STATUS OF URBAN AGRICULTURE AND ITS IMPLICATION FOR POLICY CHANGES IN URBAN LAND USE IN NAIROBI, KENYA

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A Thesis submitted in partial fulfilment of the requirements for the award of the Degree of Master of Environmental Studies (Community Development) in the School of Environmental Studies of Kenyatta University

June 2010
DECLARATION

This Thesis is my original work and has not been presented for a degree or any other award in any university.

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DEDICATION

To God, Almighty for his grace and loving care. To my beloved family: my husband, Jackson and children, Eric, Naomi and Andrew for their patience, understanding and encouragement.
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<tr>
<td>ACC/SCN</td>
<td>Administration Committee on Coordination/Sub-Committee on Nutrition</td>
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<tr>
<td>ACT &amp; CTA</td>
<td>Technical Centre for Agriculture and Rural Development and Food Security, Netherlands</td>
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<td>CAP</td>
<td>Community action plan</td>
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<td>CAST</td>
<td>Council on agriculture, science and technology</td>
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<td>CBS</td>
<td>Central bureau of statistics</td>
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<td>EMCA</td>
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<td>Faith-Based Organization</td>
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<td>Focus Group Discussions</td>
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<td>GAP</td>
<td>Good Agricultural Practices</td>
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<td>GIS</td>
<td>Geographical Information Systems</td>
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<tr>
<td>Abbreviation</td>
<td>Full Form</td>
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<tr>
<td>ICLEI</td>
<td>International Council for Local Environments and Initiatives</td>
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<td>IDRC</td>
<td>International Development Research Centre</td>
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<td>ILRI</td>
<td>International Livestock Research Institute</td>
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<td>MA</td>
<td>Millennium Assessment</td>
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<td>MDG</td>
<td>Millennium Development Goals</td>
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<td>NALEP-IF</td>
<td>National Agriculture and Livestock Extension Programme-Implementation Framework</td>
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<td>NEMA</td>
<td>National Environmental Management Act</td>
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<td>NGO</td>
<td>Non-Governmental Organization</td>
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<td>PRA</td>
<td>Public Rural Appraisal</td>
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<td>PRSP</td>
<td>Poverty Reduction Strategy Paper, 2001-2004</td>
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<td>PUA</td>
<td>Peri-Urban Agriculture</td>
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<td>RUAF</td>
<td>International Network of Resource Centres on Urban Agriculture</td>
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<td>SIUPA</td>
<td>Strategic Initiative on Urban and Peri-Urban Agriculture</td>
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<td>SOYIA</td>
<td>Soweto Youth in Action</td>
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<td>SPSS</td>
<td>Scientific Programme for Social Scientists</td>
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<td>SSI</td>
<td>Semi-Structured Interview</td>
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<td>UA</td>
<td>Urban Agriculture</td>
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<tr>
<td>UNDP</td>
<td>United Nations Development Programme</td>
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<td>UNEP</td>
<td>United Nations Environmental Programme</td>
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<td>UN-Habitat</td>
<td>United Nations Human Settlement Programme</td>
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<tr>
<td>UPA</td>
<td>Urban and Peri-Urban Agriculture</td>
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WHO  World Health Organization
WRI  World Resources Institute
ABSTRACT

Urban agriculture plays a significant role in national development by contributing towards food security, employment creation, poverty alleviation, and ecologising the “artificial” urban systems. However, it is associated with diverse negative impacts to people and the biophysical environment. Further, though generally illegal in Kenya, the practice continues unabated, being a survival strategy for the low income bracket. This study aimed at assessing its status with view of encouraging policy changes that would allow it, but make it people and environment friendly. This study employed a descriptive research design. Primary data were derived from field surveys using questionnaires, key informant interviews and focus group discussions. Secondary data were synthesized from text books, journals, newsletters, electronic media, district development plans as well as other related articles. To obtain the trend of urban agriculture, geographical information systems tools were used to generate maps for land use. Landsat satellite images were acquired covering Nairobi province for the year 2000 and 2009. For the sustainability concerns of agricultural practice the questionnaires were analysed using social package for social scientists software to come up with frequency distribution, percentages and measures of central tendency such as the means and mode which were used to summarize and interpret the research findings. In order to come up with the policy gaps, various Act of Parliament and policy papers were studied and analysed in the context of urban agriculture. The trend of urban agriculture in Nairobi showed it was on the decline due to competition of land by other land uses particularly urban development. The riverline area declined by 36.6% and rainfed agriculture declined by 42.1%, although there was an emergence of irrigated agriculture which occupied an area of 542.4 ha. Over 73.6% of urban dwellers engaged in urban farming. Urban agriculture remains popular due to its contribution to food security, income generation and employment creation. About 81.6% of urban farmers used farm inputs in their farms with potential negative implication on the environment and human health. The morbidity report for Kahawa health centre showed that respiratory diseases, diarrhoea, malaria and intestinal worms were most common. On policy gaps, the study found that urban agriculture though a survival strategy by a majority of the urban dwellers, is not addressed in key policy documents like Local Government Act, Physical Planning Act, Agricultural Act, Vision 2030, SRA, PRSP,ERS. Urban agriculture needs to be legalised, but modalities for its social, environmental and economic sustainability put in place through strategic extension services. Land should be made accessible by introducing secondary land ownership, encouraging use of treated recycled waste water and waste products, more investment in use of space effective technologies like stacked green houses, multi-storey gardens and roof top farming.
CHAPTER 1: INTRODUCTION

1.1 Background

Urban agriculture has been practiced from time immemorial. Urban agriculture is the practice of crop cultivation and livestock raising within the boundaries or the immediate periphery of a city (Madden and Chaplowe, 1997). There has been a drastic increase in urban agriculture in the last two decades, and this trend is likely to continue, mainly due to the increase in urban food demands brought about by urbanization (Mougeot, 1994). Between 1990 and 2000, global population increased by 15%, with 25% in urban areas and it’s estimated that 50% of the poor live in urban areas (World Bank, 2000). In Sub-Saharan Africa, urban population grew from 23% in 1980 to 34% in 1999 (World Bank, 2000).

Until recently agriculture was considered an exclusive rural activity. But this has changed due to the rapid increase in urban population especially in the developing countries. East Africa has the highest average rate of urbanization in Africa of 4.5% per annum (UNEP, 2002). Nairobi has an urbanization rate of 3.8% with an urban population of 3.1 million people (KNBS, 2010). This has caused a rapid increase in urban poverty and urban food insecurity (Mougeot, 2005).

Food production in the city is mainly a response of the urban poor to inadequate, unreliable and irregular access to food, and the lack of purchasing power (Mougeot,
1994; Foeken and Mwangi, 2000). Urban agriculture also contributes to local economies development, and poverty alleviation. Urban farmers come from all income groups, but the poor dominate (Mireri et al, 2007). For the urban poor, UA is a survival strategy (Mbiba, 1995). Urban agriculture contributes to food security and health nutrition, helps in managing the urban systems and in micro-climate improvement, allows savings in transportation costs, storage, and in production losses. It also stimulates development of related micro-enterprises (http://www.ruaf.org/node/ 2009).

The important role played by urban agriculture cannot be over-emphasized. However, urban agriculture is not without challenges. Urban agricultural practices are not sustainable and result in environmental pollution and production of unsafe food products. Using untreated water, contaminated soils, indiscriminate use of chemicals and keeping of livestock in over-populated areas lead to negative impact on human health. With more and more people living and working in the cities, we should seek to maximize economic, social, and health benefits of urban agriculture while minimizing the health risks. Human well-being remains a central concern, particularly for the poor urban dwellers. There is need therefore to enhance the socio-economic and ecological benefits of urban agriculture in order to safeguard the environmental gains.

1.2 Problem Statement and Justification

Urban agriculture plays a very significant role towards increasing urban food security, employment creation and in supplementing household income (UN Habitat, 2003). It is however associated with diverse negative environmental and health impacts such as
generating wastes, which pollute the environment and due to lack of institutional support may lead to production of unsafe agricultural products (Mireri et al 2007). Further, though generally an illegal practice within Kenyan by-laws (Urban Harvest, 2007), urban agriculture continues unabated as a survival tactic (Mbiba, 1995). Its implications will continue to be a challenge as urbanization increases particularly in developing countries.

Nairobi has an urban population of 3.1 million people (KNBS, 2010) and a high unemployment rate. A substantial proportion of the urban poor, not only lack decent shelter, but are unable to satisfy their food and nutritional requirements (UN-Habitat, 2004). According to urban harvest (2004), a third of Kenyan urban dwellers are involved in UA. More people are expected to turn to urban agriculture as a means to supplement food supplies and income levels. If well integrated into the urban planning UA could also help in the attainment of the MDGs, particularly MDG No. 1 (Eradicating extreme poverty and hunger), MDG 3 (Promotion of gender inequality and empowering of women), MDG 6 (Combat HIV/AIDS, and other diseases), and MDG 7 (Ensuring environmental sustainability). By increasing food production, poverty and hunger will be eradicated since the urban poor will provide nutritious food for their families, thus escaping most of the nutritional related diseases such as kwashiorkor, Marasmus and HIV/AIDS. In Kenya, the adult HIV prevalence stands at about 10.2% with an estimated 2.2 million people living with HIV/AIDS (ICASA, 2003). The urban areas are the most affected. The income of HIV/AIDS affected households has been critically minimized and they are in need of nutritious food. Urban agriculture could play a role in alleviating hunger and malnutrition among HIV/AIDS affected persons in the urban areas.
Urban agriculture also has the potential of making use of waste water and urban solid waste as key inputs to production thus ensuring environmental sustainability. Urban agriculture can also mitigate some of the negative impacts of climate change such as famine and reduction of carbon emissions (Smit, 1996). Some Acts of Parliament however conflict one another such as the Agricultural Act (Cap 318) and the Physical Planning Act (Cap 286) Sec.16 leading to confusion (GOK, 1994; GOK, 1989). Urban agriculture produces a lot of agricultural waste and also makes use of polluted water and effluent from industries which may lead to presence of heavy metals in vegetables. Living close to animals could also lead to zoonotic diseases. Some farmers encroach into rivers and this leads to soil erosion. It thus seems reasonable to try and enhance the socio-economic and environmental benefits of UA than continue attempting to outlaw it. This possibility with special focus on Nairobi was the gist of this study.

1.3 Research Objectives

The overall objective of this study was to assess the status of urban agriculture in Nairobi in order to justify the need to legalize it and integrate it into the urban land use and planning.

The specific objectives were:

i. To assess trends in urban land use in Nairobi with focus on land under agriculture

ii. To evaluate the socio-economic effects of urban agriculture in the study area.
iii. To analyse policy gaps within the urban development policy with respect to urban agriculture in Nairobi.

1.4 Research Questions

This study was guided by the following questions:

i. How is the trend of land use in Nairobi and what is its implication on urban agriculture?

ii. What are the agricultural practices carried out in Nairobi, Kenya?

iii. How are the sustainability concerns of these practices being managed?

iv. Are there any gaps in the current urban agriculture policy framework that need re-thinking?

1.5 Conceptual Framework

The conceptual framework has been adapted from the Millennium Ecosystems Assessment Framework (MA). The MA conceptual framework places human beings as the central focus for assessment while recognising that biodiversity and ecosystems also have intrinsic value and that people take decisions concerning ecosystems based on considerations of both well-being and intrinsic value. The MA conceptual framework assumes that a dynamic interaction exists between people and ecosystems. Changes in factors that indirectly affect ecosystems such as population, technology and lifestyles, can lead to changes in factors directly affecting ecosystems such as application of fertilizers to increase food production (Figure 1.1).
Figure 1.1: Conceptual Framework for Urban Agriculture

The resulting changes in the ecosystem causes the ecosystem services to change and therefore affect human well-being. The way ecosystems are affected by human activities will have consequences for the supply of ecosystem services, including food, fresh water, fuel wood and fibre, and for the prevalence of diseases, floods, and drought, local and global climate. Ecosystems also provide spiritual, recreational, educational, and other non-material benefits to people. Changes in availability of these ecosystems services can profoundly affect aspects of human well-being (Figure 1.1).

In Urban agriculture context, the indirect drivers affecting biodiversity are factors such as urbanization, lifestyle, marketing, or policy framework which could lead to changes in urban agriculture. Urban agriculture could be affected by factors such as fertilizer use, chemicals, organic waste, polluted water for irrigation, contaminated soils and ignorance. These could result to degraded ecosystems leading to air, water and soil pollution leading to unsustainable urban agriculture. This could have negative implication on human well-being. This study sought to assess the sustainability concerns of the urban agricultural practices, as well as analysing the policy gaps within the urban development policy with respect to UA in Kenya. The results of this study will be geared towards making urban agriculture more environmentally friendly and sustainable.

1.6 Scope

This study was conducted in a section of Kahawa and Githurai locations of the newly created Kasarani District. The two areas are Kongo-Soweto (Kahawa) and Kamuthi
(Githurai) and they boarder each other. There is a lot of farming activities along the Riara and Kiuu Rivers (tributaries of Nairobi River) which traverse this area and are believed to be heavily polluted. The farmers also use chemicals such as pesticides, insecticides, acaricides and fertilizers in their farming activities and this may be a healthy risk if not properly used. Use of compost could also lead to health issues if the compost is not well decomposed. Within the study area is farmer’s choice factory as well as several car wash activities which produce effluent which flows directly into the rivers. This is expected to have an adverse effect on urban agriculture in the area.

1.7 Definition of Study Terms

A driver - Any natural or human induced factors that directly causes a change in an Ecosystem.

Bioaccumulation- Accumulation of chemicals in the tissue of organisms through any route including ingestion, respiration, or direct contact with contaminated water sediments, and pore water in the sediment (U.S. Environment Protection Agency, 2000).

Biodiversity - The variability among living organisms from all sources inter alia terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are parts, this includes diversity within species, between species and of ecosystems (Convention on Biological Diversity, CBD).

Bio-magnification- Refers to the tendency of pollutants to concentrate as they move from one trophic level to the next.
**Bioremediation** can be defined as any process that uses microorganisms or their enzymes to return the environment altered by contaminants to its original condition. Bioremediation may be employed in order to attack specific contaminants, such as chlorinated pesticides that are degraded by bacteria, or a more general approach may be taken, such as oil spills that are broken down using multiple techniques including the addition of fertilizer to facilitate the decomposition of crude oil by bacteria.


**Ecosystem services**- Benefits people obtain from ecosystems. They include provisioning services such as food and water; regulating services such as floods and diseases; cultural services such as spiritual, recreational, and cultural benefits and supporting services, such as nutrient recycling, that maintain the conditions for life on earth.

**Environmental health**- Environmental health are aspect of human health and disease that are determined by factors in the environment including biological, physical, chemical, social and psychological environmental factors in an environment, including outdoor and indoor factors (as definrd by World Health Organization).

**Food Security**- Food security exists when all people, at all times, have access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for active and health life (FAO,1999).

**Gender** can be defined as the socio-cultural construction of roles and relationships between men and women.
**Hydroponics** - Growing of crops directly on solid waste or compost without soil.

**Irrigated agriculture** - Mostly cultivation of vegetables from streams, drains and wells.

**Land Tenure** - Refer to the terms and conditions under which rights to land and land-based resources are acquired, held, transferred, or transmitted.

**Organoponics** - A production technique applied by state-owned gardens which involves raised container beds with a high ratio of compost to soil for intensive planting of vegetable crops. Particularly useful for vacant lots that have been paved over with concrete or where the soil is extremely poor or hard to plough.

**Rainfed agriculture** (non-irrigated agriculture) - It consists of rain-fed cultivation of staple crops such as maize and cassava on open spaces, on temporary fallow land or in backyard.

**Stakeholders** - A person, group or organization, or system which affects or can be affected by an organization action.

**Sustainable agriculture** - It is the practice of farming produce that will contribute to the well-being of the land and wider environment, whilst producing a substantial yield.

**The Local Agenda 21 (LA21)** - A Campaign that promotes a participatory, long-term, strategic planning process that helps municipalities identify local sustainability priorities and implement long-term action plans. It supports good local governance and mobilises local governments and their citizens to undertake such multi-stakeholder process.

**Urban Agriculture** - It is practiced inside (intraurban) or on the outskirts (peri-urban) of a town or a city. It focuses on raising food and animal crops, but also includes
recycling household waste and waste water for agricultural purposes, the processing and distribution of different foods and non-food products using human and material resources, products, and services that are found in the same or surrounding areas.

**Urban and Peri-Urban Agriculture** – Production, processing and marketing of food and other products on land and waste in urban and peri-urban areas. Urban agriculture includes the application of intensive production methods and natural resources and urban waste to yield a diversity of crops and livestock.

**Value Added Agriculture** - A process of increasing the economic value and consumer appeal of an agricultural commodity.

**Vermiculture** - The use of worms to digest organic waste into rich humus, similar to compost, that can be applied in urban agricultural local varieties of both surface and burrowing earthworms can be used, although the latter are particularly suited as they not only digest organic matter but also modify the soil structure.
CHAPTER 2: LITERATURE REVIEW

2.1 Summary of the chapter

This section includes historical development of urban agriculture with particular emphasis on the Kenyan situation, the socio-economic and ecological benefits of UA, occupational health and safety, UA and gender perspective, policy and legal dimension to UA, environmental change and the last section is on the UA situation in Kenya.

2.2 Historical Development of Urban Agriculture

The practice of UA is not new. In ancient civilizations there is evidence by archaeologists about the practice of UA (Mougeot, 1994). In most countries however, agriculture was considered a rural activity until recently. But this has changed due to the rapid increase in urban population especially in the developing countries (UNEP, 2002). According to Mireri et al., (2007), some key factors that have accelerated growth of UA are rapid urbanization, ineffective agricultural policies, crippled domestic food distribution systems, constrained spending and subsidies, wage cuts, soaring inflation and rising unemployment. Other factors include increasing levels of urban poverty, structural adjustment and agricultural policies, economic transition and disasters. It’s estimated that by 2030, 60% of the world’s population will be living in the cities (UN-Habitat, 2004). Growing population goes hand in hand with growing food insecurity and malnutrition (Mougeot, 2005). Rapid urbanization leads to a continuous extension of the city into the rural suburbs, bringing large areas under the direct influence of the urban centres.
In Kenya, UA dates back to 1899 when the railway workers mainly from India started the practice in the mainland towns (Mireri et al., 2007). During this time UA was restricted and the colonial regime strictly enforced planning regulations that prohibited UA, but after independence UA witnessed rapid growth due to increased urban population despite the restrictive regulations with many Africans taking up the practice. Urban farmers come from all income groups, but the poor dominate (Mireri et al., 2007). Majority of urban households are unable to feed themselves, so they turn to UA for survival (Mbiba, 1995). While urban planners and managers have open spaces designated for future development, the urban poor view such land as idle land, an underutilized scarce resource which could be put into immediate use such as agriculture (Mbiba, 1995). Agricultural technology has advanced over the years increasing urban agriculture’s yields per square yard (Smit, 1996).

2.3 Socio-Economic and Ecological Benefits of Urban Agriculture

Urban agriculture is characterised by high population densities, high energy use, resource consumption, and generation of waste. In addition, there are competing uses of resources within the confines of urban areas (Boischio, 2006). Urbanization goes together with a rapid increase in urban poverty and urban food insecurity. Although viewed as a survival strategy for the urban poor, UA has several other socio-economic and environmental benefits associated with it.

Urban Agriculture contributes to food security and health nutrition. Food production in the city in many cases is a response of the urban poor to inadequate, unreliable and
irregular access to food, and the lack of purchasing power (Veinhuizeen, 2006). According to Kisner (2008) urban agriculture is the primary survival strategy of poor households in Harare. Research in East Africa has shown that children of urban farming families are better nourished than those from non-farming families (Mwangi, 1995; Foeken and Mwangi, 1996). Urban agriculture has the potential to contribute to the alleviation of disease burdens by reducing the prevalence of diseases related to under-nutrition. Inadequate nutrient intake leads to impaired nutritional status and increased vulnerability to infectious diseases (ACC/SCN, 2000). Direct impacts of UA therefore are improved health conditions due to a richer vitamin A and protein diet (Bertina and Belevi, 2001). In Dar es Salaam, authorities encouraged the practice of urban farming in order to raise food-supply levels (Jacobi et al., 2000). Over 200 million urban residents produce food for urban market providing 15-20 % of the world’s food (Armar-Klemusu, 2000; UNDP & IDRC, 1996). Most poor families spend 60-80 % of their income on food (Nugent, 1995). Urban agriculture plays an important role in enhancing food security especially for the urban poor and helps improve both food intake and the quality of food (http://www.ruaf.org/node/513).

Today, hunger and malnutrition are the underlying cause of one-third of all deaths of children under the age of five and accounting for roughly 3.5 million preventable deaths each year. More than 960 million people around the globe suffer from hunger and another 2 billion are malnourished (Armar-Klemusu, 2000). Urban subsistence production can lead to an immediate reduction in hunger and an improvement in nutrition (Bryld, 2003).
In Mwanza, Tanzania, even the wealthier household heads face income insecurity and often plant crops to ensure family food security during lean times (Flynn, 2001).

It also contributes to local economy development. Growing food saves households expenditure on food. The urban poor consumers spend between 60-80% of their income on food, making them very vulnerable to higher food prices (http://en.wikipedia.org/wiki/urban-agric, 2009). Urban food prices generally decrease when food supplies increase, thus raising the level of disposable income that poor families can spend on other necessities, such as education and healthcare (Urban Agriculture Network, 1996). In Dar es Salaam, for instance, UA forms at least 60% of the informal sector and is the largest employer and in 1993, urban fresh production was worth estimated US dollars 7 million (Mougeot, 1994). In Addis Ababa, profits are earned by even the smallest scale urban farmer producer with very low capital (Staal, 1997). In Nairobi, in the early 1990’s agriculture provided the highest self-employment earnings among small-scale enterprises and the third highest earnings in all of urban Kenya (House et al., 1993). Urban agriculture also stimulates the development of related micro-enterprises such as agricultural inputs, processing, and marketing of outputs (UN-Habitat, 2003).

Urban agriculture plays an important role in the urban environment management system (Deestra and Girardet, 2002). Waste water and solid wastes can be transformed into resources for growing agricultural products (Smit and Nasr, 1992). The compost allows urban farmer to use less chemical fertilizers, thus preventing environmental problems
related to contamination of ground water. Compost creates employment and provides income for the urban poor (Lock and de Zeeuw). The use of waste water for irrigation has advantages for the urban farmer since it contains lots of nutrients. More appropriate waste management leads to a decrease in health risks (Birley and Lock, 1998).

Urban agriculture also helps in micro climate improvement. The green spaces around apartment blocks and houses, as well as neglected spaces in the city, help to improve the physical climate because vegetation can; help increase humidity and lower temperatures, helps improve air quality (Deestra and Girardet, 2000), and helps break wind with positive impacts on the micro-climate (Veinhuizeen, 2006). It also allows savings in transportation costs, storage, and in production losses. It minimizes transportation of food to the city thus saving energy and contributing to sustainability and a positive environmental impact. It also improves the quality of the environment (http://en.wikipedia.org/wiki/urban-agric, 2009).

Urban agriculture also has other potentials such as having a positive effect on biodiversity, reducing atmospheric pollution and global warming and making urban people more aware about the environment through direct experience of growing foods as opposed to depending on packaged and pre- packed foods (Deelstra and Girardet, 2000). Rooted plants stabilise the ground and reduce soil erosion.

Gardening and food production is good exercise. It increases self- esteem, pride, confidence, personal satisfaction, and efficacy (Hanna and Oh, 2000). It has been
connected to reducing risks of obesity in children and adults (Reynolds and Anderson, 2004), coronary heart disease, glycaemia control and diabetes. Working with plants in the outdoors benefits the mental health, mental outlook, and personal wellness of individuals. Cultivation triggers both illness prevention and healing responses (Veenhuizen, 2006). This study is expected to evaluate the socio-economic and ecological effects of UA in the study area.

2.4 Urban Agriculture, Occupational Health and Safety

Obstacles such as limited access to land and water sources, lack of services and capital are common among urban poor, hindering their success in urban agricultural activities (UN-Habitat, IDRC 2003). Foods produced in or near cities may be detrimental to human health if irrigation water is contaminated by industrial effluent (heavy metals), or if untreated water is used for irrigation of food crops (ACP-EU&CTA, 1998). It may also cause diarrhoeal disease and helminthic infections (Biosafety News, 2002). Where free flowing water sources are used, contamination is a major concern (Armar-Klemesu, 1999). According to Cornish et al. (2001) there are high levels of microbial pollutants in Nairobi River. Low income farmers block sewers to get water and nutrients for irrigating their crops, causing risks from pathogens as well as any heavy metals in the wastewater (CCN et al., 2007). A study by Gath Engineers consortium in 1991 shows that untreated effluents mainly emanate from industries, open drainage from carwash activities, raw sewage from residential premises and hostels, discharge from burst sewers, oil from petrol stations and oil-manufacturing industries, among others. For instance, effluent from industries located in Makadara division exhibits high quantities of mercury, in a
range of 2.8–13.4 mg/l (UON/UNEP, 2005), well above the recommended WHO guidelines for mercury of 0.006 mg/l (WHO, 2006). In the developing world, some 90% of all sewage is discharged, along with the foecal coli form bacteria that cause intestinal diseases, directly into rivers, lakes, streams and coastal waters (Nelson, 1996).

In Nairobi, the majority of plots farmed are located along the Nairobi River, which is heavily contaminated with both industrial and human waste (Foeken and Mwangi, 2000). Almost half of the vegetables consumed in the city of Nairobi are grown on the banks of these polluted rivers (Biosafety News, 2002). According to Hide and Kimani (2000) a research carried out in Nairobi showed that 3,700 farmers in Nairobi practice irrigation and that 36% of this use wastewater. The main risk for consumers of waste water irrigated produce arises when vegetables or salad crops grown with untreated water are consumed raw, without proper washing or treatment (Veenhuizen, 2006). Wastewater containing pathogens can contaminate crops directly through contact during irrigation or indirectly as a result of soil contact, blowing dust, workers, and insects (Crook, 1998). Pathogens penetrate fruits or vegetables when the skin is broken. Contamination through roots is minimal. Post-harvest handling of crops at markets and households is the most detrimental stage. This is a threat to both the producers and consumers of the agricultural products. Some of the pathogens found in untreated waste water are bacterial in nature such as *Escherichia Coli*, *Salmonella typhi*, *Salmonella spp*. *Shigella spp*, *Vibrio cholerae*; Viruses e.g. *Adenovirus*, *Poliovirus*, *Rotavirus* and *Hepatitis A*; Protozoa and Helminths (Stanier et al., 1996). These could cause cholera, typhoid, bacterial infections, as well as diarrhoeal, amoebic dysentery, and infection from intestinal nematodes.
Agricultural workers in waste water irrigated fields are directly exposed to infection and require protective clothing as well as greater risk awareness (Greye, 2001).

Cultivating along roadsides is a risky practice since it exposes food to car pollution. There is great risk of chemical contamination in dense urban settlements. Soils near railways and industries risk heavy metal pollution from airborne lead and cadmium from gasoline exhaust (Mireri et al., 1997) as well as pesticides, sulphur and nitrate. These toxicants affect the nervous, digestive, and circulatory systems, particularly threatening the health of young children (Graefe et al., 2008). Lead is probably the most dangerous for children, as it interferes with their vitamin D production and mental development (Veinhuizeen, 2006). Very young children are particularly vulnerable to environmental soil lead through hand to mouth behaviour. Lead could also be from industrial emissions (Urban Harvest, 2007). In many cases, UA is practiced close to roads, where exhaust fumes and run-off from roads can contaminate crops. When it comes to vegetables, there is an intake of heavy metals in vegetables grown along roadsides with heavy traffic, and lead is of particular concern in Kenya. High levels of lead were observed in kales grown in Nairobi (Urban Harvest et al., 2004). According to Flynn (1999), over 60-80% of heavy metal toxins in human bodies in urban industrial areas were the result of consuming contaminated foods rather than through air pollution. 1999).

Indiscriminate use of agro-chemicals increase agricultural yields, but residues from them can have a negative impact on soils. It also poses a health risk to local water sources if
high inputs levels are used (Urban Harvest, 2007) and when elements such as nitrogen, phosphorous and potassium leach to the underground water (Graefe et al., 2008). Risks can also arise from the over-use of chemicals by inexperienced illiterate workers. There is also the risk of soil pollutants being absorbed by plants and crops that are either eaten by man and/or livestock causing biomagnifications and bioaccumulations (Afullo, 2006).

Urban agriculture plays a significant role in urban environment management through waste recycling and bioremediation. But this opportunity has not been exploited due to lack of space for waste recycling activities and absence of appropriate policy on waste management (Urban Harvest, 2007). Despite the environmental and social beneficial aspects of waste recycling, it has negative effects such as poor health and living conditions for the urban poor who deal in waste picking (Furedy, 1992). Pathogenic organisms in residues, Zoonotic diseases, disease vectors and respiratory problems are of major health concern (Furedy, 2001). Issues of health are crucial to both the farmers and the consumers of products derived from recycled products (Asomani- Boateng and Haight, 1999). Urban agriculture also generates wastes that must be efficiently managed to safeguard the lives of the residents (Mireri et al., 2007). Re-use of organic waste could also be a potential risk due to contamination by chemical and especially metals. These may be essential for plant growth, but in higher concentration can have the potential to harm soil organisms or plants and may enter into the food chain (Birley and Lock, 1997).

Livestock not vaccinated against diseases such as anthrax, rabies, and brucellosis may be a healthy risk (Ishani, 1987). Some bacterial diseases carried by cattle are bovine
tuberculosis and brucellosis. Bovine tuberculosis is transmitted via ingestion of contaminated unpasteurized dairy products or through contact with infected animal material (Lock and de Zeeuw, 2001). This may raise the possibility of zoonotic diseases especially in the densely populated urban environments. Human brucellosis and echinococcus infection transmitted by domestic livestock may also occur as a result of inappropriate zero-grazing and animal waste disposal in slaughter houses or densely populated areas (Cooper, 1991). Unattended livestock and those that stray often feed on refuse, and are likely to consume industrial effluents or wastes containing heavy metals. These are hazardous to the animals and end up in human food chain. Animal refuse may also carry germs that cause diseases transmitted through milk and meat, such as tuberculosis and anthrax (Lock and de Zeeuw, 2001). The wastes also contaminate water sources (CCN et al., 2007) as well as providing a breeding ground for rodents and flies which are important carriers of parasites, bacteria, and viruses causing human health risk. Other concerns are unpleasant odours, noise from pigs, cows, and hazards (Mireri et al., 2007).

Other common problem confronting UA are the legal restrictions and economic impediments to accessing land and resources (http://wikipendia.org/wiki/urban-agric, 2009). Urban authorities and planners view UA as a marginal activity (Egziabher et al., 1994), a nuisance and health hazard, a practice harmful to consumers, farmers, the environment, the urban land economy and the city’s appearance (Urban Agriculture Network, 1996). According to the Physical Planning Act, UA is prohibited or restricted and is not considered within the urban land use and development plans (GOK, 1989).
Urban farmers are constantly harassed by city authorities, crops slashed and burnt (Egziabher \textit{et al.}, 1994) and this dissuades many urban farmers from investing in UA (UN-Habitat, 2004). In a study carried out among the urban farmers with no access to land, it showed that the poor are under-represented (Flynn, 2001). Urban agriculture has therefore failed to reach its full potential because people are concerned about security of tenure and threats to their growing crops. Perhaps lease agreement among concerned parties may help.

Inappropriate farming practices are other challenges faced by urban farmers. These practices may under certain situations lead to reduction of vegetation or siltation of water bodies. Although the Agricultural Act Cap 318 spell out the number of metres from streams (GOK, 1994), in Nairobi farmers cultivate right up to the river. The Act is implemented through the unpopular provincial administration (chief’s Act). Because of the under-valuation of UA, and the stiff competition for land, UA is often pushed back to the marginal areas within a city such as wetlands and hill-tops, where it may harm the fragile ecosystem if not properly guided (Veenhuizen, 2006). According to Ayoga \textit{et al.}, (2004), urban and peri-urban flower farms, which are being favoured by urban farmers, present a specific set of problems. They consume a great deal of water, which contributes to urban water shortages. In peri-urban areas, where people rely on boreholes or shallow wells for domestic water supply, these may be contaminated by the large amounts of agro-chemicals used by flower farms. The study is expected to come up with the policy gaps that will enhance UA by reducing the occurrence of health issues related to UA.
2.5 Urban Agriculture and Gender

Women play a crucial role in household food production. In Sub-Saharan Africa, women are responsible for looking after the home, by providing it with food, usually through subsistence farming (http://www.idrc.ca/uploads/user). They boost household nutrition, generate income and build social inclusion among the urban poor (Havorka et al., 2009). Even in male-headed households, women still bear the brunt of food insecurity because of their primary responsibility of feeding their families (Lee-Smith, 1994). Women constitute the majority of participants in UA in African cities and constitute over 65% of the world’s urban farmers (Lee-Smith, 1994; Veinhuizen, 2006). They dominate the marketing of fresh food in various market types (UN Habitat, 2003). According to Rakodi (1991) urban women seek to retain autonomous control over their own independent sources. Urban agriculture acts as a springboard by which low-income women enter business (Freeman, 1993). Urban agriculture allows women to work close to their homes and to provide extra food to improve the nutritional status of their children and to sell the surplus (IDRC, 2004). Research in Uganda has shown that mothers have more time to spend on child care activities when their primary source of livelihood is agriculture as opposed to other forms of employment (Maxwell et al., 1998).

However, women often face difficulties accessing land, water, labour, capital, technologies, and other services (Harvoka et al., 2007). Due to gender inequality, women are prevented by laws, customs and attitudes from owning and controlling assets, and in decision-making. Women and children are often more vulnerable to environmental hazards because of their work, role, and the discrimination they face in terms of access to
resources and income (Cities Alliance et al., 2007). Yet, women’s vital contribution has been neglected by city council officials, economic planners and development practitioners who concentrate more on industrialization of food crops (Harvoka, et al., 2009). Legal and policy frameworks are not fully promulgated for protection of urban farmers and women especially (Kiguli, 1995). The majority of poor women who depend on land for their livelihood are either landless or have limited and insecure rights to land. They access land mostly as customary land but lack decision-making rights.

2.6 Overview of Policy and Legal Dimension to Urban Agriculture

Urban agriculture (UA) has been promoted over the last couple of years by a large number of local and national governments, urban actors and international agencies, such as UN-Habitat’s Urban Management Programme, FAO, International Development Research Centre (IDRC- Canada), CGIAR-Urban Harvest and the International Network of Resource Centres on Urban Agriculture and Food Security (RUAF) as a strategy to promote food security and poverty reduction, sustainable resource use and environmental management, social integration and local participatory governance (IDRC, 2004).

Cuba, Argentina and Brazil are countries where substantial government support is given to the development of UA. Other countries such as Botswana, Zambia, Benin and China are preparing policies favourable to UA, often as part of a broader strategy (e.g. food security policy, poverty reduction, sustainable city development policy or irrigation policy (Kisner, 2008). Rosario (Argentina), Kampala, Dar es Salaam, Bulawayo (Zimbabwe) are formulating policies or programmes on UA (IDRC, 2004). This trend is
reflected in a number of declarations on UA in which local and national level policy makers have stated their formal commitment to develop policies and programmes on UA, as was the case of the mayors present at regional meetings in Quito (2000), Dakar, (2002), Addis Ababa (2003), and Beijing (2004), and S. Africa/Harare, (2003) ministers conference on UA (Veeinhuizen, 2006).

In Cuba, in the 1970’s trade agreements with the Soviet Union led the Cuban government to emphasis production of sugar and citrus fruits to be exchanged for cereals and other food products from the Soviet Bloc (Kisner, 2008). By the 1990’s state land was 80% of all agricultural land. In 1989, with the onset of special periods the situation changed radically and imports from Soviet Union dropped. Cuba was unable to feed itself and the government encouraged use of abandoned public and open spaces for food production with the aim of promoting agricultural production in every potentially suitable space (IDRC, 2004). Even urban plots like Havana were converted to agricultural production (Murphy, 1991; Kisner, 2008). The country was able to feed its population and not rely on imports.

Kampala had a relatively limited UA policy framework previously, but has progressed significantly (Mwanga and Makumbi, 2003). Despite the positive contribution of UA, it had been banned for a long time as it was considered to be illegal, a health hazard and economically insignificant (Urban harvest et al., 2004). In 2003, the Kampala City Council (KCC) in collaboration with other stakeholders spearheaded a consultative process of re-examining the Draft Bills for Ordinances related to urban agriculture in
Kampala City (Mwanga and Makumbi, 2003). The review identified a number of gaps in the "Kampala City Draft Bills for Ordinances 2001" related to Urban Agriculture and Livestock. In December 2003, the Council approved the recommendations/inputs provided by the stakeholders for incorporation into the final Bills for Ordinances, with the objective of legalising UA and promoting more sustainable UA systems, while protecting public health (ILRI and ODI, 2006).

In Harare, there was a record of regulatory and planning steps for agricultural land use for both private and public land, but the city was ill-equipped to cope with the large scale growth in recent decades (IDRC, 2004). A local NGO conducted a survey on urban food producers which led to a forum for policymakers and eventually resulted in local policy initiatives to better manage UA. Unofficially, the large scale practice of UA is now widely accepted, and the city council has begun to change its attitude, partly as a result of information provided by the research project (Kisner, 2008). In Kinonduni, one of the municipalities that constitute the city of Dar es Salaam, UA was widely supported and practised, there were policies and regulations governing UA. In Dakar, Senegal, it was an NGO’s study on waste water management that led to a minister’s conference of UA and subsequently to legislation proposals in the national parliament. In 2003, a minister’s conference of UPA was held in Harare, Zimbabwe. The event was convened by a regional NGO, the municipal development partnership for East and Southern Africa (MDP-ASA), and sponsored in part by IDRC (IDRC, 2004). At the end of the conference, all the participating nations signed the Harare declaration strongly supporting the promotion of UPA (http://www.idrc.ca/in focus).
Though UA takes place under varying socio-political conditions and policy regimes, urban policy makers and support can contribute to the development of safe and sustainably urban agriculture by creating a conducive policy environment and formal acceptance of UA as an urban land use (Veeinhuzen, 2004). Urban Agriculture in cities is enmeshed in a complex web of policies, regulations and competing stakeholder’s interest which can restrict, constrain and sometimes outlaw the practice. The first step is to define complex interaction between different urban systems and involve all stakeholders in the formulation of agricultural process (Urban Harvest, 2007). UA takes place in a multi-sectoral environment, touches on a large number of urban management areas such as land use planning, environment and waste management, economic development, and public health, social and community development. UA is a cross- cutting issue involving a wide range of often disconnected actors or stakeholders needed for effective implementation, policy making and monitoring (IDRC, 2004). Dynamic planning must provide for UA land uses to evolve as the city expands and transforms itself. In order to match the demands of urban growth with activities of high economic and social value, urban agriculture should be included as a multi-functional component in municipal land use planning, zoning, master plans and neighbourhood development plans (Cabannes, 2003). The stakeholders includes authorities and government from all levels (local, regional and national), and the involved sectors (City planning and urbanization, urban environment management, social development and welfare, urban farmers). Involvement of the different stakeholders in planning and policy making increases the contribution of UA to sustainable urban development (http://www.ruaf.org/node/964). To increase the contribution of UA to sustainable urban development requires involvement of the
different stakeholders in planning and policy making (http://www.ruaf.org/node/964). An understanding of the role UA plays in various policy areas is important in order to formulate policies that maximise the benefits of UA whilst preventing or reducing the associated risks (Veenhuizen, 2007). The key policy objective is to integrate UA into broad urban development agendas such as related to children and youth programmes, environmental programmes, social welfare programmes and housing and development programmes (IDRC, 2004). The focus of this study is to come up with a policy framework that will address urban agricultural issues.

2.7 Urban Agriculture and Environmental Change

Urban agriculture is linked to environment at several levels. It demands resources, which may be scarce such as treated domestic water supply. This may lead to serious resource conflicts and use of unsafe water for farming. Lack of suitable land for various categories of urban farmers may cause farmers to cultivate on hazardous sites with serious health implications, UA generated wastes that must be efficiently managed to safeguard the lives of the urban residents (Mireri et al., 2007).

According to climatologists average global temperatures are expected to increase by up to $5.8^0$ c scenario and sea levels to rise on average by upto 88 cm in the 21st century (IPPC, 2007). Biologists estimate that between 3 and 130 plants and animals’ species die out daily (IPPC, 2007). Water experts anticipate rapidly rising water stress and water scarcity, desertification keeps going on, inter alia. To address these challenges, there is need to mitigate climate change by creating sustainable livelihoods for the poor while
reducing poverty to improve living conditions in the developing world (http://iopscience.iop.org). Urban agriculture can turn urban wastes into a productive resource through compost production, vermiculture, and irrigation with wastewater (Veeinhuizen, 2004). It reduces climate change by preventing overheating of urban environments. It provides indirect economic benefits, such as multiplier effects, creational benefits, economic diversity and stability, avoids disposal costs of solid waste. In terms of environmental impact, UA frequently incorporates practices which can lead to productive, reusable, self-contained waste and nutrient cycles, contributing towards the development of safe and non-polluting environments (http://iopscience.iop.org). Evidence has shown that with proper planning and management, UA can actually be a very effective and safe means of producing food (Lock and Veenhuizen, 2001).

UA can also have an impact on energy use, which is a major element in the drive to achieving more sustainable cities. Cultivating produce in close proximity to areas of consumption can result in significant energy savings, by reducing energy expenditure on refrigeration, transport and storage.

The ecological dependence of city residents on the biodiversity and ecosystem services of the rural environment is absolute (Rees 2003). Local leaders must ensure that biodiversity and ecosystems are appropriately valued and recognized and that the opportunities and benefits of conservation are realized. The policy implication is that the City Council of Nairobi should strive to reduce Nairobi’s footprint by using natural resources more efficiently and innovatively (CCN et al., 2007). Finding a safe and economical way to
recycle some or all of the municipal and agro-industrial waste holds the promise of a "triple win": clean up the urban environment, reduce the threat to health, and increase agriculture production by replacing soil nutrients (IDRC, 2004). The study will inform decisions on how to enhance the socio-economic gains made so far by UA, by improving the urban environment.

2.8 Urban Agriculture Situation in Kenya

About 13.9% of land in Nairobi is under UA (CCN et al., 2007). By the late 1990’s about 30% of the households in Nairobi were involved in urban farming (Foeken and Mwangi, 2000; Lee-Smith et al., 1987). According to Urban Harvest (2004) in Kenya a third of urban dwellers grew subsistence crops and raised livestock. Over 80-85% of the urban cultivators are women (Foeken and Mwangi, 2000). Urban agriculture is steadily becoming an alternative livelihood in the city (Foeken and Mwangi, 1998). It takes place in backyards, along roadsides, rivers and railways, in parks and industrial areas (Foeken and Mwangi, 1998). The high and middle income households constitute a significance proportion of the urban agriculture (Mbiba, 1995).

The legal situation on urban agriculture in Kenya is unclear with most urban dwellers assuming it is illegal. However a close look at the Local Government and Public Health Acts, as well as the Nairobi by-laws, indicates that urban farming may be practiced under certain restrictions (CNN et al., 2007). The local government is given powers to lease, transfer or allocate land for temporary use (sec 144), while sec 144c prohibits cultivation
by unauthorised persons on land that is not occupied or enclosed to private persons, governments and local authorities. The Physical Planning Act (Sec 16) on the other hand does not identify urban agriculture as an urban land use (GoK, 1989). Amidst the uncertainty however, farming activities have continued to thrive in urban centres in Kenya often with little regard for associated health issues such as contamination from pathogens and toxic materials among the waste materials used in farming systems and disease transmission from animals kept in unhygienic conditions (Urban Harvest, 2005). The government provides limited extension services to urban farmers, but there is no coherent legal and policy framework governing UA (Urban Harvest, 2007). Those involved in off-plot UA are subject to sporadic harassment by urban local authorities and insecurity by upcoming developers. In view of this Kenya Agricultural Research Institute (KARI) in collaboration with urban harvest- initiatives of consultative group on international agriculture research (CGIAR) organised a one day workshop to develop consensus on providing an enabling environment for advancing UPA in Kenya (Urban Harvest et al., 2004) This was also supported by ILRI, KARI, Ministry of Agriculture, Lands and Settlement, Health and Local Government, confirmed their commitment to carrying forward a policy dialogue. It was agreed that the Ministry of Agriculture was the institution to carry forward the process of developing UPA policy, with assistance from KARI (Urban Harvest, 2007). The policy document is yet to be developed.

In order to enhance the benefits of UA, it is important to localise Agenda 21 into the city’s plans and development. Kenya is a signatory to the Harare declaration of 2003 on UA in Eastern and Southern Africa, which recommends the development of policies to
create an enabling environment for integrating UA into urban economies (Ayaga et al., 2004). The draft national land policy provides for the promotion of multi-functional urban land use and the creation of an appropriate legal framework to regulate and govern urban agriculture (CCN et al., 2007). It is important that an UPA policy be developed in order to make UA sustainable. This will contribute in minimizing the health risks associated with UA. According to UN-Habitat (2001b) urban agriculture is most viable when mainstreamed into the robust strategies for land-use poverty alleviation, economic development and sound environmental management. The focus of this study therefore is to come up with results which will inform policy decisions towards a sustainable urban agriculture.
CHAPTER 3: METHODOLOGY

3.1 Study Area Characteristics

This study was done in Nairobi, the capital city of Kenya. Nairobi is located at the South-Eastern end of Kenya’s agricultural heartland, at approximately 1°9’S, 1°28’S and 26°4’E, 37°10’E (Figure 3.1).

Figure 3.1: Map of Nairobi showing the area where the study was done.

It occupies an area of about 696 km square (CBS, 2001) and the altitude varies between 1,600 and 1,850 m a.s.l. (CCN et al., 2007). Nairobi Province is currently divided into 9 Districts namely Embakasi, Njiru, Makadara, Kasarani, Starehe, Kamukunji, Dagoreti, Langata, and Westlands. The study was carried out in Kamuthi and Kongo-Soweto of.
Kasarani District. According to the 1999 national census, the population of Kasarani was 338,925 persons, while that of the 2009 national census was 525,624 persons (CBS, 2008). The annual growth rate between 1989 and 1999 was 4.8% (CBS, 2000). This has caused a rapid increase in urban poverty and urban food insecurity making the majority of urban residents turn to urban agriculture for survival. There is need therefore to ensure that safe and environmentally sound agricultural practices are used for the production of safe agricultural products and to ensure resource management sustainability.

3.2 Research Design

This study employed the descriptive research design. According to Best and Kahn (1993), descriptive research is concerned with conditions or relationships that exists, practices that prevail, points of view, or attitudes held by people, processes that are on-going, effects that are felt or trends that are developed. To a greater extent, descriptive surveys aim to obtain information from representative sample of the population, from which the researcher is able to generalise findings of larger population as a whole (Bell, 1993).

The study was meant to describe the current situation of urban agriculture and the sustainability of the agricultural practices in the study area. It involved both qualitative and quantitative methods of data collection so that both methods could complement each other. The instruments used were researcher’s own questionnaire, FGD, key informant interviews and a participatory transect walk. The questionnaires were administered to all the 341 subjects in the study area with the aim of gathering information on sustainability of the agricultural practices. A FGD was also carried out to cross check and clarify issues
that were not adequately addressed by the respondents since the FGD members have in-depth knowledge of UA practices in the study area and the discussion was conducted mainly to explain, reinforce and enrich the survey results. The key informants were interviewed in areas that required technical expertise such as health issues and legal matters that were pertinent to urban agricultural practice.

3.3 Target Population and Sampling Procedure

The population was made up of community members living in Kongo-Soweto and Kamuthi areas. Households were the basic units of study. The total population size of the area was 10,154 persons while the household number was 3,002. The sample size used was 341 households which was calculated using the formulae $S = X^2 N^2 (1-P) /d^2 (N-1) + X^2 P(1-P)$, where $S$= the required sample size, $N$= given population, $P$= population proportion that for table construction to be 0.50, as this magnitude yields the maximum possible size required, $d$= the degree of accuracy, and $X^2$= table value for one degree of freedom relative to the desired level of confidence (Kathuri and Pals, 1993).

The study employed both purposive and systematic random sampling procedures. Systematic random sampling procedure was used to select samples from the target population during administration of questionnaires. A transect area was selected and every eighth household in the area was selected as a sample (this was obtained by dividing the total population by sample size) in order to ensure fair representation of the population. The first household was selected randomly between the first and eighth household. In every household the male was the respondent, but in female headed
households the female was the respondent. Purposive sampling was used to select FGD members and key respondents (Table 3.1).

Table 3.1: FGD members and Key Informants sampled

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<tr>
<td>8</td>
<td>National Environmental Management Act (NEMA)</td>
</tr>
</tbody>
</table>

3.4 Data Collection Methods

Data collection was done using different methods depending on the specific objectives; To assess trends in urban land use Nairobi city, GIS tools were used to generate maps of land use and to delineate peri-urban agricultural areas over a nine year period. Landsat satellite images covering Nairobi province for the year 2000 and 2009 were acquired from the Ministry of Environment and Natural Resources. The images were Enhanced Thematic Mapper (ETM) with a spatial resolution of 28.5m. These images were in form of bands. They were composited to come up with a false color composite image (using RGB for 4, 3, 2 bands, respectively) ready for interpretation after which they were geo-
referred. This was done through the Remote Sensing software Erdas Imagine 9.1. The land use land cover extent for both periods was derived from the Landsat images using the Remote Sensing software GeoVis through on screen digitizing. The results are in form of shape files which were used to calculate the area in hectares of the land cover types. This was possible through the GIS software Arc View 3.3.

For the socio-economic effects of urban agriculture the research survey relied on both primary and secondary sources of data. The primary data were derived from the transect walk and field surveys using questionnaires, key informant interviews (Appendix 7.3) and focus group discussions (FGDs). The transect walk was done to give an insight into the agricultural practices and effects of farming in the area. The interview schedules were administered to respondents with the aim of bringing to light the socio-economic and environmental effects of the urban agricultural practices. The focus group discussions were carried out to cross check and clarify issues that were not adequately addressed by the respondents. The FGD members had in-depth knowledge of UA practices in the study area and the discussion was conducted mainly to explain, reinforce and enrich the survey results. The key informants are believed to have an in-depth knowledge on some issues and were interviewed through a tailor-made interview schedule to give information on specific areas of interest. Secondary data was also synthesized from text books, periodical, journals, newsletters, electronic media (internet), District Development Plans, as well as other related articles. Both qualitative and quantitative research methods were used. The questionnaires were both close-ended and open-ended. The open-ended
questions gave an opportunity to the respondents to express their views, thus yielding qualitative data.

On policy gaps analysis secondary data was obtained from relevant policy documents. These were analysed to establish gaps which hindered sustainable urban agriculture. The policy documents analysed included the following; the Local Government Act (Cap 265), Public Health Act (Cap 242), Land Control Act (Cap 302), Agricultural Act (Cap 318), the Physical Planning Act (Cap 285) and EMCA ‘99. Some policy papers were also analysed and included Vision 2030, Draft National Land Policy (DNLP), ERS, SRA, PRSP, NALEP-IF and the new constitution. Interviews were also conduction from key informants in some selected institutions such as; the MOA, Health, NEMA and CCN.

3.5 Data Analysis

In order to come up with the trend in urban land use Nairobi, the maps generated by GIS tools for the years 2000 and 2009 periods were analysed by researcher to capture the different types of land uses and their coverage. The figures obtained were compared in order to come up with the trend in urban land use.

For the socio-economic effects of UA, data was collected from the sample population using researcher’s questionnaires that were analyzed using Statistical Package for Social Sciences (SPSS version 11.5) computer package. The research findings were presented in graphs, tables and figures as appropriate. The FGD was carried out to cross check and clarify issues that were not adequately addressed by the respondents. A check list was
used during the FGD to ensure that all areas of interest were covered. Data collected from the key informants specifically the District Health Officials (CCN) were analysed to show human health issues occurring in the study area. In addition, key informants from various departments such as NEMA, MOA, CCN were interviewed using a tailor made interview schedule to give information on specific areas of interest. Focus was on descriptive statistics such as the frequency distributions namely percentages, and the measures of central tendency such as the means and mode, which were derived from the respondents. These were used to summarize and interpret the research findings. Inferential analysis was also used to assess the effects of the urban agricultural practices on the health of both food producers and consumers. Pearson’s product-moment correlation coefficient was used to analyze the different variables to establish whether there was any kind of relationship. Qualitative data obtained through field observations (transect walks), key informant interviews and FGDs were analysed either in text, diagrams or photographs to explain the UA situation in the study area.

On policy analysis, several policy documents with implication on UA were studied and analysed and gaps identified. Key informants with an in-depth knowledge on the UA issue were interviewed from the relevant institutions.
CHAPTER 4: RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter is a presentation of the results of the study as per each objective. It starts with the trend analysis of urban land use, tenure and land ownership. It then shows an overview of the socio-economic information of the sampled population with special regard to urban agricultural practices, effects of UA on the urban livelihoods, health implications, and ecological effects. Discussions based on the information contained in the results are made, and the implications of the findings cited by linking it to all the sections of the study from the background, objective and literature review.

4.2 Trend Analysis of Urban Land Use in Nairobi

4.2.1 Spatial Survey of Urban land use and its implication on Urban Agriculture

A spatial survey of urban land use for Nairobi province was carried out in order to understand how this affects UA. The maps (Figures 4.1 and 4.2) were generated by GIS tools for the years 2000 and 2009 so as to compare the land use land cover for the two periods.
Figure 4.1: Nairobi Land Use Land Cover for the Year 2000 - 21st February
(Source; Ministry of Environment and Mineral Resources)

Figure 4.2: Nairobi Land Use Land Cover for the Year 2009 - 25th September
(Source; Ministry of Environment and Mineral Resources)

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Table 4.1 shows the land use for the years 2000 and 2009 as derived from Figures 4.1 and 4.2. The area under rain-fed agriculture and riverine vegetation drastically reduced by 42.1% and 36.6%, respectively, while the area under irrigated agriculture which was non-existent in the year 2000 rose to 542.4 ha in the year 2009 (Table 4.1). This shows a shift from rain fed agriculture to irrigated agriculture. As global warming and climatic change continue to accelerate there are water shortages, drought, famine and weakening of food security in major portions of the world (Smit, 1996). Hence, the need for irrigated agriculture.

The decline in riverine vegetation also indicates that urban farmers were either clearing the areas along the rivers for farming purposes or urban development. The urban population which was 2.1 million in the year 1999 had increased by to 3.1 million by 2009 according to the 2009 census (KNBS, 2010). Due to the increased urban population there was a felt need for food and this caused the urban farmers to turn to urban agriculture. The area under coffee and forest decreased by 5.4% and 10.2%, respectively (Table 4.1), this could be due to the increase in urban population. Due to demand for land by urban developers and the drop in prices of coffee, most of the coffee cooperative societies demarcated the land for development purposes. Karura forest was also demarcated between the year 2000 and 2009 and the land was grabbed and this caused uproar by environmental activists and civil society.
Table 4.1: Comparison of Land Use Land Cover for Nairobi Province for the Year 2000 and 2009

<table>
<thead>
<tr>
<th>Land use</th>
<th>Area (Ha) 2000</th>
<th>Area (Ha) 2009</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest</td>
<td>3317.8190</td>
<td>2979.3620</td>
<td>-10.2</td>
</tr>
<tr>
<td>Irrigated agriculture</td>
<td>-</td>
<td>542.3570</td>
<td></td>
</tr>
<tr>
<td>Rainfed agriculture</td>
<td>6848.7060</td>
<td>3968.2010</td>
<td>-42.1</td>
</tr>
<tr>
<td>Riverine vegetation</td>
<td>1223.7160</td>
<td>775.6450</td>
<td>-36.6</td>
</tr>
<tr>
<td>Coffee farming</td>
<td>1674.7740</td>
<td>1585.1220</td>
<td>-5.4</td>
</tr>
<tr>
<td>Grassland</td>
<td>4403.7170</td>
<td>5189.8630</td>
<td>17.9</td>
</tr>
<tr>
<td>Highly populated areas</td>
<td>15665.2080</td>
<td>16047.3520</td>
<td>2.4</td>
</tr>
<tr>
<td>Medium populated areas</td>
<td>-</td>
<td>8717.6960</td>
<td></td>
</tr>
<tr>
<td>Shrub land</td>
<td>16994.2630</td>
<td>10153.5030</td>
<td>-40.3</td>
</tr>
<tr>
<td>Open shrubs</td>
<td>8951.0590</td>
<td>9120.0590</td>
<td>1.8</td>
</tr>
<tr>
<td>Sewage</td>
<td>334.7290</td>
<td>334.7290</td>
<td>0</td>
</tr>
<tr>
<td>National park</td>
<td>9739.8070</td>
<td>9739.8070</td>
<td>0</td>
</tr>
<tr>
<td>Airport</td>
<td>1650.1270</td>
<td>1650.1270</td>
<td>0</td>
</tr>
</tbody>
</table>

The highly populated areas increased slightly by 2.4% while the medium populated areas which were non-existence in the year 2000, occupied an area of 8717.7 ha in 2009. This was possibly due to the rise in urban population. This implies that there was competition for land by both the urban developers and the urban farmers. Open shrubs (open shrubs are areas composed of shrubs, but with some few individuals living there) increased by
1.8%, while shrubland decreased by 40.3%. This may be attributed to the need for more urban development (Table 4.1).

Another important land use activity noted was sewage system, despite the increase in urban population it remained the same between both time periods (Table 4.1). In most urban centres, sanitation infrastructure is poor, and inadequate to cope with the urbanization rate. According to the UN (2000), 2.4 billion people in the developing world lack access to basic sanitation. The excreta and large quantities of untreated wastewater end up in nearby streams and other waste bodies. Urban farmers in search of irrigation water do not have an alternative and use this polluted water, thereby raising public health concerns (Hussain *et al.*, 2002).

### 4.2.2 Land Use, Tenure and Ownership

In the study area, the on-farm plots (residential plots) were of two main categories. In Kamuthi area, there is private ownership of land by individuals whereby the government has leased the land to them for 99 years. The land size ranges between a quarter to half an acre. The residents engaged in urban agriculture mainly within their residential areas as well as in off-farm areas. In Kongo area, land is also owned by private individuals, but the majority have constructed flats for rental purposes. However, most residents still do practice urban farming within their plots and near River Kiuu. Soweto is an informal settlement area, and the residents are squatters. The area residents are in the process of acquiring the land legally, but even if they do succeed the land will barely be enough for
a decent house. Majority of these residents engage in agricultural production within their small plots and also along the roads, railway reserve, and river banks, along the sewer chambers and in any available public and/or private land. It is actually this group of farmers who engage mostly in unsustainable agricultural practices.

The study showed that out of the farmers who practiced on-farm cultivation, about 41.6% cultivated an area of less than 0.125 acres, 6.3% cultivated between 0.125-0.025 acres, 23.2% on 0.25-0.5 acres, while 28.5% cultivated in an area above 0.5 acres (Figure 4.3).

The results show that majority of residential farmers cultivate in an area of less than an eighth of an acre. However, there was more or less even distribution of off-farm plot owners irrespective of the size of land. There were 16.7% respondents who owned below 0.125 acres, 28.8% respondents had between 0.125-0.25 acres, while 28.0% owned 0.25-0.5 acres and 26.5% had above 0.5 acres (Figure 4.3).

![Figure 4.3: Land Size (acres) at Both Off-Farm and On-Farm Levels in Kahawa area](image)

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This means that urban dwellers take advantage of any vacant space to cultivate in order to supplement their income, irrespective of the size of the land in question. Urban cultivation is not practiced exclusively or even primarily by the poor urban dwellers, but also by the middle class as can be observed by the high percentage of residential on-farm agricultural activities. The study also showed a slight positive correlation between the on-farm and off-farm activities. The Pearson Correlation Coefficient was 0.294 and significance level at 0.01 (Table 4.2). This means that urban agriculture is practiced irrespective of whether it’s at the backyard or in off-farm plots and that as on-farm activities increases, so do the off-farm activities.

**Table 4.2:** Correlation between Size of On-Farm and Off-Farm Plots in Kahawa

<table>
<thead>
<tr>
<th>Size of off-farm plots( acres)</th>
<th>Pearson Correlation</th>
<th>Size of off-farm plots( acres)</th>
<th>Size of on-farm plot( acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sig. (2-tailed)</td>
<td>.294( ** )</td>
<td>Sig. (2-tailed)</td>
<td>.009</td>
</tr>
<tr>
<td>N</td>
<td>132</td>
<td>N</td>
<td>77</td>
</tr>
<tr>
<td>Pearson Correlation</td>
<td>.294( ** )</td>
<td>Sig. (2-tailed)</td>
<td>1</td>
</tr>
<tr>
<td>N</td>
<td>.009</td>
<td>N</td>
<td>.</td>
</tr>
<tr>
<td>N</td>
<td>77</td>
<td>N</td>
<td>190</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed).

On land accessibility, the study shows that 28.8% of the respondents bought their plots, 24.7% had rented, 8.5% inherited and 36.5% were squatters, while 1.5% was allocated their plots by a cooperative company (Figure 4.4).
Figure 4.4: Access to Land and Land Ownership in the Study Area

Most of those who were allocated land by the land co-operative company have since sold their plots to urban developers. Majority of the squatters were formal workers of a sisal farm, but settled in the area after business closed down and their population now includes the second and third generations. There are plans to allocate the plots to them permanently. While the squatter’s main concern is to be legally allocated the land on which they are staying, they still require to feed their families with nutritious food and to supplement their household income. They therefore engage in urban agricultural activities of various types among other engagements.
4.3 Socio-Economic Information of Respondent in Kahawa

About 29.9% of the populations were males and 70.1% were females. The study established that more females about 69.8% had access to the plots than their male counterparts who were 29.9% (Table 4.3).

Table 4.3: Access to Land by Gender

<table>
<thead>
<tr>
<th>Access to Land by Gender</th>
<th>Percentage</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>29.9</td>
<td>29.9</td>
</tr>
<tr>
<td>Female</td>
<td>69.8</td>
<td>99.7</td>
</tr>
<tr>
<td>3</td>
<td>.3</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

This may be due to the fact that because of their gender, women are charged with the role and responsibility of looking after the family and feeding it. In a study carried out by Hide and Kimani (2000) it was revealed that the majority of peri-urban farmers were women (63%), mostly between the ages of 20 and 45, the age-group with the heaviest responsibility for family food security.

Majority of the respondents had either primary or secondary levels of education at 42.9% and 41.1%, respectively. Those with college education were 8.5% and those with university education were 1.8%, while those who were illiterate were 5.9% (Figure 4.5).
Majority of the respondents were farmers 40.4%, 27.4% were casual labourers, 2.6% were in formal employment, and 18.3% were conducting other businesses while 11.3% were engaged in other activities (Table 4.4). The study found that most of the respondents were engaged in more than one occupation, for example majority of those who practiced agriculture were also involved in other activities such as small income businesses or were casual labourers. Even those in formal employment were also engaged in farming. This implies that urban farming is a supplementary activity in most households practiced to provide cheap nutritional foods to the families as well as providing some income.

The study found there was a correlation between occupation and education levels (Table 4.5). There was a slight correlation coefficient of 0.221 between education levels and occupation at p-value of 0.01.
Table 4.4: Occupation of Respondents in Kahawa

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmers</td>
<td>40.4</td>
</tr>
<tr>
<td>Casual labourers</td>
<td>27.4</td>
</tr>
<tr>
<td>Formal employment</td>
<td>2.6</td>
</tr>
<tr>
<td>Business</td>
<td>18.3</td>
</tr>
<tr>
<td>Others</td>
<td>11.3</td>
</tr>
</tbody>
</table>

Table 4.5: Correlation Matrix between Education Levels and Occupation of the Respondents in the Study Area

<table>
<thead>
<tr>
<th>Education level</th>
<th>Occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Correlation</td>
<td>.221(**))</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.001</td>
</tr>
<tr>
<td>N</td>
<td>224</td>
</tr>
<tr>
<td>Occupation</td>
<td>Occupation</td>
</tr>
<tr>
<td>Pearson Correlation</td>
<td>1</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.221(**))</td>
</tr>
<tr>
<td>N</td>
<td>224</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed).

The results of the study indicated that about 33.7% of the respondents had resided in the study area for over 15 years, 19.8% had resided there between 10-15 yrs, 25.4% between 5-10 yrs and 21% between 0-5 yrs (Figure 4.6). This implies that urban cultivation is not practiced exclusively or even primarily by recent migrants, but by a wide range of urban residents.
According to Nugent (1997) the urban farmers have dwelt in the city long enough to have acquired access to some land and other resources. In Lusaka, more than 60 percent of the farmers had been in the city for more than five years before embarking on plot gardens, and nearly 45 percent for more than 10 years (ref- www.cityfarmer.org). About 85% of these urban farmers had been residing in the city for more than 14 Years (Mwangi, 1999).

There is a positive correlation between the duration of time that residents had stayed in the area and where they did their agricultural activity i.e. whether on- farm or off-farm. The Pearson Correlation Coefficient (r) was 0.324 and the significance value was 0.01 (Table 4.6).
Table 4.6: Correlation Matrix between the Duration of Time the Residents had dwelt in the City and Farming Activities in the study area (On- Farm/Off-Farm).

<table>
<thead>
<tr>
<th>Years(categories)</th>
<th>Pearson Correlation</th>
<th>Sig. (2-tailed)</th>
<th>N</th>
<th>Where you do your farming activities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>.</td>
<td>.324(**)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>.000</td>
<td>338</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>.324(**)</td>
<td>338</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>.000</td>
<td>338</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| ** Correlation is significant at the 0.01 level (2-tailed).**

A cross tabulation between the two variables further proved the existence of a relationship (Table 4.7).

Table 4.7: Cross Tabulation Showing Relationship Duration of Time Spent in Urban Area and Farming Activities in Kahawa

<table>
<thead>
<tr>
<th>Years (categories)</th>
<th>Where you do your farming activities</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>none</td>
<td>on-farm</td>
</tr>
<tr>
<td>0- 5 yrs</td>
<td>33</td>
<td>22</td>
</tr>
<tr>
<td>5- 10 yrs</td>
<td>24</td>
<td>34</td>
</tr>
<tr>
<td>10- 15 yrs</td>
<td>15</td>
<td>26</td>
</tr>
<tr>
<td>over 15 yrs</td>
<td>4</td>
<td>42</td>
</tr>
<tr>
<td>Total</td>
<td>76</td>
<td>124</td>
</tr>
</tbody>
</table>

52
The Results showed that on-farm and off-farm farming activities increased with increase in duration of time spent in urban areas. The percentage of those who did not practice urban agriculture also decreased as resident’s duration in urban areas increased. This may be due to the fact that residents who have dwelt in the city for long have acquired some land and other resources.

The study results further showed that urban farmers engaged in agricultural activities both on-farm and off-farm. A total of 73.6% of urban dwellers practiced urban agriculture in one way or another, while 26.4% did not farm (Fig 4.7). Those who cultivated in residential areas were 37.8%, those who did off-farm cultivation were 18.8% while the remaining 17% practiced both on-farm and off-farm cultivation (Figure 4.7).

![Figure 4.7: Proportions of Off-Farm and On-Farm Urban Agricultural Activities in Kahawa.](image)
According to Lee-Smith et al., (1987) almost two thirds (67%) of urban households grow part of their food, while 29% grew these crops within the urban area in which they lived. The high percentage of those who engaged in urban farming may be attributed to the fact that foods are expensive in the city and families require a fresh supply of vegetables and animal protein for their families. They also need to supplement their family income. This exemplifies the important role played by urban agriculture in the livelihood of urban dwellers.

On-farm agricultural activities were carried out in the residential areas where people reside, usually in the backyard. In cases where the plots were small, residents usually engaged in livestock rearing since these occupy little space. The off-farm activities were usually undertaken adjacent to the homes or far from the homes depending on the availability of land. According to the study it was found that 42.2% of the respondents cultivated on privately owned land in the neighbourhood, 21.9% cultivated on railway reserve, 13.3% on road reserve, while 7% cultivated on rented lands, 4.8% cultivated on vacant public utility land and 9.4% cultivated on other areas (Fig 4.8). Other areas included cultivating along the river banks and along the sewage chambers (Figure 4.8). According to IDRC (1994) urban agriculture is practiced mainly on private residential land (32%), followed by roadside verges (29%), river banks (16%) and other public lands. Urban agriculture practised mainly on road reserves, river bank sites and railway reserve has high risks of pollution (Mireri et al., 2007). The study showed that the railway reserve has also been well utilized by the area residents, although they are usually harassed periodically by railway workers when they are clearing the area. This has led to
crop losses and has discouraged most of the farmers from engaging in urban agriculture. The study showed that only a few farmers hire farms for cultivation (Figure 4.8).

This is because the cost of hiring land is quite high and the returns are low. Those who cultivate privately owned land (own or owned by private individuals) form the highest percentage of 42.2%. This means that there are several people who own idle land. The draft national land policy should be brought into force and secondary land ownership implemented so that the urban poor can access land. At the same time landlords should also be assured of retaining their land.

**Figure 4.8: Urban Agricultural off-Farm Activities and where they were practiced**
There was a negative correlation between occupation and the type of crops/livestock kept (Table 4.8). The Pearson Correlation (r) being 0.517 and the p-value being at 0.01. There was also a negative correlation between occupation and where farming is carried out (whether on-farm or off-farm). The Pearson Correlation (r) being 0.455 and the p-value being at 0.01. A positive correlation is also noted between the types of crops/livestock kept and where the farming activities were carried out, with Pearson Correlation being 0.627 and the p-value being at 0.01 (Table 4.8). This means that the possibility of finding farmers who kept livestock growing crops at the same time was high.

**Table 4.8: Correlation Matrix between Occupation, Education Levels, Type of Agricultural Activity, and where Farming Activities took place in the Study Area**

<table>
<thead>
<tr>
<th></th>
<th>Education level</th>
<th>Occupation type of crops and livestock kept</th>
<th>Where you do your farming activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education level</td>
<td>Pearson Correlation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>1 .221(***)</td>
<td>.008</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>334</td>
<td>224</td>
</tr>
<tr>
<td>Occupation</td>
<td>Pearson Correlation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.221(***)</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>224</td>
<td>230</td>
</tr>
<tr>
<td>type of crops and livestock kept</td>
<td>Pearson Correlation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.008</td>
<td>-.517(***)</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>334</td>
<td>230</td>
</tr>
<tr>
<td>Where you do your farming activities</td>
<td>Pearson Correlation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>-.019</td>
<td>-.455(***)</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>334</td>
<td>230</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed).
4.4 Urban Agricultural Practices and Relative Importance

4.4.1 Crops Grown and Livestock Kept

The study revealed that most farmers grew both crops and kept livestock. The respondents who both grew crops and kept some type of livestock were 41%, those who cultivated field crops such as maize and beans were 13%, those who cultivated horticultural crops were 8%, while those who kept livestock only were 10% and those who did not farm at all were 28% (Figure 4.9).

![Diagram showing agricultural activities]

**Figure 4.9:** Types of Urban Agricultural activities Adapted by Farmers in Kahawa.

The most common types of livestock kept were cows, goats and local chicken, but ducks, rabbits, poultry and pigs were also kept. Horticultural crops grown were *Brassica*
oleracea, Spinacea oleracea, Lycopersicon esculentum, Capsicum annum, Solanum melongena, Allium cepa, inter alia while field crops included Zea mays, Solanum tuberosum, and musa spp. However some farmers were doing urban agriculture as a business and were rearing broiler chicken, layer chicken, kept zero-grazed cows for milk production, and pigs. Other small livestock animals commonly found were rabbits and ducks. Urban farmers in Nairobi preferred poultry followed by goats and then cattle (Ishani et al., 2002). This concurs with my results. A few farmers also kept turkeys, but this was for prestige purposes.

The respondents grew crops under two categories; irrigated crops and non-irrigated crops. The irrigated crops included mainly vegetables such as tomatoes, kales, spinach, local vegetables, pepper, cougettes, brijals and dania. The non-irrigated crops (field crops) included mainly maize, beans, bananas and fruit trees. These crop products were used by the families to improve their diets, while at the same time the surplus was sold and the income used to supplement the family income. Those who grew both crops and kept livestock gained the most since they are able to utilize the waste products from the livestock such as manure to increase their crops production. They also play an important role in ensuring environmental sustainability.

4.4.2 External Farm Inputs Utilized by the Respondents

Majority of the respondents used a variety of farm inputs for their agricultural activities. This study revealed that 81.6% of the respondents used farm inputs while 18.4% did not use any farm inputs in their plots (Figure 4.10). About 56.7% used external seeds, 28.1%
used fertilizers, 16.2% chemicals, 51.7% animal manure, 31.8% used irrigation water, and 23.9% used animal feeds, while only 3% used compost (Figure 4.10).

![Bar chart showing farm inputs used by respondents in Kahawa Study area]

**Figure 4.10: Farm Inputs Utilised by the Respondents in Kahawa Study area**

About 70.7% of the respondents purchased their seeds for planting from the shops, 6.9% used own seeds while a negligible percentage were given seeds as gifts by neighbours and 20.7% did not use any seeds (Table 4.9). Although the majority of the respondents purchased their seeds from the agro-vet shops, they were ignorant about the quality and variety of seeds to purchase. Most of the farmers ended up purchasing what the shop keepers recommended. Lack of small packages for seeds such as maize and the high cost discouraged most urban farmers from purchasing the seeds. Most of them ended up buying the packages for 1 kilogram which are usually cheaper and packaged by unscrupulous traders. Some of the respondents obtained crop cuttings and seeds especially for vegetables from friends and neighbours for propagating in their farms.
farmers lacked the knowledge on the good qualities of planting materials, despite presence of agricultural officers in the area. This increased crop pests and diseases, hence reducing the crop yields.

Table 4.9: Sources of Seeds for Planting/Planting Materials in Kahawa area

<table>
<thead>
<tr>
<th>Source</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>20.7%</td>
</tr>
<tr>
<td>Gifts</td>
<td>1.7%</td>
</tr>
<tr>
<td>Purchased from A/Vet or shops</td>
<td>70.7%</td>
</tr>
<tr>
<td>Own seeds</td>
<td>6.9%</td>
</tr>
</tbody>
</table>

About 39.1 % of the respondents used fertilizers purchased from the shops while 60.9 % did not use any fertilizer. On chemicals, only 22.6 % used chemicals which they purchased from the local agro-chemical shops, while 77.4% never used any chemicals. In Lusaka, 61% of urban farmers and 78% of periurban farmers reported using chemical pesticide, and 50% of urban farmers used chemical fertiliser (Drescher, 1996). These results do not agree with this study. A large percentage of farmers used neither fertilizer nor chemicals due to the high cost of these farm inputs. It was noted that although few farmers used chemicals and fertilizers, they lacked knowledge on safe use of chemicals. During the transect walk some workers found in a green house were not wearing any protective clothing such as masks, gloves or even gumboots, even though there was a strong odour from the chemicals used.
About 51.7% of the respondents used manure from different sources with the majority using own manure 36.1%, while others purchased or were given by neighbours, or collected from the roadside (Figure 4.11). In Nairobi, 30% of urban farmers use manure that is either purchased or produced by their own livestock. (Nugent, 1995). The most common type of manure used was poultry and cows manure. However, during the transect walk heaps of dumped manure (especially cows manure) could be seen along footpaths in the area.

![Figure 4.11: Source of Animal Manure in Kahawa](image)

According to Urban Harvest (2007), about 80% of manure is dumped, but this does not concur with the results of this study because only a few farmers were dumping their animal wastes. The majority of the farmers seemed to understand the importance of using animal manure. Nutrient recycling especially from manure is very important for the urban
farmer for improving the agricultural productivity. Dumping of manure along the paths has the effect of polluting the environment, making the area unsightly and this may cause conflicts with neighbours.

Only 3% of the respondent used organic compost, while the remaining 97% did not use any organic waste. According to a study by Urban Harvest (2007), only 1% of organic wastes were used for production of compost for use as bio-fertilizer. There are lots of nutrients in urban organic wastes (Carbon, Nitrogen, Phosphorus, and Potassium). Urban agriculture can play a significant role in urban environment management through waste and water recycling (Urban Harvest, 2007). This opportunity is not exploited due to lack of space for waste recycling activities and absence of appropriate policy on waste management. Most residents were ignorant about the importance of organic waste and most burnt it as a way of clearing the field for planting and this caused environmental pollution. Solid waste re-use can prevent loss of soil nutrients and reduce fertilizer costs. The organic matter not only adds nutrients to the soil, but maintains and builds up the soil structure as aerated moisture (Urban Harvest, 2007). The study also showed that none of the farmers used municipal waste possibly due to the fact that there are no major markets. Markets are usually sources of municipal wastes. However, there is a composting self-help group in the area called (SOYIA). They make compost waste from the wastes generated in Soweto area and sell to those interested, although marketing is a problem. The group has no long term plan for capital investment primarily because they do not have their own land to carry out their operations. Lack of market for their products is also a major constraint. Marketing is irregular and seasonal with moderate sales occurring
during the planting season. Poor marketing research, weak advertising and poor public access to the compost site negatively affects compost marketing.

On livestock rearing, the study revealed that 39.6% zero grazed their livestock while the majority of the respondents 59.7% left their animals to roam freely. Most of the respondents especially in the slum area of Soweto live in deplorable conditions; they stay too close to their animals such as poultry, goats, pig and cows for lack of space and fear of theft. The animals are also overcrowded. This increases the probability of exposure to zoonotic diseases of bacteria origin, such as *salmonella spp*, intestinal parasites such as tapeworms (*Taenia selenium*) and ectoparasites like mites and fleas (Boischio, 2006). Most of the animals could be seen grazing in the fields with some tethered and others just left to roam. The residents also complained of loitering animals which were destroying their crops. This led to neighbours conflict and contributed to emotional stress. Furthermore stray animals may inflict physical injuries on children, or get involved in motor vehicle accidents that may result to loss of human life. Emotional stress may also arise from the foul smell emitted from unsanitary cattle, poultry and piggery units within the neighbourhood. Handling of sick animals and consumption of contaminated animal products can also lead to zoonotic problems such as brucellosis, TB, skin and diarrhoea diseases (Boischio, 2006).

From the study about 31% of the residents used different types of water sources for irrigation purposes, while 69% never irrigated their crop (Figure 4.12). Out of those who used irrigation, 11% used the water from Kiuu and Riara rivers, 9% used water from
shallow wells, 7% used tap water illegally, 2% used roof harvested water or recycled water, 1% cultivated next to the sewer, while another 1% used water from a borehole (Figure 4.12).

Due to lack of proper infrastructure for safe handling of waste water, much of it ends in streams, rivers and irrigation channels. Most of the residents are served by septic tanks and pit latrines which sometimes overflowed during the rainy seasons. In the slum area of Soweto, it was observed that although UN-Habitat had constructed some sanitation facilities in the area they are not enough and residents have constructed some pit latrines which are shallow and overflows during heavy rains. The toilets are in centralized areas, while others are not yet operational and this creates a problem mainly for women and
children especially at night when they need to relieve themselves. Human wastes could be seen everywhere especially in Soweto area. All this ends up in the river Riara which is used downstream for irrigation purposes posing a health risk. The sewage system in the area though operational has never served its purpose since it has been non-functional. There was also overflowing of the sewage along the system polluting water, land and air with serious health risks to urban agricultural produce. During the transect walk it was observed that the sewer which was constructed in the 1990’s is open since the fence had been vandalized. This exposed the animals which are tethered there to health risk. Two of the treatment chambers were overgrown with water hyacinth and only one chamber is used for dumping of the waste. However, no treatment takes place.

Some agricultural activities were observed such as growing of arrow-roots and vegetables along the sewer. This may cause occupational hazards to the workers who were seen working without any protective clothing. The sewer is also thought to be a breeding ground for mosquitoes. Even after complains by the area residents not much has been achieved in terms of restricting residents from accessing the sewer as well as treatment of the same. The sewer is a human health risk in the sense that there is no treatment taking place. It seeps through River Riara which is just a few meters from it and is used downstream for irrigation purposes.

4.4.3 Challenges Faced by Urban Farmers

The study showed that urban farmers faced various challenges in their farm undertakings which in turn affected their agricultural practices, production and the quality of the
produce. The main challenges were inadequate rainfall (26%), pests and diseases infestation (21%), insecurity (35%), lack of credit facilities (13%), high cost of farm inputs (31%), lack of agricultural knowledge (10.4%), destruction of crops by animals (36%), lack of clean water for irrigation purposes (22.5%), lack of access to land (27%), and poor market infrastructure (16%) (Figure 4.13).

![Bar chart showing challenges faced by urban farmers.](image)

**Figure 4.13: Challenges faced by Urban Farmers in their Agricultural Practices in the study area. (Due to multiple responses the figures are more than a hundred percent).**

The respondents felt that the rains are erratic and unreliable and this has contributed towards low crops yield by most farmers. This problem has been aggravated by lack of clean water for irrigation purposes forcing most farmers to use polluted rivers, shallow wells and sewage water for irrigation. There is pests and diseases infestation on crops and livestock. Most farmers complained of lack of agricultural knowledge to deal with these, the problem is compounded by the high cost of farm inputs. The veterinary doctors are
also few and not easily available. Another challenge mentioned by the respondents was lack of credit facilities. In the past the government through AFC, the cooperative bank of Kenya and the cooperative movement, provided affordable credit to farmers. Due to mismanagement and political patronage and interference, most have collapsed or failed to provide the services. The formal banking is yet to develop credit facilities, but Equity bank is trying to fill that gap to suit small scale farming businesses. The market infrastructure is poorly developed and lack of modern facilities like cold rooms, water and social amenities such as toilets are lacking. Most of the marketing is done on individual basis since there are few and weak market organization. There is marketing of adulterated and contaminated UPA products as well as poor handling of produce, especially fresh and perishable products.

The other major challenge is lack of access to land. Urban and peri-urban agriculture is practiced on limited land that is increasingly being encroached by urban developers. Those who farm along the railway lines, road reserve and public utility lands are constantly harassed by the local authorities. Those who leave their animals to roam are sometimes caught unaware by the council officials who confiscate their livestock. One of the women respondent said “the city council people usually come and confiscate our animals, they should leave us alone”. This shows that although the current laws are not supportive of UPA activities, community members are ignorant about how they should keep their animals. There is also a lot of insecurity since most plots are not fenced, so there is rampant theft of crops and destruction by roaming animals. According to Cornish (2001) one of the primary constraints facing urban farmers is lack of adequate supply of
water, seeds and agro-chemical availability, theft of crops and equipments and damage to crops are also significant issues. This concurs with the results of this study.

Discussions with FGDs clarified that urban farmers are faced with all the above challenges. The challenges were ranked according to their order of importance to the urban farmers. The FGD carried out a pair wise ranking exercise (Table 4.10)
Table 4.10: Pair Wise Ranking of Challenges faced by Urban Farmers in Kahawa Area

<table>
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<tr>
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<th>TK</th>
<th>FI</th>
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<td>M</td>
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</tbody>
</table>

Source: FGD

Key

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Abbreviation</th>
<th>Challenge</th>
<th>Abbreviation</th>
</tr>
</thead>
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<tr>
<td>Lack of technical knowhow</td>
<td>TK</td>
<td>Lack of credit facilities</td>
<td>CF</td>
</tr>
<tr>
<td>Lack of farm inputs</td>
<td>FI</td>
<td>Destruction of crops by livestock</td>
<td>DC</td>
</tr>
<tr>
<td>Lack of marketing infrastructures</td>
<td>MI</td>
<td>Insecurity</td>
<td>I</td>
</tr>
<tr>
<td>Lack of irrigation water</td>
<td>IW</td>
<td>Disposal of agricultural wastes</td>
<td>DW</td>
</tr>
<tr>
<td>Lack of access to land</td>
<td>AL</td>
<td>Pests and diseases</td>
<td>P&amp;D</td>
</tr>
</tbody>
</table>

The results of the pair wise ranking are as shown below (Table 4.11).
Table 4.11: Challenges faced by Urban Farmers Ranked in Order of Importance in Kahawa Area.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Challenges</th>
<th>Why it’s a challenge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Lack of technical knowhow</td>
<td>Farmers require urban agriculture-oriented training and extension service for safe production of food.</td>
</tr>
<tr>
<td>2.</td>
<td>Lack of credit facilities</td>
<td>Poor farmers need resources in order to improve their productivity. Micro-financing programmes need to be tailor-made to assist them as a strategy to reduce poverty.</td>
</tr>
<tr>
<td>3.</td>
<td>High cost of farm inputs</td>
<td>Costs of farm inputs such as chemicals and fertilizers as well as farm equipments needs to be reduced, so that the poor urban farmers can afford them.</td>
</tr>
<tr>
<td>4.</td>
<td>Lack of access to land</td>
<td>Poor farmers lack access to land and are forced to farm on fragile land such as steep slopes and wetlands exposing land to degradation. Farming along roads and railway reserve exposes food products to pollution.</td>
</tr>
<tr>
<td>5.</td>
<td>Lack of irrigation water</td>
<td>Knowhow on water recycling and reuse is missing. Clean irrigation water is required.</td>
</tr>
<tr>
<td>6.</td>
<td>Marketing</td>
<td>Marketing infrastructure and information exchange system needs to be well organised and institutionalised.</td>
</tr>
<tr>
<td>7.</td>
<td>Destruction of crops by livestock</td>
<td>Restriction of animals needs to be enforced in order to control destruction of crops by livestock.</td>
</tr>
<tr>
<td>8.</td>
<td>Disposal of agricultural wastes</td>
<td>Agricultural wastes are a problem. Technology on recycling of organic wastes for use in farming is required as well as funds for recycling projects e.g composting</td>
</tr>
<tr>
<td>9.</td>
<td>Pests and diseases</td>
<td>Farmers need training on pests and disease control in order to increase and improve crops and animals production</td>
</tr>
<tr>
<td>10.</td>
<td>Insecurity</td>
<td>Roaming animals need to be confiscated and owners charged.</td>
</tr>
</tbody>
</table>
These were the main challenges mentioned by the respondents. In order to come up with the root causes and effects of these problems/challenges a problem tree analysis was conducted (Figure 4.14).

![Problem Tree Analysis](image)

**Figure 4.14:** Problem Tree Analysis Showing the Root Causes of Unsustainable Urban Agricultural Practices. *(Source: FGD)*
From the problem tree analysis, the root causes of unsustainable agricultural practices were identified as: lack of credit facilities, lack of clean water for irrigation purposes, lack of policies on UA, lack of access to land, lack of knowledge on natural resource recycling, lack of appropriate policies on UA and lack of law enforcement.

Some of the farmers had learnt to face the several challenges by becoming innovative and therefore increasing food production and thus providing nutritious food to their families (Plate 4.3 & 4.4).

The growing of vegetables on gunny bags is a concept which many urban farmers were adapting even in apartments since it does not require a garden. The stored chicken house also takes little space.
These can provide the family with the much needed vitamins and proteins, thus enriching the family’s diet. The urban farmers require urban oriented training in order to eradicate poverty and hunger, as well as to reduce most of the risks associated with urban agriculture.

4.4.4 Effects of UA on Urban Livelihoods

Urban agriculture contributed to the livelihoods of the respondents in several ways. These were economic as well as ecological benefits. About 79% of the respondents said it contributed to food security, 40% said that it generated the much needed family income, 14% said it created employment opportunities and only 3% said that they practiced it as a way to improve the environment (Figure 4.15).

![Figure 4.15: Benefits of Urban Agriculture in Kahawa Area](image)

<table>
<thead>
<tr>
<th></th>
<th>Food security</th>
<th>employment</th>
<th>environmental improvement</th>
<th>income generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series 1</td>
<td>79</td>
<td>14</td>
<td>3</td>
<td>40</td>
</tr>
</tbody>
</table>
The majority of the respondents practiced UA as a food security measure. They get food supplements such as fresh vegetables, maize which is a stable food in most families and also cheap sources of proteins from the livestock animals (eggs, meat, and milk). This leads to improved health conditions due to a richer vitamin A and protein diet (Bertina and Belevi, 2001). The surplus is sold and the income obtained contributes towards the much needed family income and is used for other family expenses.

Due to the structural adjustment programme (SAP) which took place in the 1980s and 1990s, UA has also become a form of informal employment to a number of residents who were affected by the retrenchments. Between 1994 and 1997, informal unemployment increased by 65% to two-thirds of the workforce (Foeken & Mwangi 2000). They engage in projects such as piggery, zero-grazing, broilers and layers rearing and growing of vegetables in green houses. These are income generating activities which contributes towards the local economy development. However, the majority of the residents in Kahawa practice urban farming as a food security measure and do not quantify the production, although they sell the surplus.

The members of the FGD were brought together with the aim of quantifying the various food products that were grown in the study area. According to the FGD local vegetables production could fetch as much as Ksh. 2500 per month. Most of the vegetables were used for home consumption. The mean milk production was 20 litres per day which translates to 600 litres per month giving a production of Ksh 18,000/month if a litre goes for 30 shillings. According to the 2009 census about 54,546 cattle, 46,837 goats, 34,717
sheep, 29,976 pigs, 342,788 commercial chicken and 279,397 indigenous chicken are reared in Nairobi.

According to MOA (2002) the amounts of agricultural production are substantial with an estimated 50,000 bags of maize and 15,000 bags of beans being produced annually in Nairobi. About 250,000 chicken are reared and 45,000 goats and cattle, 42 million litre of milk are produced in Nairobi annually. Milk alone generates upto 800 million kshs annually if priced at 20 sh/litre (Urban Harvest, 2004). Even the small livestock animals such as the rabbits were found to have a substantive income. In the slum area of Soweto a young farmer was keeping homing pigeons which were housed on the roof-top of his mother’s house due to lack of space. The pigeons are sold each for a hundred shillings, thus providing some income as well as contributing to preservation of urban biodiversity. This shows that the urban farmers eat nutritious foods and save a lot of money on foods that they would have otherwise bought. If they are well trained in agricultural production and urban agriculture legalized, poverty and hunger could be reduced. Some of the residents are also engaged in value addition of agricultural products. Such products being made are crisps from arrow roots, sweet potatoes, bananas and yoghurt making. These activities also stimulate development of related micro-enterprises such as agricultural inputs, marketing.

4.4.5 Health Implications of Urban Agriculture

The study showed that about 51.9% of the respondents said that UA contributed to unsafe food production, 35.7% was confident that it contributed to air pollution, 30.8% said that
waste disposal was a problem, 18.5% said it contributed to noise pollution, 14.8% said that the chemicals used affected workers' health, while 7.4% said that there was an increase in pests and rodents due to agricultural wastes (Figure 4.16).

![Bar Chart]

**Figure 4.16: Negative effects of Urban Agriculture in the Study Area**

These negative effects of UA are a health risk to the residents and could result to various diseases occurring among the residents. Most of the crops grown using irrigation water from river Kiuu and Riara would most likely be contaminated, since the two rivers are tributaries of Nairobi River which is heavily polluted due to poor sanitation upstream (Mwangi, 1995). The use of the untreated water from these rivers for irrigation purposes poses important health risk to the farming communities and consumers of products irrigated with waste water. Some 90% of all sewage is discharged, along with the faecal coliform bacteria that cause intestinal diseases, directly into rivers, lakes, streams and
coastal waters (Nelson, 1996). According to Shuval et al., (2001) epidemiological evidence, showed disease transmission in association with the use of raw or partially treated wastewater. This evidence pointed most strongly to the helminths as the primary problem, particularly in developing countries. Waste water used for irrigation purposes presents a risk of cholera, typhoid, and other bacterial infections, as well as diarrhoea, amoebic dysentery, and infection from intestinal nematodes (Edwards, 2001).

There was also cultivation of crops along the open sewer exposing the crops to undesirable elements from the sewer which may be a health risk. Some agricultural activities were observed such as growing of arrow-roots and vegetables along the sewer. This may cause occupational hazards especially to the farmers/workers who were seen working without any protective clothing. The food products could also contain some undesirable elements harmful to the body causing a healthy risk.

It was observed that there were some popular food kiosks in the study area which served fresh vegetable salads and juices to its customers. While this seems to be healthy, the main risk for consumers of waste water irrigated produce arises when vegetables or salad crops grown with untreated water are consumed raw, without proper washing or treatment (Crook, 1998).

Another concern highlighted by the study was poor disposal of animal waste, which posed a significant health hazard to farmers and their neighbours. Effluent from livestock houses and manure heaps could harbour various pests and rodents which may spread diseases to the inhabitants. This has been associated with augmented fly populations,
leading to an increased probability of contamination of food within households, resulting to diarrhoea diseases (Urban Harvest, 2004). Urban agriculture can create breeding sites such as ditches, poorly drainage water services caused by poor irrigation or interferences with natural drainage, and uncovered water tanks (Boischio, 2006). In addition, the wells used for irrigation may create favourable habitat for insect disease vectors, such as malaria mosquitoes (Birley and Lock, 1999). UPA has the potential to increase malaria rates. Malaria is an important cause of human morbidity and mortality. Every year more than 1 million people die of malaria globally, predominantly children under 5 years of age (Kisner, 2008). It is estimated that 300-500 million people worldwide are at risk of this disease and of this 90% live in Sub-Saharan Africa (Snow et al., 1999).

It was noted that due to the small sizes of the plots, lack of capital coupled with lack of access to land, most urban farmers are forced to live in deplorable conditions, with some sharing houses with the animals or living in close proximity with them (Plate 4.1 & 4.2).

Plate 4.3: A Cow Shed next to a house. Notice the calf feeding and a cooking pot inside the pen.

Plate 4.4: Piglets in an overcrowded pig sty
In plate 4.3 above, the cow-shed was squeezed and effluent was seen flowing behind the shed into a footpath. A cooking pot as seen inside the cow-shed is for commercial food usually sold to the area residents. A girl is doing her household chores in the background. This is very unhygienic and can cause a great health risk. Livestock animal were kept in an overcrowded manner just next to a house (Plate 4.4). This could cause a high rate of respiratory diseases which is associated with unsanitary environmental conditions. According to Boischio (2006), living close to the animals increases the probability of exposure to zoonotic diseases conditions of bacteria origin, such as *salmonella* spp, intestinal parasites such as tapeworms (*Taenia selenium*) and ectoparasites like mites and fleas. The effluent from the zero-grazing animals, poor manure disposal and dust from the poultry houses pollute the environment. The effect of this is the dissemination of disease causing organisms leading to diarrhea and respiratory problems (Boischio, 2006).

Livestock animals were seen grazing and drinking water in the sewer. These animals are exposed to pathogenic organisms and metallic substances which may be present in the sewer leading to health problems for these animals as well as the consumers. These constitute severe health risks for humans, because of the possibility of disease transmission through direct contact with animals, or in the food chain as a result of biomagnifications and bio-concentrations. Lack of vaccination of livestock could also lend to sick animals. Handling of sick animals and consumption of contaminated animal products as a result of microbiological contamination, such as non-typhoid *salmonella*
and *Escherichia coli* 0157: H7 could lead to zoonotic problems such as brucellosis, TB, skin and diarrhoea diseases (Boischio, 2006).

During the transect walk, workers found in a green house did not have any protective clothing despite the presence of heavy chemicals. The workers/farmers could be exposed to occupational health risks (Lock and De Zeeuw, 2003). Agricultural workers in waste water irrigated fields are directly exposed to infection and require protective clothing as well as greater risk awareness (Gueye and Sy, 2001). Due to inappropriate use of these chemical products and their application methods, this could cause health risks to both the farmer/workers and consumers and are responsible for environmental contamination (Birley and Lock, 1999). Use of expired pesticides may also be a source of Persistent Organic Pollutants (POP’s) as well as by products of combustion including burning of wastes which is quite common in the area as a way of clearing the field.

There was also complain of fake chemical and animal feeds on sale, especially chemicals used to increase milk production and to hasten growing of broilers. The effect of these chemicals may not be known and the residents feared that these may cause a health risk. It was found that poultry litter (droppings) was being recycled as cattle feeds by some cattle farmers. This practice occurs because chicken’s waste some feeds, which get incorporated in their litter and is then available to cattle. This is a health risk because fresh poultry manure contains pathogens. If it’s not stored for some time before use it may contain pesticide residue from bird treatment (Boischio, 2006).
The presence of farmer’s choice factory in the area though an economic venture and beneficial to many farmers, is a health risk to the residents. There is pollution from the lagoon where the factory effluent is discharged as well as air pollution from the factory’s incineration process where wastes are disposed off by burning. This produces an awful odour which affects the residents. According to the area health personnel this could be the cause of some of the respiratory problems in the area especially among the young children (Figure 4.17).

<table>
<thead>
<tr>
<th>Diseases (under 5 yrs old)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typhoid fever</td>
<td>0.2</td>
</tr>
<tr>
<td>Dysentery</td>
<td>0.1</td>
</tr>
<tr>
<td>Other diseases</td>
<td>9.9</td>
</tr>
<tr>
<td>Skin diseases</td>
<td>8.9</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>4</td>
</tr>
<tr>
<td>Other respiratory diseases</td>
<td>48</td>
</tr>
<tr>
<td>Ear infection</td>
<td>1.3</td>
</tr>
<tr>
<td>Eye infection</td>
<td>3</td>
</tr>
<tr>
<td>Intestinal worms</td>
<td>4.4</td>
</tr>
<tr>
<td>Malaria confirmed</td>
<td>3</td>
</tr>
<tr>
<td>Malaria (clinical)</td>
<td>8.1</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>12</td>
</tr>
</tbody>
</table>

**Figure 4.17: Mortality Rate for the Under 5 Years old in 2009 in Kahawa H/C**  
*Source: Extracted and Analysed from CCN Morbidity Report for 2009*

A mortality report of Kahawa health centre from the CCN was analysed to show what diseases were most prevalent both for the under five years old. Respiratory diseases had
the highest percentage of 48%, diarrhoea 12%, clinical malaria 8.1%, confirmed malaria 3% and skin diseases 8.9 (Figure 4.17).

For persons above 5 yrs old, respiratory diseases had a prevalence rate of 45%, diarrhoea had 5.3% and malaria 10.6% (Figure 4.18).

![Figure 4.18: Mortality Rate for the Over 5 Years old in 2009 in Kahawa H/C (Source: Extracted and Analysed from CCN Morbidity Report for 2009)](image)

Diarrhoea, malaria, intestinal worms, skin diseases, dysentery, typhoid fever and respiratory diseases could be related to the UA practices and also the state of the environment. It is important to note that some diseases resulting from UA practices may take time to manifest themselves such as those that occur as a result of biomagnification and bioaccumulation, but this does not however make them less important.
Some pig’s farmers fed their pigs with left-over foods (swill) from hotels to supplement the commercial feeds. Swill often has a bad odour and this could be offensive to the area residents and could help spread communicable diseases. While this is a good practice for utilization of resource management, care needs to be taken to ensure that it does not cause human ill-health.

4.4.6 Ecological Effects of Urban agriculture

Waste management is one of the key challenges faced by urban farmers in the study area. If not properly managed, animal waste can be a significant source of human health hazards. It was observed that some farmers had the habit of disposing off their wastes especially cows manure along the paths as well as directing their livestock effluents along the paths (Plates 4.5 & 4.6).

Plate 4.5: Cows Manure Disposed off near a Foot-Path

Plate 4.6: Ducks feeding on effluent in between houses in Soweto
The effluent from the zero-grazing animals, poor manure disposal and dust from the poultry houses pollute the environment, increasing the health risks of the residents. The children do not have a good playing ground and the environment exposes them to various diseases. The effect of this is the dissemination of disease causing organisms such as flies leading to diarrhea and respiratory problems (Boischio, 2006). Dumping of manure along the paths has the effect of polluting the environment, making the area unsightly and this may cause conflicts with neighbours.

There were also car wash activities along the river Riara further compromising the quality of the water. The effluent from these car wash activities contained oils and detergents among other substances and were flowing freely in the river. River Riara is used downstream by residents to wash clothes and irrigate crops as well as providing drinking water for their livestock. These car wash activities polluted the river and exposed those using the water to health risk.

The use of pesticides to maintain yields not only has a negative impact on the environment, but may also lead to insects developing resistance to the pesticides themselves (NEMA, 2003). Use of expired pesticides may also be a source of Persistent Organic Pollutants (POP’s) as well as by products of combustion including burning of wastes which is quite common in the area as a way of clearing the field. Insect pests can be a serious threat to productivity as they devastate crop yields and transmit diseases to both crops and livestock. There are serious concerns that reliance on pesticides to
maintain yields not only has a negative impact on the environment, but may also lead to insects developing resistance to the pesticides themselves (NEMA, 2003).

Lack of agricultural knowledge and lack of access to land pushed the urban farmers to cultivate in fragile lands such as in steep slopes and along the river banks without taking any measures to control soil erosion. Some of the respondents knew what was expected of them in regard to soil conservation measures, but felt that the government should pay them to prevent soil erosion. One respondent said “the land for the agricultural officers along the river is still there” although she had cultivated up to the river bank without leaving the recommended area.

4.5 Policy Analysis on Urban Agriculture

Urban agriculture is on the increase despite lack of policy guidelines and practice. However, some Acts of Parliament have provision for UA upon compliance with certain requirements, while some policy papers also support agriculture in general, but have several gaps in relation to UA (Table 4.12)

Table 4.12: Policy Analysis with Implication on Urban Agriculture

<table>
<thead>
<tr>
<th>Policy Statement</th>
<th>Gaps</th>
<th>Possible Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Local Government Act (cap 265); It gives local government powers to lease, transfer, or allocate land for</td>
<td>There is contradiction between Sec. 144c &amp; Sec. 155c. The local authorities uses Sec.</td>
<td>-UA should be recognised as an urban land use. -Idle land should be</td>
</tr>
<tr>
<td>temporary use (sec 144).</td>
<td>144c to harass and destroy any agricultural activities in the urban areas and disregards Sec 155c which supports UA.</td>
<td>utilised by poor urban farmers for food production so long as they follow the laid down rules and regulations to ensure safety of food products and the environment.</td>
</tr>
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</tr>
<tr>
<td>-Sec 210 empowers local government to make laws necessary to maintain resident’s health safety and well-being, good rule and governance; prevent and suppress nuisance; control, regulate or compel any acts they are empowered to perform. -Sec. 144c prohibits cultivation by unauthorised persons on land that is not occupied or enclosed, or belonging to private persons, governments and local authorities. -Sec. 155c also provides for the planting of famine relief crops by persons to support themselves in any part of the country where there is shortage of foodstuffs.</td>
<td>-Sec. 118 (1) (e), explains what a nuisance is” any noxious matter or</td>
<td>-The CCN whose mandate is to keep the city clean should provide a designated area for waste disposal. -It should also encourage waste recycling programmes, to help reduce the agricultural waste. This would keep the city clean as well as</td>
</tr>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
waste water flowing or discharged from any premises, whatever situation, into any public street, or into gutter or side drawn of any street, or into any mullay or water course, irrigation channel or bed thereof not approved for the reception of such discharge.”

<table>
<thead>
<tr>
<th>The Land Control Act (Cap 302); Provides for controlling transaction of agricultural land. The minimum agricultural land that can be transacted is about 1 acre. The act directs that any agricultural land in municipalities or townships must be declared by the minister for land in the Kenyan gazette.</th>
<th>This is unsupportive of UA since smaller land parcels than this exists in the urban areas where intensive farming takes place.</th>
<th>Institutions should be put in place at the local level to allocate vacant land temporarily to poor urban farmers for food production purposes without gazetting of agricultural land.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Agricultural Act (Cap 318) This provides for conservation, management and development of natural resources for agricultural growth and development. -Objective 5 provides for stable agriculture and production of special export crops (GOK, 1994). This is for rural agriculture and does not provide for urban agriculture.</td>
<td>In the urban areas currently, there is a lot of agro-processing and value addition activities taking place, this should be provided for.</td>
<td>Food security issues should be encouraged in urban areas. -Cottage industries and agro-processing should be encouraged if the country is to achieve vision 2030 which envisions Kenya as a middle industrialised economy by the year 2030.</td>
</tr>
<tr>
<td><strong>The Physical Planning Act (Cap 286);</strong></td>
<td><strong>-Sec.16 of the act clearly indicates the land that should be in the plan, and it does not identify agriculture as an urban land use. Therefore according to planning legislation, agriculture is not a legitimate land use.</strong></td>
<td><strong>Urban agriculture should be identified as an urban land use and be well integrated into the urban planning and development.</strong></td>
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<tr>
<td>----------------------------------------</td>
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</tr>
</tbody>
</table>
| -Sec.16 states that “a physical development plan may be prepared for the purpose of improving land and providing for the physical development of such lands and securing suitable provision for transportation, public purpose, utilities and services, commercial, industrial, residential and recreational areas, including parks, open spaces and reserves and also for the making of a suitable provision for the use of land for building or other purposes.” | -Sec.29 does not define what is proper and orderly and this is left at the discretion of the local authorities. This may not favour UPA and thus the need to integrate UA into the urban planning and development. | **Environmental Management Coordination Authority (EMCA)-EMCA 1999;**
| **Environmental Management Coordination Authority (EMCA)-EMCA 1999;** | -Political interference by powerful individuals has rendered the act almost impossible to fully implement. | **NEMA should come up with an environmental policy to be integrated in urban agricultural practices to**|
| This was enacted in 1999 to co-ordinate the activities of the various | | |
agencies tasked to regulate the various sectors. NEMA is one of the main administrative organs established to exercise general supervision and coordinate over all matters relating to the environment. It is mandated to promote the integration of environmental consideration into development policies, plans, programmes and projects.

EMCA has established a committee that deals with the issues of water and air quality. It gives advice on how to establish criteria and procedures for the measurement of water quality and recommends the minimum water quality standards for all the waters of Kenya and for different uses, including water for agricultural purposes.

<table>
<thead>
<tr>
<th>The new constitution of Kenya; On public land the new constitution states that public land shall not be disposed of or otherwise used except in terms of an act of parliament specifying the nature of that disposal or use (GoK, 2010).</th>
<th>Considering that most of the urban poor use vacant public land for their agricultural activities, the new constitution does not explain how the poor can access the land for</th>
<th>Mechanisms should be put in place so that the urban poor can be allocated idle land on a temporary basis for food production purposes so as to achieve MDG 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>-Proper mechanisms have also not been put in place to deal with various aspects as stipulated in the act. -Lack of finances has also hampered the full implementation. Proper mechanisms should be put in place so that various bodies set up by this act are given more authority to deal efficiently with environmental matters.</td>
<td>-Rules and regulation to ensure safety of urban food products and the environment, monitoring and surveillance of agricultural practices and products should be intensified.</td>
<td></td>
</tr>
<tr>
<td>Policy/Strategy</td>
<td>Food Security</td>
<td>Economic Development</td>
</tr>
<tr>
<td>----------------</td>
<td>---------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Kenya Vision 2030; On addition of value to Kenyan products, the policy mentions the importance of increasing the annual GDP growth to an average 10% over the vision period (GoK, 2007).</td>
<td>There is a gap on how UA will be enhanced, so that urban farmers can benefit from value addition, yet there is a lot of value addition and agro-processing in Nairobi. - On water and sanitation, the policy fails to mention recycling and reuse of waste water which is abundant in urban areas. The policy addresses the importance of increasing areas under irrigation in ASAL areas.</td>
<td>To increase the annual GDP by 10% and make Kenya a middle industrialized country by 2030, the government should encourage projects on value addition especially for the urban farmers. - Recycling and reuse of waste water in agricultural areas should be encouraged as this would go along way in improving agricultural production.</td>
</tr>
<tr>
<td>Economic Recovery Strategy for Wealth and Employment Creation (ERC), 2003-2007; Its aim was to reduce poverty and create employment</td>
<td>Addressed only rural agriculture and UA was ignored.</td>
<td>To reduce urban poverty paper should have addressed UA issues such as value addition of agricultural products.</td>
</tr>
<tr>
<td>Poverty Reduction Strategic Paper</td>
<td>As the ERC</td>
<td>As the ERC</td>
</tr>
</tbody>
</table>
The aim of the government was to industrialize the country by 2020 and reduce poverty by half by 2015.

### Strategy for Revitalising Agriculture (SRA), 2004-2014;
Its goal was to achieve a progressive reduction in unemployment and poverty, the two main challenges that Kenyans face. It stressed the importance of reviving cash crops in rural areas, while nothing was mentioned in relation to urban agriculture.

- It also failed to address UA issues.
- The recommended legal and regulatory framework does not recognize UPA.

### National Agriculture and Livestock Extension Programme Implementation Framework (NALEP-IF);
This has facilitated implementation of extension programmes in urban environment. This programme is focused to address the needs of urban vulnerable groups, mainstreaming gender in the planning process, community empowerment, combating of HIV/AIDS and other environmental conservation.

Agriculture is however done on any available land with no regard to safety of agricultural products.

The farmers require guidance on good agricultural practices to ensure safe food production and a clean environment.

### The Draft National Land Policy
How to identify the
It is a good policy and
(DNLP)
Its vision is to guide the country towards a sustainable and equitable use of land.

very poor and ensure that they have been given an opportunity to access land, benefit from it needs to be well thought out.

if well implemented, the issue of squatters and other people having too much land will be a thing of the past.
CHAPTER 5: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of Findings

The land use trend for Nairobi province indicated a decline in riverline vegetation as well as a shift from rainfed agriculture to irrigated agriculture. The riverline area declined by 36.6% and rainfed agriculture declined by 42.1%, but there was emergence of irrigated agriculture which occupied an area of 542.4 ha. in 2009. Generally there was a marked decline in urban urgriculture. There were some changes in the settlement areas, although the sparsely populated areas increased marginally there emerged a medium settlement area which occupied an area of 8718 ha. in 2009. This implied that there was competition for land between urban farmers and urban developers.

The results showed that UA is practiced by a majority of urban dwellers irrespective of their education level, occupation and the duration of time spent in the urban area. Over 73.6% of urban dwellers engaged in urban farming. Urban agriculture is practiced in every available place. According to the study, UA is popular due to its contribution to food security, income generation and employment creation. The study also showed that UA is associated with some negative effects such as environmental pollution and health related issues. About 81.6% of urban farmers used some form of farm inputs in their farms. The urban agricultural practices used such as, contaminated water for irrigation purposes, contaminated soils, chemicals mis-use, and rearing of livestock in unhygienic conditions puts the health of producers and consumers of urban products at risk. Agricultural waste such as manure dumped on roadsides, animal wastes effluent as was
seen in Soweto and air pollution from the farmers choice factory pollute the environment and cause human ill-health. The morbidity report showed some diseases prevalent in the study area such as respiratory diseases, diarrhoea, malaria, intestinal worms and skin diseases.

On policy gaps analysis it was evident that urban agriculture has not been recognised as an urban land use and this has serious implication on the state of the environment and human well being. The policy documents relating to UA are conflicting and the status of UA practice unclear, however it continues unabated and is a survival strategy. Its implications will continue to be a challenge as rate of urbanization increases in Nairobi, Kenya.

5.2 Conclusions

The study showed that the area under urban agriculture is on the decline due to competition for land despite the increasing urban population. Urban agriculture was practiced by a majority of urban dwellers irrespective of their education levels, occupation, or duration of time spent in urban areas. Cultivation was done on any available land. Urban agriculture remains popular due to its contribution to food security, income generation and employment creation. The contribution of UA cannot therefore be over-emphasised. It contributes to achievement of MDG 1- reduction of poverty and hunger, and if well practised can lead to achievement of MDG 7- ensuring environmental sustainability. The study also revealed that UA causes some negative effects such as environmental pollution and human health issues. Some of the diseases which were
prevalent in the study area were respiratory diseases, malaria, diarrhea and typhoid and this leads to human ill-wealth. The current policies do not address UA issues thus affecting the way UA is practiced with serious implication on the health of both producers and consumers. It’s imperative therefore that an UA policy be developed and those relevant existing policies be harmonised so that there is no contradiction whatsoever. To increase the gains made so far, there is need to integrate UA into the urban development planning and development.

5.3 Recommendations

In order to promote safe and productive UA, there is need for policy and institutional framework reforms at both the national and municipality/county levels to integrate UA into the urban land use. The following issues need to be addressed:

- Access to land- Land is critical to agriculture and livestock production and a major obstacle to UA. The draft national land policy though very commendable needs to be well implemented and care should be exercised when incorporating the other existing laws so that UA is practiced in a sustainable manner. There is need to consider secondary ownership of land, but structures should be put in place to protect original land owners.

- Value addition on commodities should be encouraged through cottage industries, this will help achieve Vision 2030 to make Kenya a middle industrialized country by 2030.
• Extension service to pay special attention to training especially on occupational health and safety (OHS) in order to increase productivity, ensure safe production of urban foods and environmental sustainability.

• There is need to train urban farmers on high density farming and emerging technologies, for instance stacked green houses, vertical farms (multi-storey gardens), mushroom farming and roof top farming to intensify production.

• Encourage use of recycled waste water for irrigation purposes- farmers should be trained in reuse and recycling of waste water to increase production.

• Proper disposal and recycling of agricultural wastes should be encouraged to ensure environmental sustainability.

• National Environmental Management Authority (NEMA) which is tasked with environmental management issues need to be strengthened.

• Further research needs to be conducted in the study area to establish the exact quantities of pathogens and metals in Rivers Riara and Kiuu and to ascertain if they are as per the WHO guidelines. It’s also important to come up with waste recycling and treatment technologies that are appropriate, effective, easily maintained and transferable to the local needs. The farmers need basic knowledge on the safe use of compost and adequate application methods.
6. REFERENCES


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International Livestock Research Institute (ILRI) and ODI (Overseas Development Institute), (2006). Process and Partnership for Pro-poor Policy Change Project.


Lock, K. and de Zeeuw, H., (2001). London School of Hygiene and Tropical Medicine, London ETC-RUAF, Leusden, the Netherlands.


7. APPENDICES

7.1: Interview Schedule

Questionnaire No ……………………
Sub-location ……………………… Estate ………………………

Section A: General Information
1. Gender  Male ( )  Female ( )

2. Education level: Illiterate ( ) Primary ( ) Secondary ( ) College ( ) University ( )

3. Occupation: Farmer ( ) Casual labourer ( ) Formal employment ( ) Business ( ) Others ( )

4. Who has access to the plot?  Male ( )  Female ( )

Section B: Agricultural Activities Carried Out

5. How long have you stayed in this area (Years)?
   0-5 ( )  5-10 ( )  10-15 ( )  Over 15 ( )

6. Where do you do your Farming Activities?
   On-farm ( )  Off-farm ( )

7. What is the size of the on-farm plot ………… (Acres)

8. What is the size of off-farm plot ………… (Acres)

9. If off-farm, where exactly do you farm
   Road reserve ( )  Railway reserve ( )  Public utility land ( )
   Privately owned land ( )  Rented farm ( )  Others Specify ( )

10. How did you access your land (own plot)?
   Inherited ( )  Bought ( ) Allocated from land buying company ( ) Rented ( )
   Others specify ( )

11. What crops do you grow/ livestock kept?
   1)  5)
   2)  6)
   3)  7)

13. Do you use any external input on the farm?  Yes ( )  No ( )

14. If yes, which ones?
Inputs | Tick | Source
--- | --- | ---
Seeds |  |  
Fertilizers |  |  
Chemicals |  |  
Animal manure |  |  
Compost wastes |  |  
Municipal council wastes |  |  
Irrigation water |  |  
Animal feeds |  |  

15. How do you house your livestock? Zero-grazed ( ) Semi-permanent structures ( ) Others ( )

Section C: Effects of UPA on Urban Livelihoods

16. How are you benefiting from Urban Agriculture?
   Food security ( ) Employment creation ( ) Income generation ( )
   Improvement of environment ( ) Others Specify ( )

17. How have you suffered by engaging in urban agriculture?
   1.  
   2.  
   3.  
   4.  
   5.  
   6.  

18. Has any member of your household been sick seriously for the last 1 year?
   Yes ( ) No ( )

19. If yes, what ailments? 1………….. 2 …………… 3…………….. 4………..

20. What are the challenges you face as an urban farmer?
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7.2: FGD

1. What are the challenges faced by urban farmers and what is the order of importance?

2. What are the effects of urban agricultural practices and what are the root causes of these challenges?

3. What is the production of the various crops/livestock products kept in the study area?

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108
7.3: Key Informant Interview

During the research study the following key issues will be tackled;

1. Ministry of Health

What are the common human diseases prevalent in the area?

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What are the factors affecting their occurrence?
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……………………………………………………………………………………………………..
Is there a relationship between some of these diseases and the production, Consumption of urban food products?  Yes ( )  No ( )

If yes, which ones?
1) …………….. 2) …………….. 3) …………….. 4) …………….. 5) ……………..

2. National Environment Management Authority (NEMA)

Being the main administrative organ established by EMCA ’99 to exercise general supervision and coordination over all matters relating to the environment, what is your organization doing to ensure that urban farmers and consumers of urban products are safeguarded against environmental pollution and unsafe food production from urban agricultural practice.
### 7.4 Required Size for Randomly Chosen Sample

Table for determining sample size

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N=Population size;  \( S = \) sample size