

Essence of Environmental Governance in Solid Waste Management: A Spatial Analysis of the unplanned Dumpsites in Nairobi County

Authors: Ogotu Florence Akinyi¹, Kimata Dennis², Kweyu Raphael³

1. Wangari Maathai Institute for Peace and Environmental Studies, University of Nairobi
2. Wangari Maathai Institute for Peace and Environmental Studies, University of Nairobi
3. Kenyatta University, Nairobi, Kenya

* Corresponding Author E-mail: florence.akinyi@gmail.com

Abstract: *In Nairobi County, rapid urban settlement patterns have been on the increase and this in turn results to stretching the existing resources. Due to this, the existing Solid Waste Management systems have resulted to the mushrooming of unplanned dumpsites. Environmental governance in solid waste management is becoming a key pillar in the proper waste management strategies and dominates the development discourse. This has been a constant challenge since public facilities such as dumpsites are not properly mapped by the relevant authorities. Most Nairobi County residents are not conscious of proper and well-maintained waste management systems. The purpose of this study was to explicate the essence of environmental governance in Solid Waste Management using spatial analysis to study why unplanned dumpsites are on the increase in Nairobi County. This study adopted a descriptive research design, and the study areas were the two hundred and seventy seven unplanned dumpsites distributed across three main areas of study namely: Lavington and its environs, Embakasi and its environs and Kibera areas. Sampling was done through Spatial analysis, the data sources were mainly from QuickBird images of 2003 and 2007, and WorldView-2 images of 2013 and 2017. Other secondary data used were Nairobi County boundary shape-file, Kenya rivers shape-file, Kenya roads shape-file and Kenya settlements shape-file they were all obtained from Survey of Kenya databases. This paper however recommends that urban planners in Nairobi County should play a key role in managing Solid Waste. This paper provides a platform for other researchers to conduct further investigation on the essence of Environmental governance to promote solid waste management in Nairobi County.*

Keywords: *Solid Waste Management, Environmental governance, Unplanned dumpsites in Nairobi County, Environmental management spatial analysis, Solid waste management spatial analysis*

1.0 INTRODUCTION

Domestic and industrial waste generation continues to increase world-wide just as growth in consumption and the spur in urbanization. Notably in developed countries, per capita waste

generation has increased nearly three-fold over the last two decades, which translates to five-six times higher than that in developing countries (UNEP, 2005). Developing countries for instance, have not effectively implemented measures that control mushrooming of dumpsites in urban cities (UNEP, 2005). Solid Waste Management (SWM) in most developing countries is predominantly characterized by inefficient collection methods, insufficient coverage of the collection system and improper disposal of municipal solid wastes. Funding for waste management is always inadequate, and real costs are never fully recovered (UNEP, 2005). Unplanned dumpsites in Nairobi city are growing in numbers and are due to poor garbage collection services offered by both the County government and other relevant service providers (Njoroge, Kimani & Ndunge, 2014). There is a consensus that the various aspects of good governance are crucial in addressing Solid Waste Management challenges in cities globally, especially in developing countries. Environmental governance incorporates rules, processes, and behaviour by which interests are articulated, resources are managed, and power is exercised (Kazungu, 2010). This implies that governance structures include laws, regulations and policies that guide any process of environmental management. Thus, effective environmental governance frameworks of Solid waste management should include practical, implemented and well enforced laws and regulations (Henry, Yongsheng & Jun, 2006). There should exist proper integration and collective implementation of both local and international conventions, policies and environmental administrative structures that ensure efficiency of service delivery is not compromised (Guerrero, Maas & Hogland 2013). Institutions that are mandated with ensuring that proper values that govern Solid Waste Management within a decision making process of their nations and individuals (UNEP, 2016). Human activities generate waste which can be harmful to the environment, animals, plants and the ecosystem. However, only sound environmental governance can limit the damage done to the environment and reverse the mushrooming of unplanned dumpsites (Achere, 2012).

Environmental governance in Solid Waste Management addresses the inadequate infrastructure, financing, lack of clear roles and responsibilities of these authorities and uncollected and uncontrolled disposal of waste in public areas which have made the task more difficult, hence public health and sanitation is threatened by increased unplanned dumpsites (Muniafu & Otiato, 2010). Waste management systems in Africa currently are not well maintained at household level since thousands of tons of functional solid waste are generated daily end up in open dumps and wetlands, contaminating surface and ground water and posing major health hazards to human beings and the environment as illustrated by the spatial analysis of the unplanned dumpsites in Nairobi County (Chuen, Lim & Choong, 2011).

Waste management in Nairobi County is a perilous undertaking in that increasing urbanization, rural-urban migration; rising standards of living and rapid development associated with population growth have resulted in increased solid waste generation by industrial, domestic and other activities (Henry, Yongsheng & Jun, 2006). The increase in solid waste generation has not been accompanied by equivalent increase in the capacity of urban authorities to deal with this problem of mushrooming unplanned dumpsites. The proper management of waste has thus

become one of the most pressing and challenging environmental problems in Nairobi (JICA, 2010). The inability of city authority to collect and dispose waste, has led to indiscriminate dumping which further contribute to poor sanitary conditions, and incidences of environment-related health problems (Ikiara, 2006; Oyake, 2012). This study sought to examine the essence of environmental governance of Solid Waste Management that result to unplanned Dumpsites in Nairobi County.

2.0 METHODOLOGY

The study adopted a descriptive research design in order to provide a framework to examine current conditions, trends and status of events. Descriptive research design is more investigative and focuses on a particular variable factor. Data was collected in Nairobi County from existing high resolution QuickBird images of 2003 and 2007, and WorldView-2 images of 2013 and 2017, both supplied by Digital Globe. These images were selected on the basis of their spatial resolution and cloud cover percentage. QuickBird has a spatial resolution of 60 cm while WorldView-2 has 50 cm. The selected images had a cloud cover percentage of less than 10 per cent. Other secondary data used were Nairobi County boundary shape-file, Kenya rivers shape-file, Kenya roads shape-file and Kenya settlements shape-file both of them from Survey of Kenya databases. Field reconnaissance was carried out to record and collect data on the exact ground locations of some of the unplanned dumping sites in Nairobi County. This data was collected by visiting the dumping sites and recording their ground coordinates in a handheld GPS unit. Ground coordinates of two hundred and seventy seven unplanned dumping sites were collected and photographs of the sites taken. These images were composed of those acquired from 2003 to 2017. The 2003-2017 image acquisition periods was chosen because very high resolution satellite images that are suitable for dumping sites spatial analysis were only available from 2003.

Handheld GPS receiver was used to record the exact geographical locations of the different dumping sites that were subsequently used in helping to identify the corresponding dumping sites locations on the very high resolution satellite images. The digital camera was used to take photographs of all the dumping sites that were covered in the study. The shape-file of Nairobi City County was uploaded on the Digital Globe satellite image website for identification of the area of study. All satellite images covering the area of study were screened for suitability based on cloud cover and time interval between successive images.

3.0 RESULTS

The following were the results of the spatial analysis of the unplanned dumpsites in selected Nairobi neighborhoods. The results are presented in the following order: Spatial analysis of the study location; spatial analysis of the illegal dumpsites in Nairobi County for the period of 2003-2017 and Unplanned dumping Sites patterns in Lavington, Embakasi, Kibra and their environs.

3.1 Spatial Analysis of the Study Location

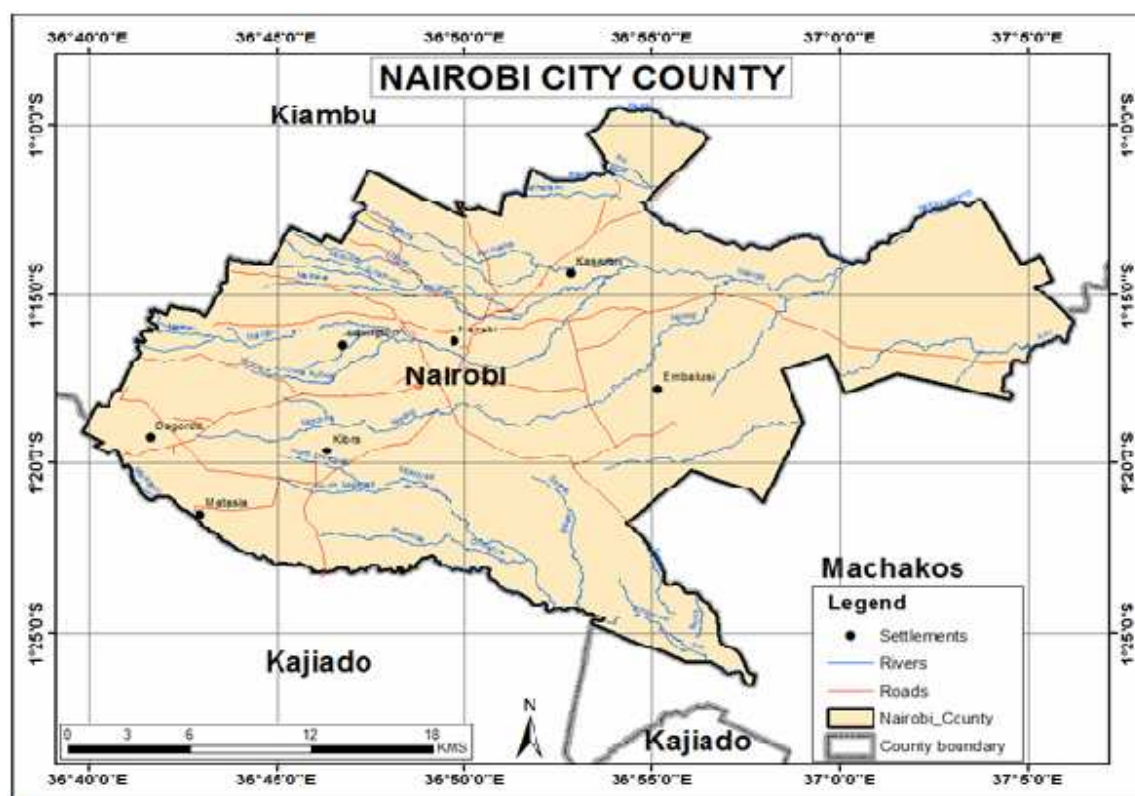


Figure 1

A map of the study location, Lavington, Embakasi and Kibra, Nairobi County.

Figure 1 shows the map of Nairobi county and the three focus areas of the study, namely Embakasi, Lavington and Kibra which are the common illegal dumpsites of the county.

3.2 A spatial analysis of the illegal dumpsites in Nairobi for the period of 2003- 2017

High resolution satellite data were analyzed spatially to capture both the extent and the area covered by the dumping sites on different satellite image data sets. This was captured using object based satellite image interpretation and it involved on-screen digitization of areas covered by the dumping sites. The on-screen digitization depicted the difference in spatial coverage of the dumping sites in 2003, 2007, 2013 and 2017. The GPS points collected from the field were overlaid on the satellite images to identify the locations of illegal dumping sites. The spatial extents of the dumping sites on the different images were captured by digitizing polygons around the dumping sites. The Figures 2, 3, 4 and 5 shows the Spatial Analysis results of the unplanned Dumpsites in Nairobi County between the years 2003, 2007, 2013 and 2017.

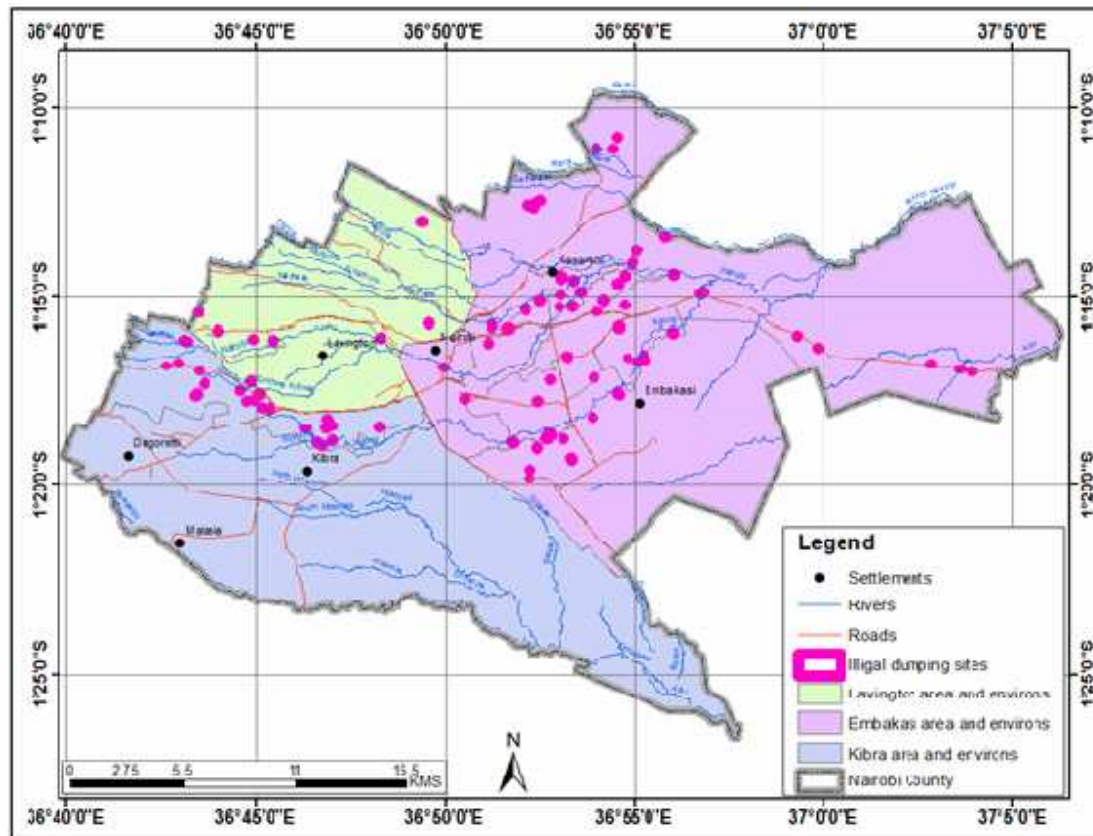


Figure 2

Distribution of unplanned dumping sites in Lavington, Embakasi and Kibra in 2003

This spatial analysis of the illegal dumpsites in Nairobi County was conducted in three Sub-counties of Nairobi County namely Lavington, Embakasi and Kibra in the year 2003. The illustrated number of illegal dumpsites is concentrated on the three focus areas.

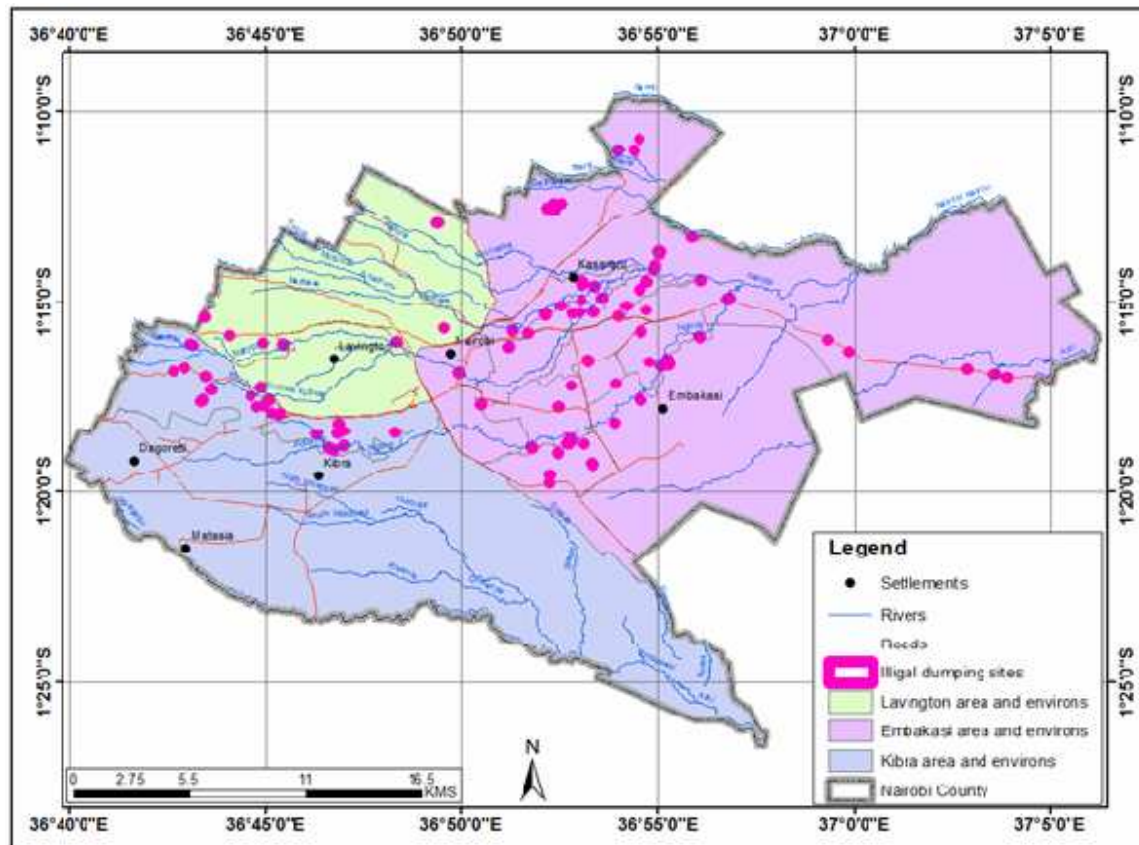


Figure 3

Distribution of unplanned dumping sites in Lavington, Embakasi and Kibra in 2007

This spatial analysis of the illegal dumpsites in Nairobi County was conducted in three Sub-counties of Nairobi County namely Lavington, Embakasi and Kibra in the year 2007. The illegal dumpsites are operational in the years 2003-2007.

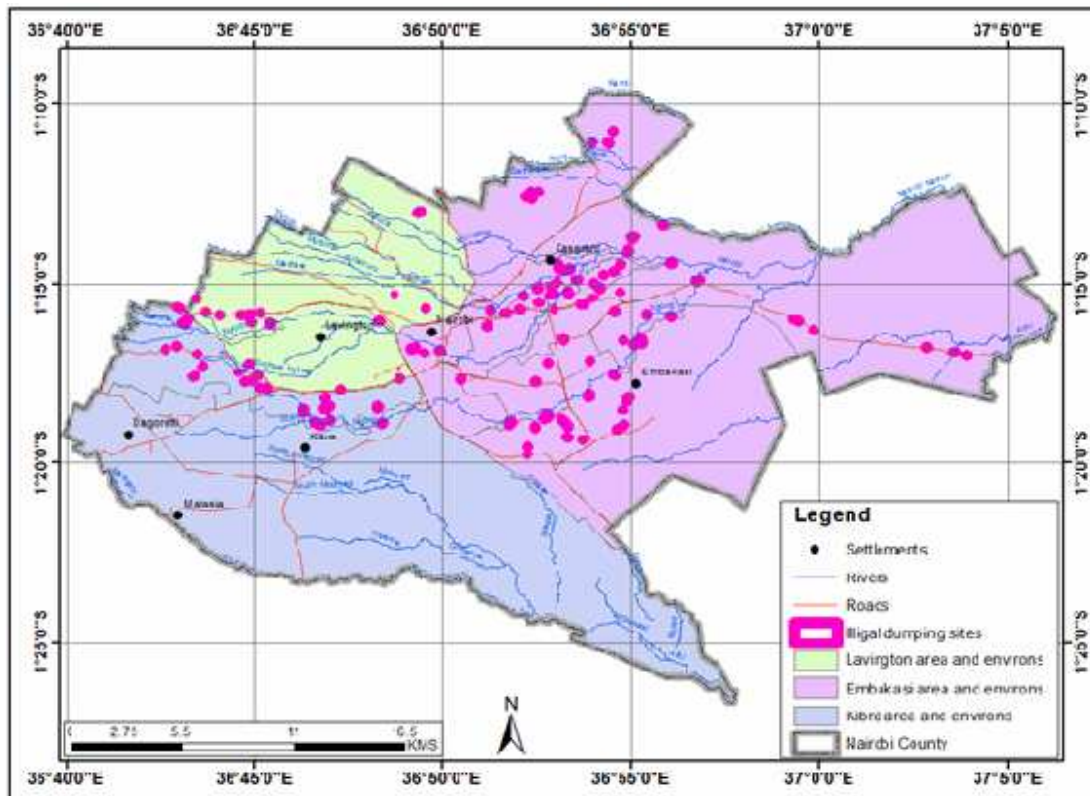


Figure 4

Distribution of illegal dumpsites in Lavington, Embakasi and Kibra in 2013

This spatial analysis of the illegal dumpsites in Nairobi County was conducted in three Sub-counties of Nairobi County namely Lavington, Embakasi and Kibra in the year 2013. The number of illegal dumpsites has increased from the initial number of dumpsites as illustrated above.

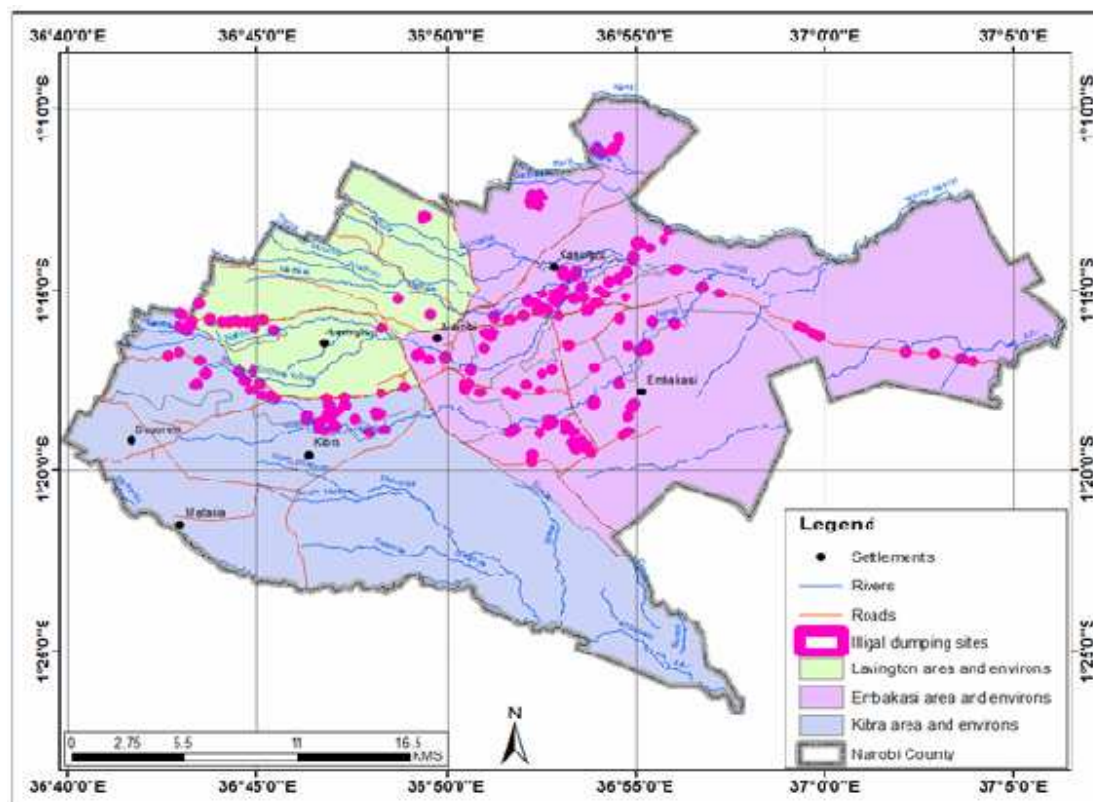


Figure 5

Distribution of unplanned dumping sites in Lavington, Embakasi and Kibra in 2017

Figure 5 illustrates the latest images of illegal dumpsites in Nairobi County which was conducted in three Sub-counties of Nairobi County namely Lavington, Embakasi and Kibra in the year 2017.

3.3 Unplanned dumping Sites patterns in Lavington, Embakasi, Kibra and their environs

The illegal dumping sites' spatial coverage in Nairobi between 2003 and 2017 was 7.35 ha, 7.96 ha, 11.03 ha and 16.94 ha in 2003, 2007, 2013 and 2017 respectively. From the study findings, the spatial area was determined by the extent of the unplanned dumpsites which was calculated in hectares. Embakasi had a larger spatial area of 6.55ha in 2003 to 15.04ha in 2017, thus had more unplanned dumpsites unlike Lavington (0.25 ha, in 2003 to 0.53 ha in 2017). Kibra on the other hand had (0.55ha, in 2003 to 1.37 ha in 2017) with the least number of dumpsites respectively.

4.0 DISCUSSION

Nairobi County is one of the smallest Counties in Kenya and yet is the most populous County in terms of its population. The rapid population growth has been due to a number of reasons such as employment opportunities, business opportunities and other factors that attract residents to the city (Satterthwaite, 2009). Just as the population of the city increases, so are the environmental challenges (Allison, 2010). Solid waste management in the city has been a menace and the amount of Solid waste generation has been on the increase to levels that have caused global attention. Nairobi's status is largely characterized by low coverage of solid waste collection, pollution from uncontrolled dumping of waste, inefficient public services, unregulated and uncoordinated private sector and lack of key solid waste management infrastructure (JICA, 2010). The change in organic waste in these city locations and an increase in plastic and other non-biodegradable wastes can be attributed mainly to the residents changing lifestyle (UNEP, 2016).

The analysis results from very high resolution satellite images show that the spatial coverage of unplanned dumping sites in the entire City of Nairobi was on the increase and this was attributed to the increase in population. According to Census reports of 2009, the population of Nairobi County stood at 4 million residents. This automatically would result to an increase in solid waste generation. Other major sources of solid waste were generated by the numerous economic activities and industrialization (Muniafu & Otiato, 2010). In addition, Nairobi City has limited number of legal dumpsites, this meant that the existing sites were over time getting overwhelmed by the increase in waste generated. The Dandora dumpsite for instance, is the main dumpsite that serves the entire City and some of the wastes generated in other metropolitan towns like Kajiado, Kiambu and Machakos find their way in the same dumpsite (Henry, Yongsheng & Jun, 2006). In a report by UNEP (2016), studies conducted by different urban planning experts recommended that the dumpsite be relocated to the nearby Ruai area. This was because the area had plenty of space to supplement the increasing waste generated by the City residents. Unplanned dumpsites are as a result of an overstretched legal dumpsite and management challenges (UNEP, 2005, KNBS, 2015).

Failure to effectively implement policies and regulations on solid waste management with institutions dealing with solid waste management lack synergy resulting to lack of coordination and inefficiency (Troschinetz & Mihelcic, 2009). Additionally, Policies and regulations on solid waste management are inclined towards collection, transportation and disposal, with least emphasis on recycling and re-use. Public attitude towards waste management and lack of empowerment on environmental values and ethics by the relevant institutions, thus waste is viewed as mere waste and not resources that can be harnessed to create wealth (Lesley & Frankline, 2017).

4.0 CONCLUSION

The spatial analysis of the illegal dumpsites in Nairobi County clearly brought out the essence of ensuring proper environmental governance structures that control emergence of illegal dumpsites within Nairobi City. This paper clearly bring out how the governance process operates in the local context with regards to managing Solid Waste and hence emergence of illegal dumpsites in an Urban setting. Good governance promotes equity, participation, pluralism, transparency, accountability and the rule of law done in a manner that is effective, efficient and enduring that can help overcome the challenges of solid waste management in urban cities like Nairobi County.

This paper documents that lack of good governance is the main problem in waste management in Nairobi City County, thus waste management institutionalization of good governance by bridging the gap between different stakeholders in solid waste management through inclusiveness and participation.

Solid Waste Management in Urban settings such as Nairobi City continues to be a challenge and relevant agencies and stakeholders must devise ways to curb the challenges that come with it. Before governments and relevant local and global institutions implement sustainable solid waste management plans and strategies, it is necessary for all stakeholders to first of all encourage basic Solid Waste Management practices such as: ensuring they use sustainable waste dumping methods, proper recycling methods, sustainable collection and transportation of solid waste that suits the type of waste generated and creation of awareness and education among all stakeholders in their areas of jurisdiction.

REFERENCES

- Achere, R. (2012). *Solid Waste Management: A World Perspective and the Cameroon case study* (Msc Thesis Universidad Fernando Pessoa), Porto Portugal.
- Allison, K., & Von Blottnitz, H. (2010). *Solid Waste Management in Nairobi: A Situation Analysis*. Technical Document Accompanying The Integrated Solid Waste Management Plan Prepared By: Environmental & Process Systems Engineering Group, University of Cape Town. For The City Council of Nairobi on Contract for the United Nations Environment Programme Draft, 17.
- Chuen, K. P., Lim, Y. M., and Choong, C. K. (2011). *Household demand for solid waste disposal options in Malaysia*. Germany: University Library of Munich.
- Guerrero, L. A., Maas, G., & Hogland, W. (2013). Solid waste management challenges for cities in developing countries. *Waste management*, 33(1), 220-232.

- Henry, R. K., Yongsheng, Z., & Jun, D. (2006). Municipal solid waste management challenges in developing countries–Kenyan case study. *Waste management*, 26(1), 92-100.
- Ikiara, C. (2006). “Opportunities and Challenges in Privatising Urban Environmental Infrastructure: Lessons from the Dandora Dumpsite Nairobi”. Paper presented at a Workshop on Public Expenditure and Service Delivery in Africa: Managing Public Expenditure to Improve Service Quality and Access 9-11 October 2006.
- JICA (2010). The study on solid waste management in Nairobi City in the Republic of Kenya : final report. Japan International Cooperation Agency (JICA); in collaboration with CTI Engineering & Environmental Technology Consultants. [Online]. Available from: <http://lvzopac.jica.go.jp/external/library>.
- Kazungu, R. K., (2010), Improving Governance for Sustainable waste management in Nairobi, 46 th ISOCARP Congress, 2010.
Kenya National Bureau of Statistics (2015) Kenya population and Housing census.
- Lesley, K. S., Nelson, O., and Frankline, O.O. (2017) Challenges of Solid Waste Management in Kisumu, urban Forum, issue 4 / 2017.
Oyake, L. O. (2012). Managing plastics waste in Urban Kenya, Niche Innovations in production and Recycling, Wageningen University, Netherlands.
- Muniafu, M., & Otiato, E. (2010). Solid Waste Management in Nairobi, Kenya. A case for emerging economies. *Journal of Language, Technology & Entrepreneurship in Africa*, 2(1), 342-350.
- Njoroge, B. N. K., Kimani, M., & Ndunge, D. (2014). Review of municipal solid waste management: A case study of Nairobi, Kenya. *International Journal of Engineering and Science*, 4(2), 16-20.
- Njeru, J. (2006). The urban political ecology of plastic bag waste problem in Nairobi, Kenya. *Geoforum*, 37(6), 1046-1058.
- Satterthwaite, D. (2009). The implications of population growth and urbanization for climate change. *Environment and Urbanization*, 21(2), 545-567.
- Troschinetz, A. M., & Mihelcic, J. R. (2009). Sustainable recycling of municipal solid waste in developing countries. *Waste management*, 29(2), 915-923.
- UNEP (2016). UNEP Frontiers 2016 Report: Emerging Issues of Environmental Concern. United Nations Environment Programme, Nairobi.



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UNEP. (2005). Solid Waste Management, Nairobi, Kenya United Nations Commission on Human Settlement (UNCHS) – Habitat (2001). Tools to support, participatory urban decision making. Nairobi, Kenya: UNCHS.
