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Occurrence level of urban and peri-urban farming activities across major network links of Nairobi County, Kenya

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Key words: Urban and peri-urban agriculture, Urban farming households, Farming enterprises, Roadside farms, Road transects, Nairobi City

Abstract

Urban and peri-urban agriculture can play a crucial role in the economy, social and dietary life of urban dwellers. The city of Nairobi is going through urbanization challenges including provision of food, especially in slum areas where majority of urban poor lives. Reliable data on extent of urban/peri-urban areas being used for farming in Nairobi County, spatial distribution of such areas, type of crops, animals and proximity to market places are lacking. The aim of this study was to determine occurrence level of farming activities across four major network links of Nairobi County. Purposive sampling was applied in selecting four major network links (road transects). Semi-structured questionnaires were administered to farmers through face-to-face interviews. Data was collected on socio-economic characteristics, agricultural enterprises and consumption patterns. Data was analyzed at 5% level of significance, using descriptive statistics and chi-square test was performed. Farming activities generally increased with an increase in distance from the city center towards the Nairobi outskirts along three road transects. Crops only (90%) was the main farming enterprise practiced. More occurrences of farming activities were on Mombasa (33%) followed closely by Ngong (26%) and Thika superhighway (25%) road transects. Least farming activities were observed on Waiyaki way transect (16%). Fruits (27%) and vegetables (19%) topped the crop produce grown while poultry (38.5%) and cattle (34.6%) were the most reared livestock. These research findings will supplement to Nairobi City planners' decision making process concerning urban and peri-urban agriculture in regard to land use allocation.

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Introduction

Urban and peri-urban agriculture, which includes both crop production and livestock rearing in and around towns, cities and metropolitan, has been recognized as serving an important role in the economic, social, and dietary life of many cities in Sub-Saharan Africa (Lee-Smith, 2013; Stewart *et al.*, 2013; Conceição *et al.*, 2016). Kenya has during the last four decades, witnessed rapid rate of urbanization estimated at 6% spurred by the perceived better opportunities in the urban centres as opposed to increasing incidences of poverty and insecurity in the rural areas (Owuor, 2019). Confronted with rapid urbanization, thousands of families strive to "improve their access to food and raise income through agricultural activities in urban and peri-urban areas" (Lee-Smith, 2013; Mwaura *et al.*, 2019; Mwangi and Crewett, 2019).

In Kenya, Nairobi City County has the largest urban population with 3,138,369 people (KNBS, 2010) and is ranked position two (2) in poverty with a poverty rate of 22.5 percent. The city of Nairobi equally is going through the urbanization challenges including the provision of food, water and sanitation especially in slum areas where majority of the urban poor are living. Between a third and half of the country's urban population live in poverty, and given the pace of urbanization, urban poverty will represent almost half of the total poverty in Kenya by 2020 (Mutisya and Yarime, 2011; Ruel *et al.*, 2017a; Shifa and Leibbrandt, 2017; Lucci *et al.*, 2018). Moreover, while urban poverty has been decreasing according to some measures, statistics indicate that the proportion of the urban population that is poorest of all (the 'food poor' and 'hardcore poor') has been on the rise (Rudolph and Kroll, 2016; Ruel *et al.*, 2017a; Ruel *et al.*, 2017b).

Urban planners are increasingly interested in agriculture within and around cities and have to decide whether to maintain or not areas for agricultural land use within and close to growing cities (Recasens *et al.*, 2016; Martellozzo *et al.*, 2018). The ability of urban farming to continuously supply food for the urban poor, especially in developing nations, will depend on better planning to enable sustainable management of the practice.

The question of food safety and urban food systems is consequently becoming an issue of significance for international agencies, urban politicians and policy-makers, urban administrations and urban populations themselves. The 2009 Population and Housing Census results released in August 2010 revealed that Kenya's population had risen by ten million people since the last count in 1999, an average of one million people per year (KNBS, 2010). The increasing urban population has put pressure on the food demands. Because of the undervaluation of urban agriculture and stiff competition for land, urban agriculture is often pushed back to marginal areas within the city, where it may harm the fragile ecosystems if not properly guided (Thuo, 2013; Agarwal and Sinha, 2017; Dominati *et al.*, 2019). This is due to the replacement of arable fields with other land uses (like residential). Urban agriculture has potential to make cities more socially and ecologically sustainable, but urban planners have not had effective policy levers to encourage this (Bricas *et al.*, 2019; Halliday, 2019). Though some of urban dwellers of Nairobi City County practice some form of agriculture to provide food for themselves and their families, there is need to question the current status of the city, in regard to available food systems (FAO, 2013; Wascher *et al.*, 2017; Onono *et al.*, 2018). The type of agricultural production and location influences food safety and space usage. Reliable data on the extent of urban/peri-urban areas being used for farming in Nairobi County, the spatial distribution of such areas, type of crops, animals and proximity to market places are lacking (Revi and Rosenzweig, 2013; Tilman *et al.*, 2017; Robineau and Dugué, 2018; Smidt *et al.*, 2018). This can partly be attributed to the fact that ground-based survey methods for data capture for detecting and measuring change are relatively expensive and time consuming. The aim of this study was therefore to determine occurrence level of farming activities across four major networks of Nairobi City County.

Materials and methods

Study area

Nairobi, the capital city of Kenya, covers an area of about 696km². The city is bounded within geographic coordinates of 1°16'S latitude and 36°48'E longitude (Fig. 1).

It had an estimated population of 3,138,369 people as per the 2009 population census, and 4,337,080 people as per 2019 population census, both conducted by Kenya National Bureau of Statistics (KNBS, 2010; KNBS, 2020). The population growth rate of Nairobi is estimated at about 4.1 percent per annum, however about 60 percent of this population are described as urban poor and live in informal settlements (Mutisya and Yarime, 2011). Nairobi City County has eleven (11) sub-counties (KNBS, 2020). Urban areas are Starehe, Makadara, Embakasi, Mathare and Kamukunji whereas peri- urban are Kasarani, Westlands, Dagoretti, Lang'ata, Kibra and Njiru. At between 1600 and 1800 metres above sea level (Rateng, 2019; Ogega *et al*., 2019), Nairobi enjoys a moderate subtropical highland climate. There are two rainy seasons, with long rains falling between March and May and short rains between October and December (Foeken and Mwangi, 2000). Annual rainfall ranges between 300mm and 700mm (Wangari, 2013).

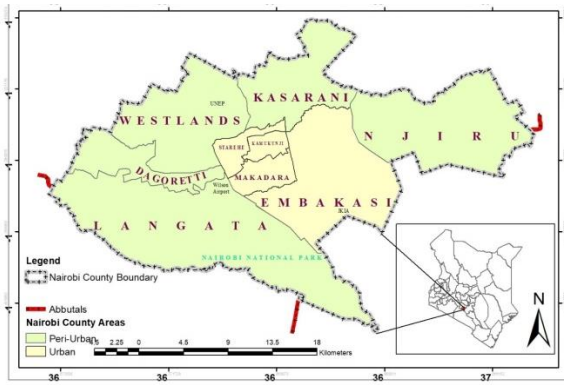

Fig. 1. Map of study area showing urban and peri-urban areas of Nairobi City County. (Source: Author)

Data Collection

The target population for this study were the active urban and peri-urban farmers Nairobi City County, who were identified by the help of the sub-county agricultural officers and divisional agricultural extension officers from the Ministry of Agriculture. Purposive sampling was applied in selecting 4 major network links (road transects) of Nairobi City County with active urban and peri-urban agriculture farmers. Multistage (branching links) and systematic sampling were used to select data points (farming households) for making observations and administering semi-structured questionnaires through face-to-face interviews. Along each network link, sampling points were set systematically to draw the *i*th farmer on the list of the active urban farmers that were provided for the specific region. Thika superhighway, Mombasa road, Ngong road, and Waiyaki way were identified as the four major network links that transect Nairobi City County and dissect it into four (4) quarters. Sampling was conducted along these links and along their main access points (secondary access roads). Sampling points along the access road was set at around 100 metres intervals for a length of 1000 metres. A Global Positioning Systems (GPS) receiver (Garmin model Etrex 10) was used to map respondents' farms during field survey. The information gathered during the field survey included the respondents' socio-economic characteristics, land tenure, type of agricultural enterprises practiced, consumption patterns, sources of water for farming, waste management (crop, livestock and water), farming challenges and farmer-urban planners' relationship in regard to urban and peri-urban agriculture.

Data analysis

Geographical points collected by use of a GPS were loaded onto ArcGIS software (as shapefiles) and ArcMap version 10.3 was used to process maps of sampled sites and localities. The survey data collected was checked, cleaned, coded and input on a spreadsheet. Statistical analysis was performed descriptively using the Statistical Package for the Social Sciences (SPSS Version 20). In determining any association between variables, contingency tables (Pearson chi-square) was used to obtain results. All data was analyzed at 5% level of significance. Results were presented using tables, pie charts, bar graphs and maps.

Results and discussion

Out of the 672 households visited, 58.63% (394) were actively involved in farming activities. The farming enterprises involved in growing crops only were 90.61%, rearing livestock only 0.25% while those growing both crops and rearing livestock were 9.14% (Table 1).

Table 1. Urban and peri-urban agriculture enterprises undertaken along four major road transects in Nairobi City County, Kenya.

Road transect name	Type of farming enterprise			
	Crops only (%)	Livestock only (%)	Crops & Livestock (%)	Total (%)
Mombasa	32.99	0.00	0.51	33.50
Ngong	26.14	0.00	0.00	26.14
Thika Superhighway	21.07	0.00	3.81	24.87
Waiyaki Way	10.41	0.25	4,82	15.48
Total (%)	90.61	0.25	9.14	100.00

These results indicate that there are noticeable farming activities carried out along and close to major roads of Nairobi City County. This is because most of the city dwellers do not own their own land. In their study, Ogendi *et al.* (2019) and Mwaura *et al.* (2019) observed road reserves being among the open spaces embraced by urban and peri-urban dwellers of Nairobi City County for farming. The intensity of farming activities generally increased with an increase of distance from access links/centers near the Nairobi City central business district (CBD) to the further placed (outskirts) access links/centers along three major network links of Nairobi City County. The exception was along Mombasa road transect whereby the reverse of that observation was true (Fig. 2). The number of farms observed in this study increased as one moved from the urban areas to the peri-urban areas of the city. These findings were in agreement with Githugunyi (2014), who observed that agricultural land use pattern in Nairobi metropolitan area would show zones of gradually increasing intensity from the built-up edges to where the city has no direct influence upon agricultural practice.

Fruits (27%) and vegetables (19.9%) were the major crops cultivated along the major network links while fodder (4.8%) and oilseed crops (0.3%) were the least grown crops (Fig. 3). Fruit crops (47.7%) were mostly found cultivated along Mombasa road transect (Fig. 4). Fodder crops were mostly cultivated along Waiyaki Way (40%) and Thika Superhighway (40%) transects. Roots & tubers (37.9%), vegetables (33.8%) and sugar crops (36.4%) were found mainly along Thika Superhighway. Grains (31%), pulses (52.2%), ornamental plants (53.8%) and oilseed crops (100%) were cultivated along Ngong road transect. Poultry (38.5%) and cattle (34.6%) were the major livestock found along the 4 major networks in Nairobi County (Fig. 5). Studies conducted by Alarcon *et al.* (2017) indicate that indeed Nairobi City County farmers do keep various categories of livestock; with dairy cattle keeping ranging from small scale to large scale.

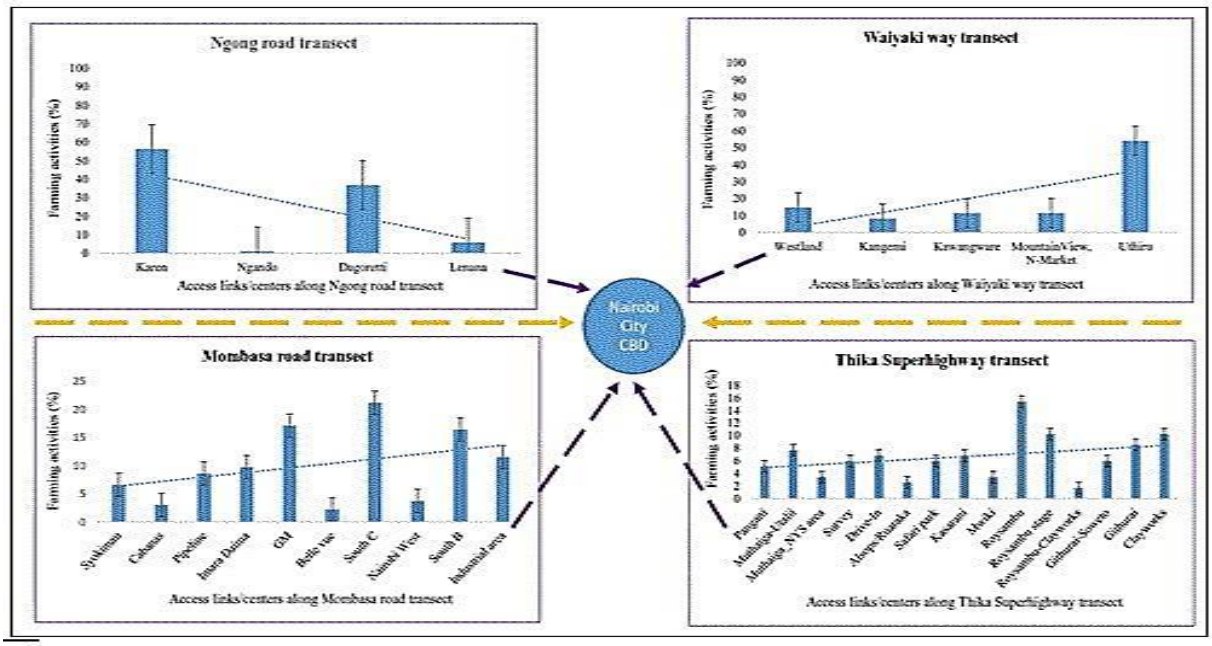

Fig. 2. Intensity of farming activities at access links/centres along four major road transects in Nairobi City County, Kenya.

Alarcon *et al.* (2017) further revealed that most dairy cattle animals kept by Maasai beef fatteners were grazed along roads and river sides, while zero-grazed animals were fed with grass/hay cut along roads, yet still some beef keepers had small gardens with grass for their animals. In their studies, Foeken and Mwangi (2000) and Wangari (2013) observed poultry, goats and sheep being reared within Nairobi City County. In another study, it was reported that commercial layers and indigenous chicken were kept in Dagoretti (Onono *et al.*, 2018). These poultry play a significant role in supporting livelihood of urban and peri-urban households by providing eggs, income and chicken manure (Onono *et al.*, 2018).

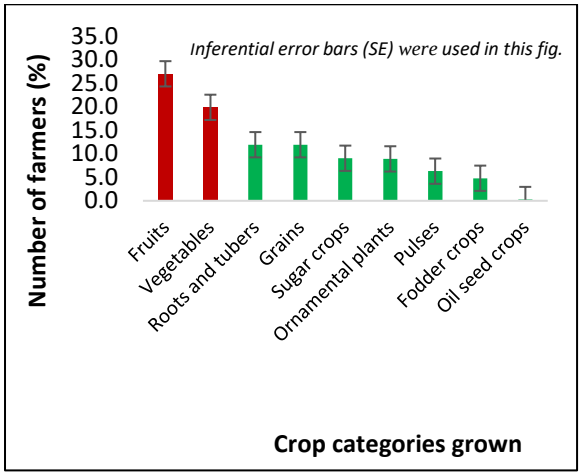

Fig. 3. Proportion of farmers engaged in various types of crop categories across four major network links in Nairobi City County, Kenya.

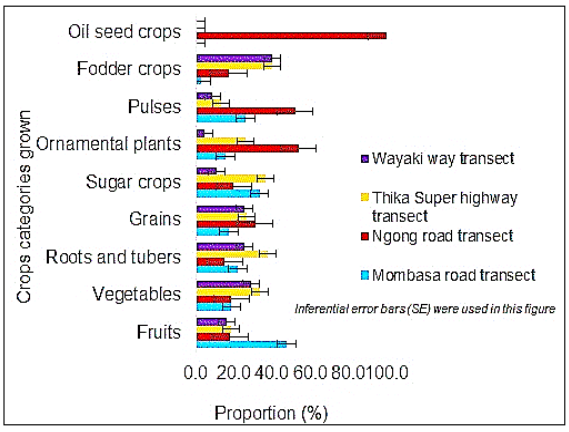

Fig. 4. Proportion of various types of crop categories along four major road transects in Nairobi City County, Kenya.

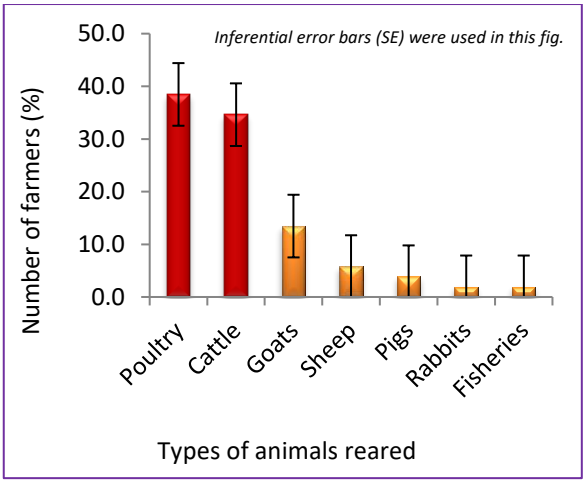

Fig. 5. Proportion of farmers rearing different types of livestock along four major road networks in Nairobi City County, Kenya.

Rabbits were only found reared along Thika Superhighway transect while cattle, poultry, goats, pigs, sheep and fisheries were mainly along Waiyaki Way transect (Fig 6). Rabbitry is an emerging urban agricultural enterprise as an alternative source of animal protein in space constrained environment. Alarcon *et al.* (2017) reported that rabbit farming was gaining popularity in Nairobi city and was done by either individual farmers, groups or institutions such as schools who sell their animals directly to consumers or for own consumption. Alarcon *et al.* (2017) reported that these rabbits were fed on green weeds or grass harvested from roadsides. This concurred with observations in this study whereby rabbits were fed on vegetable remains, freshly cut grass and weeds sourced from nearby farms.

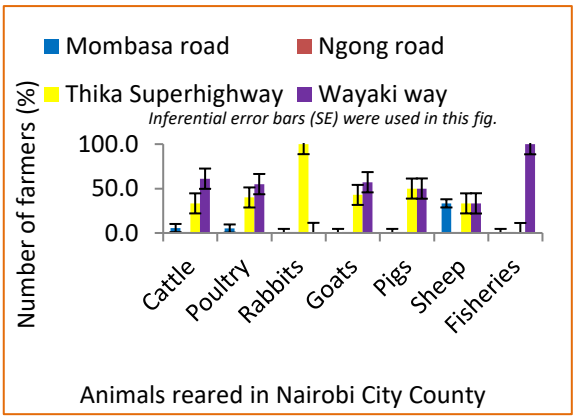

Fig. 6. Distribution of livestock along four major network links in Nairobi City County, Kenya.

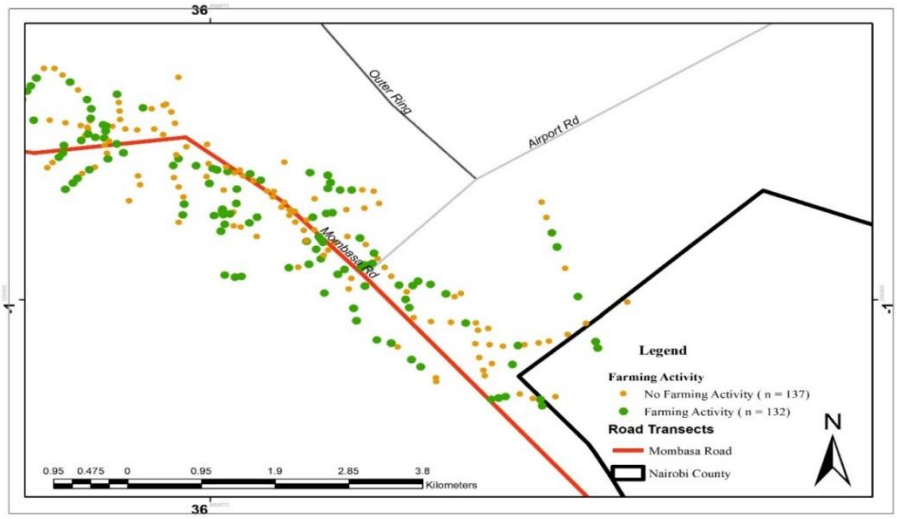

Fig. 7. Map showing the occurrence level of farming activities along Mombasa road transect. (Source: author).

The intensity of farming activities at various access points along Mombasa road transect (Fig. 7) generally decreased as one moved from the main road access point to the further interior (Fig. 8).

Fruit trees were substantially the major crop cultivated along this transect while fodder and oilseed crops were the least grown crops (Fig. 9).

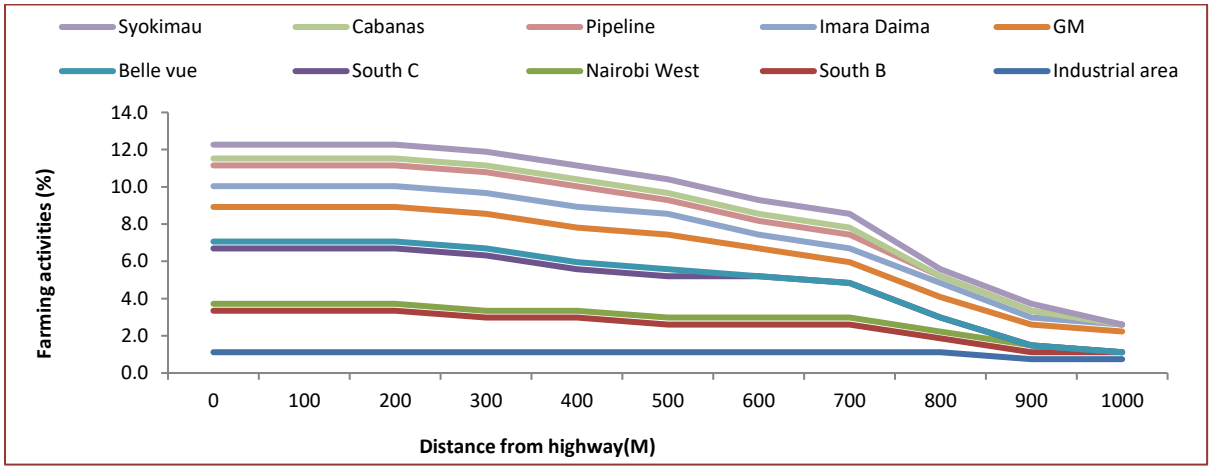

Fig. 8. Trend of farming activities at access links along Mombasa road transect.

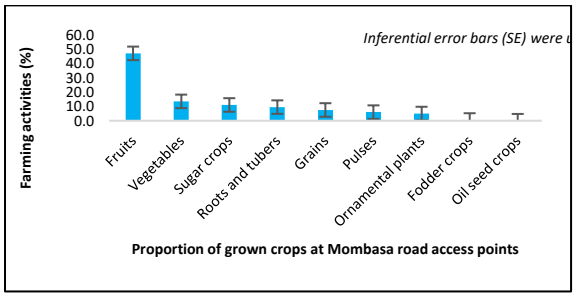

Fig. 9. Proportion of various categories of crops grown along Mombasa road in Nairobi County, Kenya.

Cattle, poultry and sheep were the main livestock found along Mombasa road transect (fig. 10) in enclosed structures and open rearing.

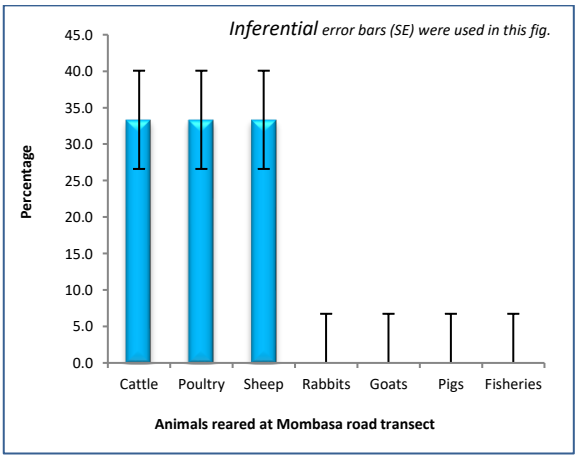

Fig. 10. Proportion of household rearing livestock along Mombasa road transect in Nairobi City County, Kenya.

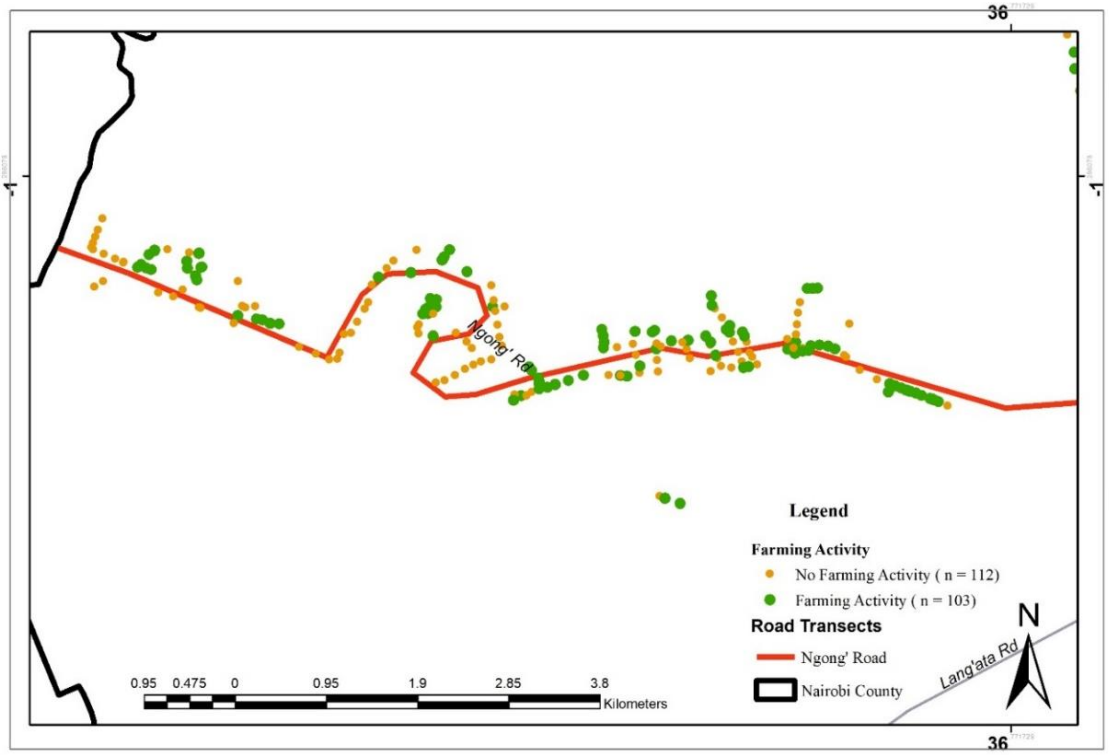

Fig. 11. Map showing the occurrence level of farming activities along Ngong road transect in Nairobi City County, Kenya. (Source: author).

The intensity of farming activities along various access links along this road (Fig 11) generally decreased with increasing distance from the main road at 0M to the further interior up to 1000M (fig 12).

Ornamental plants and fruit trees were the major crop types cultivated along this road transect while fodder and oilseed were the least grown crops (Fig 13). There wasn't any livestock observed during the period of survey.

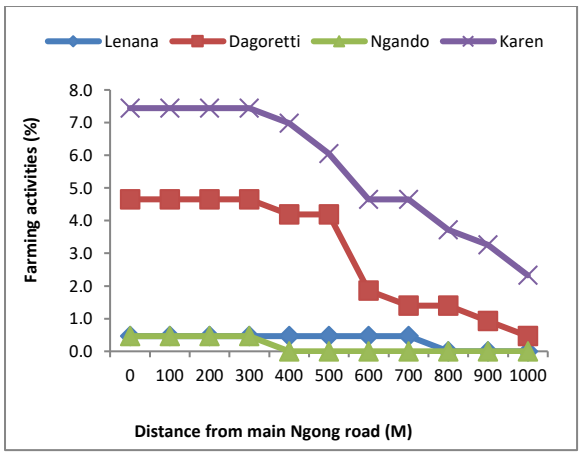

Fig. 12. Intensity of farming activities at access links along Ngong road transect in Nairobi City County, Kenya.

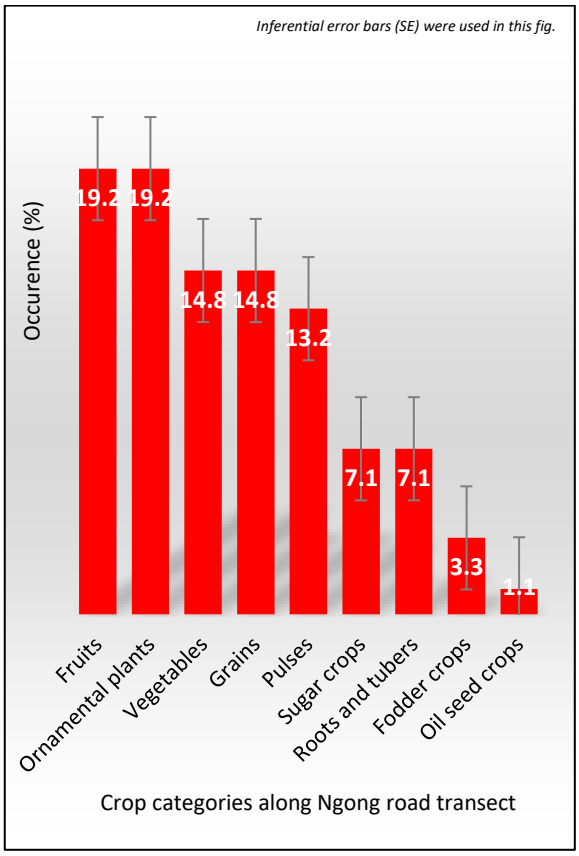

Fig. 13. Proportion of various categories of crops grown along Ngong road transect in Nairobi City County, Kenya.

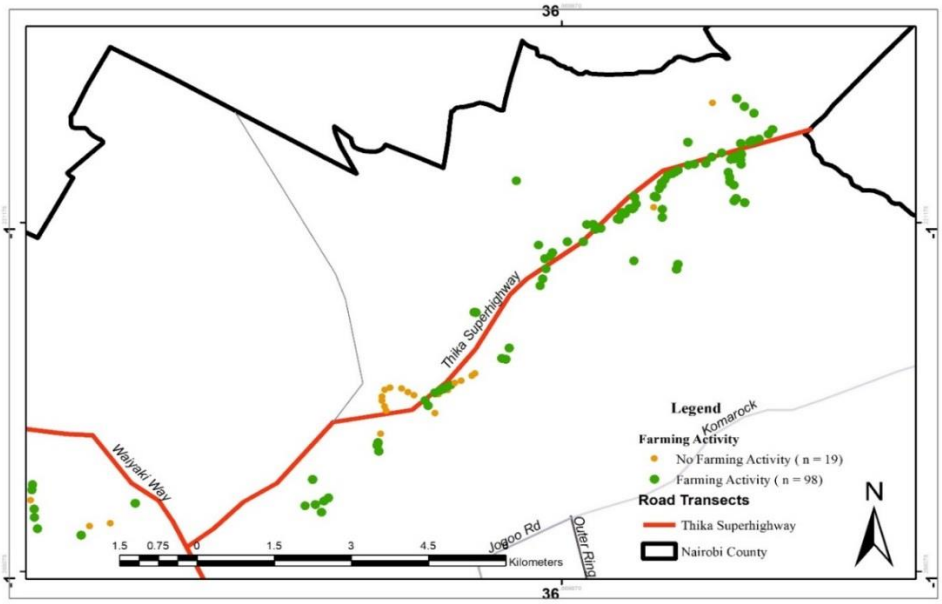

Fig. 14. Map showing the occurrence level of farming activities along Thika Superhighway transect in Nairobi City County, Kenya. (Source: author).

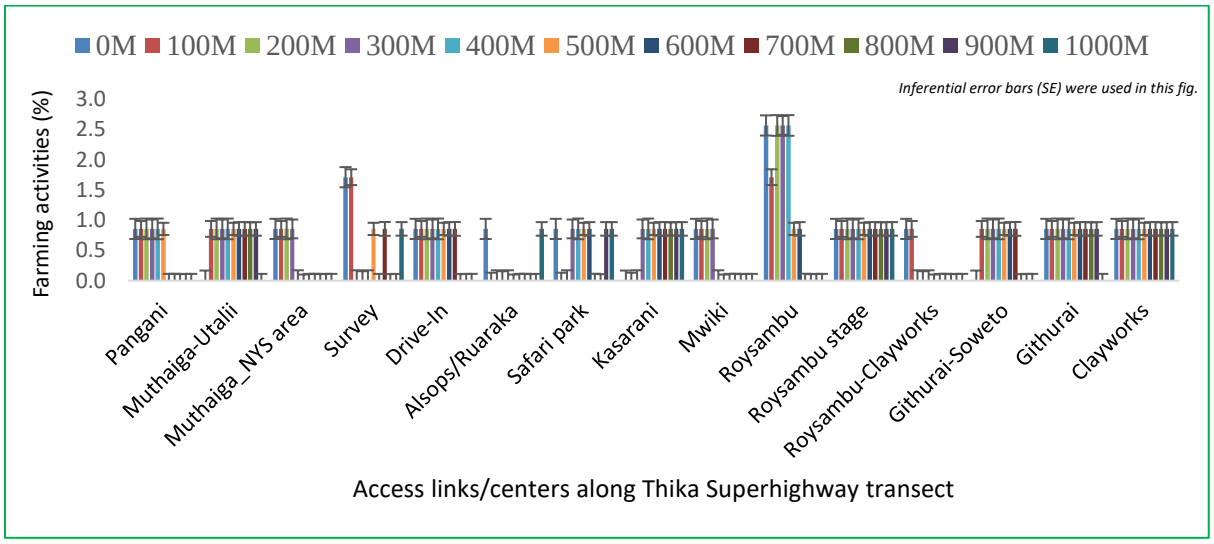

Fig. 15. Trend of farming activities along access links of Thika Superhighway transect in Nairobi City County, Kenya.

The intensity of farming activities at various access links along this road transect (Fig 14) generally remained constant (uniform) as one moved from the main road at 0M to the further interior up to1200M (Fig. 15).

Vegetables, fruit trees, roots & tubers were the major crops cultivated along this road transect while pulses and oilseed were the least grown crops (Fig. 16).

Poultry and cattle were the main livestock found along Thika Superhighway road transect (Fig. 17).

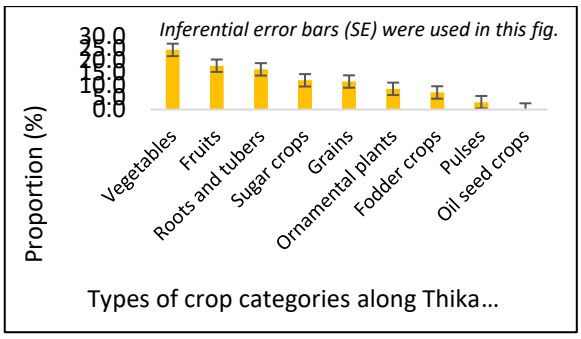

Fig. 16. Proportion of various categories of crops grown along Thika Superhighway transect in Nairobi City County, Kenya.

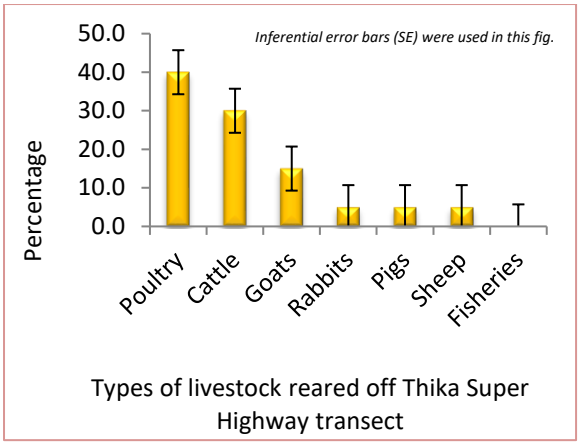

Fig. 17. Proportion of types of livestock reared off Thika Superhighway transect in Nairobi City County, Kenya.

The intensity of farming activities at various access links along this road (Fig 17) was uneven as one moved from the main road transect to the further interior (Fig 18).

Vegetables (28.8%) (kales, broccoli, cauliflower, lettuce and red cabbages) and fruit trees (21.9%) (bananas, avocado, and loquats) were notably the major crops cultivated along this road while ornamental plants (2.1%) and oilseed (0.3%) crops were the least grown crops (Fig 19). Cattle (37.9%) and poultry (37.9%) were the main livestock recorded along Waiyaki Way road transect (Fig 20).

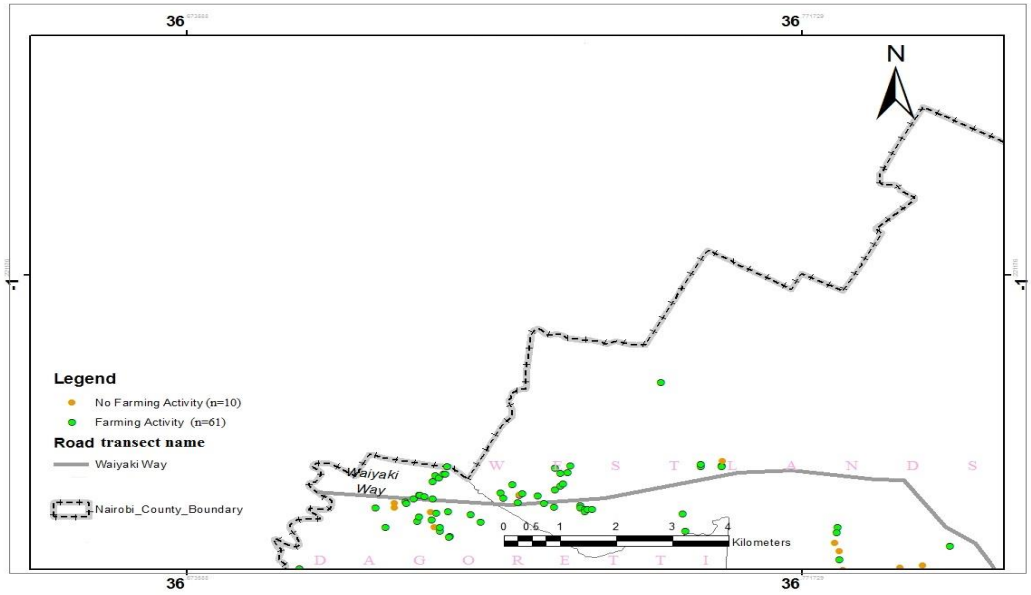

Fig. 18. Map showing the occurrence level of farming activities along Waiyaki Way transect in Nairobi City County, Kenya. (Source: author).

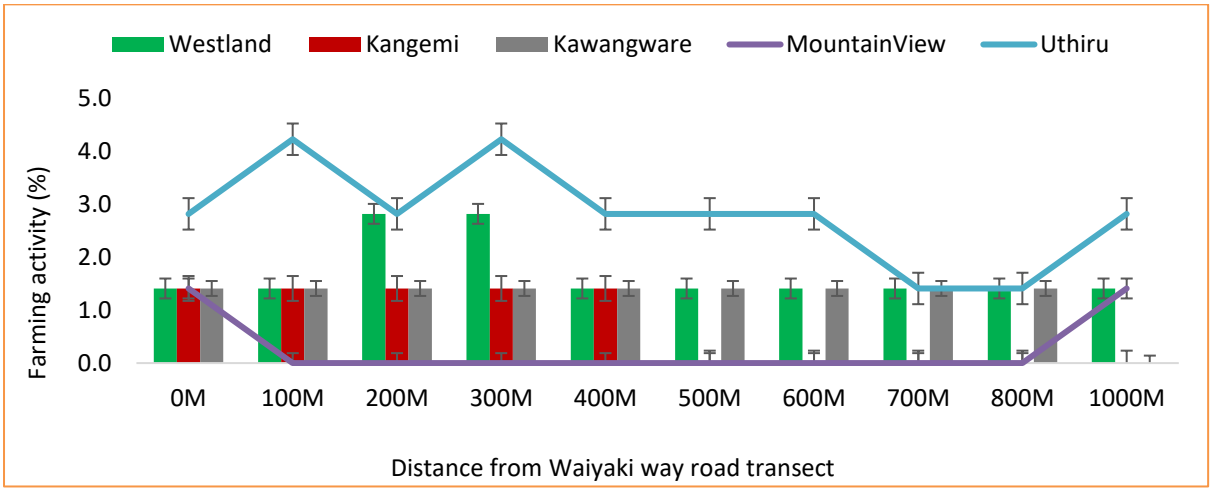

Fig. 19. Intensity of farming activities along access links of Waiyaki Way transect in Nairobi City County, Kenya.

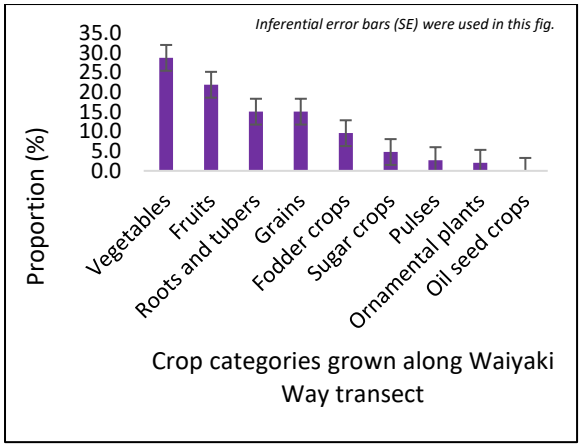

Fig. 20. Proportion of various categories of crops grown along Waiyaki Way transect in Nairobi City County, Kenya.

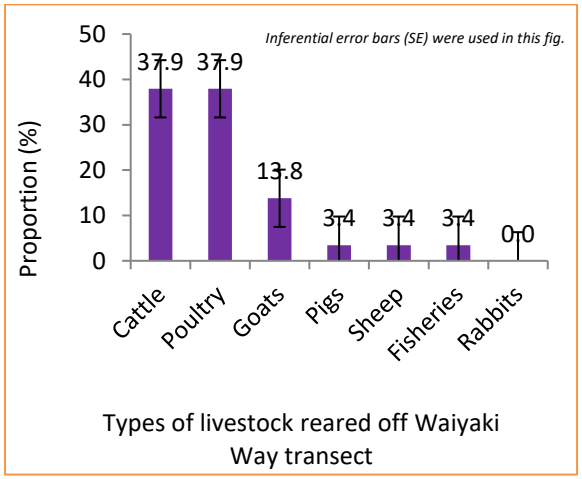

Fig. 21. Proportion of types of livestock reared off Waiyaki Way transect in Nairobi City County, Kenya.

The farming households noticeably engaged in crop and livestock production as a livelihood strategy meant to supplement their source of fresh vegetables, fruits and animal products. Sales from surplus farm produce could supplement their source of income. This was in agreement with Lee-Smith (2013) and Wangari (2013) who noted that these farming activities were due to rapid increase in population and the nutritional needs of the city dwellers.

Conclusion

There were more occurrences of farming activities on Mombasa road transect (33%), followed closely by Ngong (26%) and Thika superhighway (25%) road transects. Least farming activities were observed on Waiyaki way transect (16%). Generally, the farmers engaged in a diversity of farming activities, with a majority preferring crop production enterprises (90%). Fruits (27%) and vegetables (19%) topped the crop produce grown both for home consumption and selling of the surplus to the neighbors and local market. However, a smaller percentage of farmers practiced mixed farming (9.14%) with poultry (38.5%) and cattle (34.6%) observed as being the most reared livestock. The intensity of farming activities generally increased with an increase of distance from Nairobi City center (CBD) which is the urban area, to the further placed (outskirts) access links (towards the peri-urban areas) along three major network links of Nairobi City County. The exception was along Mombasa road transect whereby the reverse of that observation was true.

These research findings will supplement to Nairobi City planners' decision making process concerning urban and peri-urban agriculture in regard to land use allocation. This will aggrandize future research and contribute to the development of suitable policies for urban farming that will play a crucial role towards improved livelihoods of the urban poor since urban farmers cultivate a wide range of crops and rear a large number of livestock with substantial yields. Further studies to be conducted on the presence and level of contaminants in the farm produce obtained from roadside farming along the road transects that may pause health risks to the consumers. Further studies to be conducted on the preference of certain crops and livestock by farmers on each transect. Further studies are also needed to evaluate livestock production technologies in urban and peri-urban areas of Nairobi City County.

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