

Environmental Effects of Urban Cattle Keeping in Nakuru Municipality, Kenya

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Abstract

Dilemma exists in Kenya among various urban dwellers and policy makers on whether to promote or prohibit urban cattle keeping. This is due to the intricate nature of the tradeoffs between its benefits and associated environmental hazards. The current study, therefore, sought to assess environmental effects of urban cattle keeping in Nakuru Municipality in Nakuru County of Kenya. Through a cross-sectional survey, primary data was collected using sets of structured and semi-structured questionnaires, and focused group discussions. Stratified sampling was used, with simple random sampling within the strata applied. Fishers Exact Formula was then used to select the 186 cattle keepers that were interviewed. Chi-square and paired t-tests were performed to determine the existence of significant differences between observations. Results indicate that majority (90.3%) of the survey respondents disagreed that cattle waste had any environmental hazards. This was due to lack of awareness among urban cattle keepers on environmental hazards related to livestock keeping in confined areas and close proximity to human beings. Most (82.8%) of the survey respondents who practiced zero-grazing perceived bad odour/ air pollution as an environmental hazard. Similarly, those who grazed their cattle by the roadside or streets perceived bad odour /air pollution and littered streets as environmental hazards. Overall, the type of cattle rearing system was highly associated with environmental hazards. The number of cattle kept, however, was independent of the environmental hazard ($P=0.191$, $\chi^2_4=6.109$). The heaping of manure in the cattle pen was more likely to contaminate the environment than when given away or applied on the kitchen garden. There were differences in the rating of environmental hazards of cattle waste across levels of education attained by the respondents ($P=0.191$, $\chi^2_4= 6.109$). However, there were no differences between respondents who deposited cattle waste less than 10 meters away from the household and those who deposited it farther away. Generally, there was no proper cattle waste management procedures in Nakuru Municipality. It is recommended that cattle waste management be decentralized with active participation of organized urban cattle keepers and supported by the public. User pay principle should also be applied whereby urban cattle keepers pay a determined fee for cattle waste collection. This would assist in the sustainability of the decentralized service. The findings in the current study are useful for policy formulation on the management of cattle waste and associated environmental hazards in the Municipality and other areas with similar circumstances.

Keywords: Environmental Hazards, Urban Cattle Keeping, Cattle waste, Nakuru, Kenya

1. Introduction

The number of people living in urban centres continues to grow at approximately twice the rate of that in the rural areas (UN Habitat, 2001). The global city population is expected to rise to 6.4 billion people by the year 2050 (United Nations, 2008), with a projected proportion of 60% of Kenyans living in urban centers by 2030 (Republic of Kenya, 2007; World Bank, 2011; Ngetich et al., 2014). In this regard, Nakuru town is the fourth largest town in Kenya; with an estimated population growth rate of 13.3% per year, making it one of the fastest growing towns in Africa (UN Habitat, 2011). This rate of urbanization has exerted pressure on food supply and the environment. This rising demand for food, coupled with cultural changes and prevailing economic conditions, have forced the urban population to keep cattle at the backyard of their compounds or even on a free-range system to supplement food supply (IDRC, 1994; Tegegne et al., 2000; Cheruiyot et al., 2014). This practice has increased significantly and poses a threat to the urban environment and human life in general despite the many

by-laws enacted by the local authorities aimed at regulating urban agriculture.

It is evident from the foregoing that urban dwellers, public health officials and Municipal policy makers are faced with an intricate scenario of whether to promote or prohibit urban cattle keeping because of the delicate balance between its benefits and the related environmental hazards. The benefits of urban cattle keeping include; diversification of income, improved food security and nutrition of the low-income urban population, manure for crop production, power generation (i.e., biogas), draught power, generation of employment and poverty elevation (IDRC, 2006; Tegegne et al., 2000). Conversely, there is a growing concern that urban livestock production is creating health risks and environmental degradation (UNDP, 1996; Ruel et al., 1998; UNDP, 2005; Kagira & Kanyari, 2010; Cheruiyot et al., 2014). The major polluting agents are animal waste (i.e., solid and liquid waste discharge), antibiotics and hormones, chemicals from tanneries, fertilizers and pesticides used to spray feed crops, and outbreaks of zoonotic disease due to proximity to livestock (Ishani et al., 2000; de Haan, 2007; Cheruiyot et al., 2014). Consequently, urban livestock keeping is often declared illegal. For instance, Nakuru Municipal By-Laws prohibit the keeping or rearing or grazing of any animal, except pets (e.g., cats and dogs) within the jurisdiction of the Municipality without a valid permit (MCN, 2006). Further, the town planning legislation in Kenya generally does not recognize urban agriculture as a legitimate land use that should be provided for (Physical Planning Act, 1996). Other regulations in the country also provide clear guidelines on the management of urban activities and waste management (e.g., Environmental Management and Coordination Act, 1999; Animal Diseases Act, 2012; Public Health Act, 2012). However, enforcement of these regulations has not been quite successful (Mireri et al., 2007) largely due to logistical reasons.

In Kenya, dustbins and nylon bags have been provided around the urban centers to dispose of domestic waste material but there are no 'dustbins' for cattle waste. The major challenge currently is, therefore, the handling of effluents and emissions from cattle waste. Consequently, there is need to assess environmental effects of urban cattle keeping in Nakuru Municipality so that appropriate policy guidelines and management systems can be developed to curb associated environmental hazards. This was the purpose of the current study.

2. Research Materials and Methods

The study was carried out in Nakuru Municipality in Nakuru County of Kenya, a description of which can be found in Cheruiyot et al. (2014). A cross-sectional survey was undertaken, in which primary data was collected from cattle keepers in the Municipality with the use of sets of pre-tested structured and unstructured questionnaires. Stratified sampling was used, with simple random sampling within the strata applied to select the survey respondents. The Municipality was divided into five clusters according to the existing administrative locations, namely; Afraha, Baharini, Barut, Kaptembwa and Lanet (Cheruiyot et al., 2014). Because the study design was cross-sectional, Fishers Exact Formula was used to get the sample size of 186 households as depicted in equation 1 below:

$$n = z^2pq/d^2 \quad (1)$$

where: n = desired sample size, z = z-score associated with 95% confidence, p = proportion in the target population who believed cattle waste disposal methods posed a threat to the urban environment (an estimate of 50% was used), $q = 1-p$ (proportion in the target population who did not believe cattle waste disposal methods posed a threat to the urban environment), and d = amount of discrepancy tolerated on p (this was set at 0.072). A table of random numbers was then used to randomly select respondents from the population from a list of cattle keepers in the Municipality provided by the Nakuru County Livestock Production Office. Additionally, structured interviews for key informants were also undertaken to collect data from individuals who had special knowledge or perceptions on the subject of the study. Focused group discussions were done in each location with groups of individuals who were well informed about the research topic or were likely to provide more informed responses to obtain perceptions on environmental concerns arising from cattle keeping in the Municipality (Cheruiyot et al., 2014). Quantitative and qualitative data were collected, emphasising on the full analysis of the environmental effects of urban cattle keeping in the Municipality. Secondary data was obtained from records and documents in the Municipality and other relevant government offices. General statistics were then used to describe the results, and chi-square and paired t-tests performed to determine if there were any significant differences between observations. The results are presented in tabular summaries.

3. Results and Discussions

3.1 Environmental Hazards of Cattle Waste

Majority of the survey respondents (90.3%) disagreed that cattle waste had any environmental hazards, with only 9.7% agreeing it had, an observation similar to that of DFID (2002) for cities in East Africa and Foeken & Owuor (2006) for Nakuru Municipality. This was attributed to lack of awareness among urban cattle keepers on environmental hazards related to livestock keeping in confined areas and close proximity to human beings. Table 1 below shows the type of cattle grazing system practiced by cattle keepers versus environmental hazards in the Municipality. Majority (82.8%) of the survey respondents who practiced zero-grazing perceived bad odour/ air pollution as an environmental hazard, a finding similar to that of Ishagi et al. (2002) for Kampala City in Uganda and Foeken et al. (2004) for Dar es Salaam, Tanzania. Improper architectural planning of cattle sheds and inadequate cattle waste disposal mechanisms were deemed to be the causes of bad odour/ air pollution. Those who grazed their cattle by the roadside perceived bad odour (49.5%) and littered streets (76.9%) as environmental hazards. Generally, the type of cattle grazing system was highly associated with environmental hazard.

Table1. Type of cattle grazing systems versus environmental hazards in Nakuru Municipality, Kenya

Type of grazing system	Count/ Group*	Environmental hazard			Total
		Bad odour/Air pollution	Littered streets with cattle waste	Breeding ground for flies	
Zero-grazing	Count	48.0	2.0	8.0	58.0
	A	82.8	3.4	13.8	100.0
	B	47.5	3.1	40.0	31.2
	C	25.8	1.1	4.3	31.2
Semi-zero grazing	Count	3.0	13.0	3.0	19.0
	A	15.8	68.4	15.8	100.0
	B	3.0	20.0	15.0	10.2
	C	1.6	7.0	1.6	10.2
Roadside grazing	Count	50.0	50.0	9.0	109.0
	A	45.9	45.9	8.3	100.0
	B	49.5	76.9	45.0	58.6
	C	26.9	26.9	4.8	58.6
Total	Count	101.0	65.0	20.0	186.0
	A	54.3	34.9	10.8	100.0
	B	100.0	100.0	100.0	100.0
	C	54.3	34.9	10.8	100.0

*A= % within type of grazing; B= % within environmental hazards; C= % of total.

Table 2 below presents the results of the number of cattle kept versus environmental hazards in the Municipality. It was apparent that the number of cattle reared was independent of the environmental hazards from cattle waste ($P=0.191$, $\chi^2_3=6.109$). The findings in the current study may be attributed to the fact that land ownership was a limiting factor in urban livestock keeping in Nakuru Municipality (Cheruiyot et al., 2014). This implies that associated environmental hazards are felt in equal strength regardless of the number of cattle reared due to close proximity of cattle to the urban households.

Table 2. Number of cattle kept versus environmental hazards in Nakuru Municipality, Kenya

Number of cattle kept	Count/ Group*	Environmental hazard			Total
		Bad odour/ Air pollution	Littered streets with cattle waste	Breeding ground for flies	
1-5	Count	19.0	13.0	6.0	38.0
	A	57.7	34.6	7.7	100.0
	B	19.2	20.5	6.7	17.1
	C	9.9	5.9	1.3	17.7
6-10	Count	32.0	20.0	22.0	74.0
	A	46.0	25.4	28.6	100.0
	B	37.2	36.4	60.0	41.4
	C	19.1	10.5	11.8	41.4
11-15	Count	37.0	23.0	14.0	74.0
	A	54.0	30.2	15.9	100.0
	B	43.6	43.2	33.0	41.4
	C	22.4	12.5	6.6	41.6
Total	Count	88.0	56.0	42.0	186.0
	A	51.3	28.9	19.7	100.0
	B	100.0	100.0	100.0	100.0
	C	51.3	28.9	19.7	100.0

*A= % within number of cattle kept; B= % within environmental hazards; C= % of total.

Table 3 below presents the cattle waste disposal mechanisms versus environmental hazards in the Municipality. It was evident that the heaping of cattle waste in the shed was more likely to contaminate the environment than giving it away or applying on the kitchen garden. This was explained by the fact that heaped cattle waste was being washed downstream and, therefore, contaminated the water. Similarly, heaped manure produced greenhouse gases like methane, which has the potential to cause global warming as well as considerable bad odour/ air pollution, and attracts flies and parasites that have potential of transmitting zoonotic diseases. Similar observations were made by Ishani et al. (2000) and FAO (2006).

Table 3. Cattle waste disposal mechanisms versus environmental hazards in Nakuru Municipality, Kenya

Waste disposal mechanism	Count/ Group*	Environmental hazard			Total
		Bad odour/Air pollution	Littered streets with cattle waste	Breeding ground for flies	
Heaped in cattle pen	Count	35.0	28.0	17.0	80.0
	A	43.8	35.0	21.3	100.0
	B	52.2	36.4	40.5	43.0
	C	18.8	15.1	9.1	43.0
Gave away	Count	15.0	42.0	6.0	63.0
	A	23.8	66.7	9.5	100.0
	B	22.8	54.5	14.3	33.9
	C	8.1	22.6	3.2	33.9
On kitchen garden	Count	17.0	7.0	19.0	43.0
	A	39.5	16.3	44.2	100.0
	B	25.4	9.1	45.2	23.1
	C	9.1	3.8	10.2	23.1
Total	Count	67.0	77.0	42.0	186.0
	A	36.0	41.4	22.6	100.0
	B	100.0	100.0	100.0	100.0
	C	36.0	41.4	22.6	100.0

*A= % within waste disposal mechanism; B= % within environmental hazards; C= % of total.

Table 4 below shows the distances to cattle waste disposal sites and environmental hazards generated in the Municipality. There were differences in the rating of environmental hazards across the two groups of respondents, i.e., those whose cattle waste was deposited less than 10 meters from the household and those whose waste was deposited more than 10 metres away ($P=0.021$, $\chi^2_2=7.689$). Depositing cattle waste nearer the households exposed the households to bad smell, flies and other associated parasites compared to farther away.

Table 4. Distances to disposal sites for cattle waste versus environmental hazards in Nakuru Municipality, Kenya

Distance to disposal site (metres)	Count/Group*	Environmental hazard			Total
		Bad odour/Air pollution	Littered streets with cattle waste	Breeding ground for flies	
≤10	Count	68.0	39.0	31.0	138.0
	A	49.3	28.3	22.5	100.0
	B	84.0	69.6	63.3	74.2
	C	36.6	21.6	16.7	74.2
≥10	Count	13.0	17.0	18.7	48.0
	A	27.1	35.4	37.5	100.0
	B	16.0	30.4	36.7	25.8
	C	7.0	9.1	9.7	25.8
	Count	81.0	56.0	49.0	186.0
	A	43.5	30.1	26.3	100.0
	B	100.0	100.0	100.0	100.0
	C	43.5	30.1	26.3	100.0

*A= % within distance to disposal site; B= % within environmental hazards; C= % of total.

3.2 Municipality's Policy Regulations Governing Cattle Keeping

Majority of the farmers (over 90.0%) were aware of the role of the Municipal Authorities in regulating cattle keeping within the Municipality. Although the Municipal Authorities should enforce its by-laws and prosecute the wrongdoers, the current study showed that only 32.4% of the offenders had been penalized with regard to cattle keeping or cattle waste management. Due to slackness in the enforcement of the by-laws and the continued decrease in land sizes, there is a worrying trend in the increase of cattle keeping and associated environmental hazards in the Municipality. Generally, the survey respondents indicated that there were inadequate cattle waste management procedures and policy guidelines to deal with environmental hazards from urban cattle keeping. It was established that the Municipality had formulated new by-laws which provided for decentralized service delivery for domestic waste collection, transportation and safe disposal (MCN, 2006) but there was no provision for cattle waste management.

4. Conclusions and Recommendations

Majority of the survey respondents disagreed that cattle waste had any environmental hazards, a response attributed to lack of awareness on the environmental hazards associated with urban cattle keeping. Environmental hazards were independent of the number of cattle reared but associated with the distance of cattle waste deposition from the household. Overall, there were inadequate procedures and policies guiding cattle waste management in the Municipality. Based on the findings, it is recommended that cattle waste management be decentralized, with active participation of organized urban cattle keepers and supported by the public. User pay principle should also be applied whereby urban cattle keepers pay a determined fee for cattle waste collection and disposal. This would help to support the sustainability of the decentralized service. The findings in the current study are useful for policy formulation on the management of cattle waste and associated environmental hazards.

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