices are carried out at the landfill sites, the sites do not meet the criteria of well-engineered, sanitary landfills. Meanwhile, the close proximity of residential properties to the landfills has often brought city waste management authorities into confrontations with residents.

Although our analysis is limited by the paucity of data on the Ghanaian housing and real estate sector, we can conclude that our study of Mallam and Oblogo landfills and their effects on nearby property values supports the conclusion of many developed world studies that landfills have a depressing effect on residential property values. We conclude that while the presence of the landfills affected property values negatively, it is not the only variable to affect property values. Of equal importance and significance are factors such as property location relative to the level of urbanization in the community where a property is located, and total costs incurred in constructing the property. In other words, in the context of this study, the value of property in the landfill area is determined both by landfills (in terms of distance and year of completion of property development) and by other factors of urbanization. Nevertheless, our conclusion is in line with analysts who argue that landfills have depressing effects on property values.

The present state in which landfills are sited and operated in Accra and elsewhere in Ghana leaves much to be desired. If residential properties are viewed as a strategic area for stimulating economic growth, while at the same time improving the living conditions of Ghanaians,⁸ then the siting and management of landfills warrants a more serious level of political attention. National and local government investments (such as good and durable roads, streetlights, schools, playgrounds) must be located in landfill host communities to ameliorate some of the negative externalities associated with landfills. Indeed,

national and local government provision of such resources would align with the obligations, commitments, and responsibilities contained in the national constitution and other development policy documents. More importantly, the EPA (Ghana) should be endowed with the necessary capacity to enforce its landfill health and safety guidelines. Though the existing guidelines of the EPA do not address the issue of landfills and property values, the full implementation of these guidelines will promote a clean and safe environment, which will likely have a positive impact on housing values. Full implementation of environmental guidelines, however, has rarely been the case in Accra and other urban centers in Ghana.

Funding

This study was made possible as a result of a research grant (IFS Research No. S/4639) from the International Foundation for Science (IFS). However, the views expressed herein do not necessarily represent those of IFS or its Board of Governors.

Notes

1. See Appiah-Kubi (2004) for a detailed discussion of District Assemblies' (local governments) noncollection of property taxes in Ghana.
2. Because of the incremental nature by which houses are developed in Ghana, it is very common to find people occupying uncompleted buildings while development of the structure proceeds.
3. Includes Ga East, Ga West, Ga Central, and GA South Municipalities.
4. City local governments are referred to as either Metropolitan Assemblies or Municipal Assemblies. Metropolitan Assemblies are for cities/large towns with populations of over 250,000 while Municipal Assemblies are defined as towns with populations of 90,000–250,000.
5. The size of residential properties and materials used give some indications of property value, socio-economic background of property owners, and the classification of the neighborhood as "Class A."
6. One Ghana Cedis (GhC) was equivalent to US\$1.4 at the time of survey (June–July 2009).
7. The price variable (total cost incurred in putting up the property) per our estimate warrants inclusion in the model. Aside from the fact that the initial costs of construction affect the current sale value, a test for correlation between the independent variables (multicollinearity) using the variance inflation factor (VIF) did not reveal any multicollinearity problems. The mean VIF for the regression estimate is 4.16, which is distant from the standard multicollinearity threshold of >10 . Indeed, if the price variable is removed, only LSIZE (the size of the land) is significant in the model and the R^2 drops. This implies that the price variable contributes to the overall model fit and its omission engenders omitted variable bias.
8. This is advocated in Ghana's medium-term development policy frameworks including the Growth and Poverty Reduction Strategy (GPRS II) and Ghana Shared Growth Development Agenda (GSGDA) (National Development Planning Commission [NDPC], 2005, 2010).

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