

**AN ASSESSMENT OF THE IMPORTANCE OF URBAN
CROP CULTIVATION IN MAKADARA SUB COUNTY,
NAIROBI CITY COUNTY, KENYA**

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DECLARATION

I declare that this research project is my original work and has not been presented for a degree in any other University

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This research project has been submitted for examination with our approval as the University supervisors

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DEDICATION

I would like to dedicate this project to my husband Morris Omollo and children Nicholas and Adrian who inspired me into the completion of this project and also to my family who supported me both financially and emotionally all through the study. And to the Food Planning and Innovation for Sustainable Metropolitan Regions (FOODMETRES) Project team – Prof. Samuel Owuor, Dr. Romborah Simiyu, Dr. Theresa Mbatia, Dr. Jacqueline Walubwa, and Grace Githiri.

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ABSTRACT

Urbanization is mostly associated with growth and development. However, it comes along with various challenges such as increased poverty levels, high unemployment rates, and food insecurity. As such, urban households have had to come up with different coping strategies to enable them to survive. One of the strategies adopted by the vast majority of urban low-income families is urban agriculture. The practice of urban agriculture has, over time, been used to improve livelihoods, and overall well-being of the people through assured food security, increased income and provision of employment opportunities. This study aims to assess urban crop cultivation practices using Makadara Sub County as a case study. It mainly focuses on (1) the nature and extent of crop cultivation;(2) the importance of carrying out crop cultivation; and (3) the innovative crop cultivation practices adopted by farmers. Field research comprised of structured interviews with the sampled farmers, key informant interviews, and direct field observation. Data was analysed using descriptive statistics. The study results are largely based on data generated from a sample of 35 crop cultivators in three administrative wards of Makadara Sub County, namely Viwandani, Makongeni, and Hamza. The study shows that crop cultivation activities are being carried out on a large scale or small scale and on any parcel of land available. Where land or other resources are limited, farmers have come up with innovative ways to carry out their farming. The practice has also improved household's access to food and increased their incomes through sale of produce and on savings from buying food. Those in the nearby areas are also able to buy food at subsidized costs from the farms and are assured of fresh produce. Crop cultivation also helps in preserving biodiversity and enhances the aesthetic value of urban areas. It is evident that participation in crop cultivation practices improves livelihoods of urban dwellers and thus should be given support through integrating the practice in national urban policies as well as enhancing urban farmers' capacity through relevant extension services. The key study recommendation is to promote the use of public private partnerships to enhance the use of innovative technologies in urban crop cultivation.

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CHAPTER 1: INTRODUCTION

1.1 Background

The turn of the 21st century has seen a massive movement of the world population turning into urban dwellers with more than half of seven billion humans now moving to city areas (WUF, 2012). The rate of urbanization is considerably higher in growing countries as compared to developed countries. Even as urbanization is regularly associated with growth and improvement, it comes with numerous challenges consisting of increased poverty and high unemployment costs. Coupled with insufficient town regulations, making plan mechanisms and allocation of assets, rapid urbanization can emerge as an excessive challenge to any region, potentially leading to political, monetary, and social unrest (UN-HABITAT, 2012). Towns and urban authorities are confronted with huge challenges of looking for ways to meet the wishes of the ever-growing populace, and for that reason establishments and individuals are faced with the task of starting sustainable city development, particularly in growing countries.

Agenda twenty-one (Rio Summit) reiterates the need to facilitate the availability of primary amenities to urban citizens such as meals, while Sustainable development goal 1 requires the eradication of poverty in all its bureaucracy anywhere within the world (UN-HABITAT, 2015). Kenya Vision 2030 also aims at achieving national food security where Citizens will have access to safe, sufficient and nutritious foods that meet their dietary needs. Due to rising poverty levels, the urban areas have advanced several coping techniques to raise food and profits. One of the coping methods adopted in cities is agriculture. Rural dwellers who migrate to the metropolis also frequently bring their agricultural routines with them, for livelihood and food security (Thys et al., 2005). The alternate introduced about with the aid of the movement of agriculture from rural areas to city environs, and the peri-urban phenomenon has brought about a massive shift in livelihood in city areas.

In the history of urbanization, agriculture in urban areas makes up the more substantial portion of the urban form and function. Thereby, urban agriculture can be exploited by

both the poor and urban farmers for commercial purposes and also play a significant role in ensuring the food security of poor urban families (WUF, 2012). Additionally, urban agriculture provides an avenue that enables the utilization of land in the city for more than one purpose. However, in Africa, some governments have policies that limit the ability to conduct farming activities in urban areas as farming is often associated with causing environmental ills in the cities. However, it is crucial to note that some governments have recognized the importance of urban agriculture especially to the low income families and have gone ahead to put in place policies that favour the practice in urban areas (Nugent, 2000).

1.2 Research Problem Statement

Crop cultivation in urban areas has faced a tremendous increase in the recent years due to challenges that have resulted from the economic crises that have been met in the recent times by most of the developing African nations (Mougeot, 2015). The need to have food security is often the driving factor for the poor; however, it is essential to note that for some, it is just a means of survival from day to day. Additionally, some of the less fortunate folk sell their produce to be able to purchase primary household equipment and material. Not only does urban farming aim at addressing issues of food production in cities, but it also aims at dealing with other necessities of the urban area dwellers such environmental protection and the need to have sustainable development. It is critical to note that both the high and low-income families that take part in urban farming aim at receiving financial rewards, this contributes to a significant portion of the income influx in the nation and thus contributes to economic growth (Foeken & Owuor, 2008).

Although the role of agriculture in urban areas in the reduction of poverty and food security in urban environs has received an increase in awareness and support, the practice is still largely unexplored and the government is yet to support the field through urban farming and planning policies. Lack of government support makes this area of agriculture exposed and further worsens the chances of achieving sustainability in the area despite its importance in improving livelihoods. Agriculture in urban areas leads to several significant contributions, and some of them are as follows; leads to economic development and the

alleviation of poverty in the realization of the universal right to access food, societal inclusion of poor urban women as well as the need to make the city greener and manage wastes in urban areas through re-use. As such, this study is an assessment of urban crop cultivation in Makadara Sub County, Nairobi City County, Kenya.

1.3 Research Questions

The study seeks to provide answers to the following questions:

1. What is the nature and extent of crop cultivation practiced in Makadara Sub County?
2. What is the importance of crop cultivation to the farmers in Makadara Sub County?
3. What are the innovative crop cultivation practices adopted by farmers in Makadara Sub County?

1.4 Research Objectives

The ultimate intention of this study is to assess the urban crop cultivation practices in Makadara Sub County of Nairobi City County in Kenya. The specific objectives that emanate from this broad objective are:

1. To determine the nature and extent of crop cultivation practiced in Makadara Sub County.
2. To identify the importance of crop cultivation to the farmers in Makadara Sub County.
3. To assess the innovative crop cultivation practices adopted by farmers in Makadara Sub County.

1.5 Justification of the Study

Urban crop cultivation plays a vital role in the urban environment as it is incorporated into both the urban ecological and economic systems. It includes connections such as the deployment of urban dwellers as workers; use of resources such as wastewater for irrigation and urban compost manure as fertilizer; straight regards to metropolitan consumers; direct effects on cosmopolitan ecology; forms a section of the food system in urban areas; and leads to the competition of land with other municipal needs. In Sub Saharan Africa crop cultivation in urban areas has been used as a means of improving the livelihoods of many urban residents and their general living conditions as it increases the ability for households

to have access to food during periods of uncertainty, shortages and instability. Additionally, it generates income as farmers then have to produce to use and sell any surplus and this also contributes to good health by providing highly nutritious and fresh foods, among many other multi-functional benefits (Bush, 2010; Zezza & Tasciotti, 2010).

1.6 Scope of the Study

The primary focus of the study was to discuss the crop cultivation practices that have been adopted by urban farmers in Makadara Sub County. This study is part of a more extensive research on “Food Planning and Innovation for Sustainable Metropolitan Regions (FOODMETRES). One of the components of the broader project is to evaluate the crop cultivation practices that have been adopted by urban farmers in Nairobi, using Makadara Sub County as a case study. The innovations that are indicated in this research are those that have been documented as innovations in other areas.

1.7 Operational Definitions and Concepts

Urban agriculture/farming	This is active crop cultivation and livestock rearing in areas inside urban areas. It’s the activity of cultivating, processing and distributing food in or around a village, town, or city.
Crop cultivation	It refers to the planting, tending, improving, or harvesting of crops or plants to promote their growth.
Innovative urban farming practices	Refers to a different way of carrying out agricultural practices and the management of natural resources by either creating or modifying the existing methods.
Sustainable urban farming	It is the satisfaction of basic desires by providing food using improved production and distribution systems, income, employment, environmental protection, and savings in transport
Land Use Planning	Refers to municipal zoning by-laws which can determine the prohibition, allowance, or promotion of municipal, agricultural zoning within defined modalities.

CHAPTER 2: LITERATURE REVIEW

2.1 Nature and Level of Sub-Saharan Africa Urban Agriculture

Agriculture in urban areas involves the following key areas; production, processing, and marketing of food and other products in peri-urban regions on land and water. Often this consists of the application of exhaustive methods of production that include the utilization of urban waste and other natural resources for livestock and the yielding of a wide range of crops (UNDP, 1996; Mougeot, 2000). According to Haddad *et al.* (1998), the locus of inequality has made a tremendous shift in urban areas, which has led to malnutrition and food insecurity in urban areas the same to rural areas. Agriculture in urban areas is majorly a reaction of the urban poor due to the following:

- Inequality in access to regular food supply as a result of the availability or the lack of purchasing power.
- Unequal distribution in employment and the availability of such chances as a result of the drop in the economies of the developing nations.

In Africa, agriculture inside the city areas entails growing of crops, which include vegetables, fruits, and grains. The cultivation is conducted in the areas which are enclosed, inclusive of in own family compounds, in gardens or vacant areas together with plots. (Onyango, 2010). Studies advocate that agriculture in urban areas can lead to extensive modifications within the area of food security, particularly in households that live below the dollar mark, moreover; it might contribute to the generation of steady income at the same time providing employment where there exist low employment levels (Lovell, 2010). There may be also evidence to suggest that some of the food products sold in city markets assist in satisfying the growing client call in the ever-developing towns of Africa, in addition to monetary independence to both the dealers and producers of the agricultural produce (Ellis & Sumberg, 1998; Lynch et al., 2001; Simatele & Binns, 2008).

In the Capital of Tanzania Dar es Salaam, agriculture in urban areas has had both a critical and historical impact on the food environments in general and to the livelihoods and eating habits due to food security and the making of urban areas greener and creation of employment. An example is between the year 1967 and 1991, the number of families that

moved to urban areas increased from 18 to 67%. Additionally, urban agriculture got credited for more than sixty percent of the employment created in the year 1997, and this made the sector runner up in the creation of new jobs in the nation. A study conducted in the year 2000 gave the result that urban farming provided income for more than four thousand individuals living in Dar es Salaam (IIED, 2013).

In Zimbabwe's capital of Harare, over twenty thousand framers in urban areas access sufficient food material in open areas in the city. The production of agriculture and in cities around Harare took a major expansion during the hard economic times as the poor depended solely on agriculture to feed their families. The administration of the city recognized the importance of agriculture in the city and went a step further to ensure that maize can get cultivated in the city by allocating pieces of land to urban dwellers by holding meetings with the stakeholders in the quest to come up with adequate policies that support the same (Kutiwa et al., 2010).

In a study that was conducted in the year 1996 in Kano city in Northern Nigeria, it was determined that the city was responsible for the growth of a large number of vegetables and fruits and that most of the people responsible for the growth were men. Both the wealthy and business individuals in Kano took the growth of vegetables and fruits as a viable business while those who would be said to be poor just grew the plants to consume at home and sell the remnants. A step was taken to locate the biggest area where agriculture was conducted within the city through the Federal Aviation Authority transmission masts, and this led to the area getting opened up by the start of the year 1980. However, the land was given out on the basis of the first individuals to request. (Binns & Lynch, 1998: Lynch et al., 2001)

In Kenya, there has been significant growth in agriculture in urban areas, and this has largely been attributed to the increased poverty levels and the rise in prices of food (Foeken, 2006). These conditions are as a result of the natural increase in the population and the increased rate in the rural-urban migration as the population is moving to urban environments in the quest to search for better living standards and get access to the best

amenities. In the late 1980s, the country experienced a recession in the economy, and it caused the economic growth of the nations to decline steeply. The recession led to the need to adjust some structural policies which had a major effect on the increase in the levels of poverty within the nation. The measures taken made the life of the general population expensive, and the condition is even worse for the poor in society. This resulted to the marginalization of the several vulnerable groups in urban locations such as the poor (KCO, 1992) and this was a big contributor to their turn to urban farming as a means of sustaining their livelihoods (Foeken, 2006)

In Kenya's capital Nairobi, urban farming has played a very critical part in the quest to improve the living standards of the less fortunate that live in urban locations. However, it should be noted that those who practice agriculture in urban areas deal with the production of different crops such as Kale or Sukuma Wiki, Irish potatoes, Maize, Bananas, among others. (Smith et al., 2005) The production that is yielded in Nairobi annually is immense as it gets estimated that the county produces more than fifty thousand bags of maize annually while producing an equally large amount of more than fifteen thousand bags of beans per year. In a research that was conducted in the year 1995 in the slum area of Korogocho in Nairobi, several farmers' annual incomes were compared to individuals, who did not participate in farming, and it was discovered that the people who participated in farming had more food security as compared to those who did not. Additionally, the findings were confirmed by the level of food intake in (100 Kcal/consumer unit/day) that originated from their production completely and the rate of children who had malnourishment and stunted growth. (Drechsel et al, 2003).

2.2 Importance of Urban Agriculture

Three different dimensions should determine the way urban agriculture is looked at according to Nugent (1999), and they include the following; the ecological aspect, social and the economic aspect of agriculture. The ecological angle enables the farmers to get maximum benefits while still making a sustainable addition to the city.

2.2.1 Contribution to Food Security

Agriculture in urban areas tends to have a significant contribution to economic activities as it enhances production of food consumed in cities around the world (Smit et al., 1996; Mougeot, 2005). Surveys from the early 1990s have suggested that urban farming has had steady growth; others have gone ahead to suggest that more than eighty million individuals across the globe practice urban farming (Mougeot, 2005). The planting of crops in metropolitan areas has received acknowledgment in recent times as a vital source of nutrients, minerals, and proteins that would not be available for the urban population otherwise. This, in turn, suggests that farming in urban areas can help in improving the health of the residents of these areas. A study that was conducted in Uganda's capital of Kampala suggested that there was a wide difference between the low earning and the high earning groups in cases where those with a low income practiced agriculture. Additionally, the difference between the rich and poor homes that did not practice agriculture was even wider (Maxwell, 1995).

2.2.2 Economic Benefits

Farming in urban areas holds an industrial appeal as it helps the farmers, particularly the underprivileged, to utilize their non-farm earnings for different needs instead of buying food, hence improving the wellbeing of the urban farming homes. According to RUAF (2007), underprivileged families in developing nations use fifty to seventy percent of their earning to acquire food, and therefore, the benefit of farming by the urban poor is appreciated. Farming also creates employment as labor will be required to work, and it will improve the livelihoods of many metropolitan dwellers. Other economic benefits include reduced transport costs in the search for farm produce as the products will be readily available nearby.

Other than the monetary gains that farming in urban areas can guarantee, the enterprise also facilitates the growth of other businesses that are related to the field of agriculture and farming within the urban location. Some of the businesses that can benefit from this include; marketing businesses, packaging, and the processing industry (Bakker et al., 2000). Delivery and production of input may consist of activities such as composting of

wastes in urban areas, collection of the same wastes, production of pesticides to protect the produce, transportation and the buying of chemical fertilizers to improve the yield among others. Additionally, the process of transformation of the agricultural produce into edible foodstuffs such as the conversion of yogurt from milk or the turning of potatoes into French fries through frying. It is critical to note that the process of conversion can be done at both an industrial and household level to sell to the local shops or markets.

The municipal administrations, together with other organizations in the sector, have a critical role to play to motivate the development of small-enterprises that are related to the area of farming in urban areas. The city of Quito in the nation of Ecuador supported urban farming through the provision of markets that would enable the farmers to sell their produce. Additionally, all the organic remains that are left behind after a market day are then collected by groups made up of majority women then refine the waste and use it as manure on their farms; this makes the situation a win-win for both parties (RUAF, 2010).

2.2.3 Social Benefits

In the early times, farming in urban areas was assumed to be a means of survival used mainly by individuals from the less earning groups and those who have moved from rural areas to the city to secure food and buy household items. However, it is critical to note that modern scholars have identified diverse groups of individuals who take part in urban agriculture today (Lovell, 2010). Some of the individuals include the middle-earning families who take part in urban farming as a way of supplementing their income. On the other hand, families that are considered as high-earners practice urban farming in the quest to ensure that the food they consume is obtained from an environmentally friendly source. The participation of women in the sector suggests that urban farming is a useful method of ending poverty where women among others are considered as the vulnerable individuals within the urban setting and the community in general (RUAF, 2007; UNDP, 1996).

In cities that are more developed the farming done in urban areas is majorly conducted due to the psychological and physical relaxation, it offers to those who practice it as compared to farming for the basis of food production (RUAF, 2007). Farms that are around urban

and semi-urban areas can also serve as recreational sports for those who live in urban areas as they can provide farms visiting opportunities for individuals who live in and around the city as they get an opportunity to meet the country-side within the city. Also, gardens and farms create a peaceful environment for recreation and would lead to an increase in the physical space of the city. Some additional benefits include; beautification, the creation of employment which would enable the residents to meet their daily needs while in turn, creating a source of local pride.

2.2.4 Environmental Benefits

Urban areas are part of a typical living system that has both living and non-living things. The process forms relationships that can get termed as complicated, and hence, the urban environment in a vital component of the biosphere (Barton, 2000). One of the critical problems in this system is that of hunger that is related to that of poverty. However, urban farming forms part of the solution that can be used to tackle this problem. In the ecological approach theory, urban locations should be seen as individual systems that function as part of a more extensive system. However, the ecosystem strives to be as unique as possible from the rural areas system in regards to the food supply.

The information is the same as the Brundtland view on the meaning of sustainable development since it revolves around the idea of enhancing and maintaining the human life quality in the social, economic and environmental aspects, this should be maintained under the capacity of the ecosystem base (United Nations, 1987). Urban farming can result in the betterment of the eco-system if it is managed and planned properly as part of the components of the existing ecosystem. Generally, farming in the urban areas is related closely to the following concept; nutrition, food security, the environment, and sustainability. Farming in urban locations is also closely intertwined with beautification, exercise, social interaction, and leisure. Table 2.1 illustrates the multifunctional activities offered by urban farming and justifies the reasons as to why the practice should be encouraged.

Table 2.1: Multifunctional Activities of Urban Agriculture

Function	Description and Justification
Production	Farming in urban areas results in the production of vegetables, fruits, milk, meat, and many other foodstuffs.
Economic revitalization	Farming in urban areas creates jobs for those living in urban areas and better their living conditions economically and as a community.
Energy conservation	Creation of local produce saves the population the energy that would have been wasted in the process of importing, packaging, and transportation of food from other areas.
Urban greening	Farms that are used for the production of agricultural material make a massive contribution to the making of the cities greener.
Human health	In addition to the apparent benefits of access to green space, urban agriculture offers healthy food and encourages physical activity.
Management of Waste	Organic wastes can be compressed and put to use as fertilizer for the improvement of soil fertility for food growth.
Biodiversity	The agricultural environments in urban areas are capable of a diverse collection of native plants, crops, and species.
Microclimate control	Conducting agricultural activities in urban areas can play a vital role in the modification of the environment to create a microclimate.
Community socialization	Urban households often see as farming a social activity through sharing of the produce, information, and labour.
Cultural heritage	Farming in urban areas can give access to the urban population to rare and traditional foods that are grown in the countryside.
Education	Agriculture provides children with an opportunity to learn about some of the agricultural related terminologies such as nutrition, food, the economics of agriculture, among others.

Source: Lovell (2010)

2.3 Constraints to Urban Agriculture

There exist vast opportunities to utilize farming in urban areas for the sustainable utilization of land, and many such opportunities have been used all over the globe. However, the rise of new enterprises comes with several underlying issues. Among the biggest issue that exists is the lack of land to be utilized for agriculture in urban areas, and the inability to have the security of tenure for the individuals who wish to practice agriculture in urban areas. The lack of tenure is mainly in regions where the agricultural practices compete with other land uses like developments as such uses would guarantee more returns to the owner of the land as compared to farming (Lovell, 2010). In the current urban setting, many farms have been established in areas that are not developed such as vacant plots, and the landowners tend to practice agriculture until they can put up structures that would guarantee more returns than farming.

In urban areas communities that are categorized as marginalized and the minority have more difficulty in accessing land and obtaining the required security, consequently, such individuals are the ones who have the greatest need to utilize the land for farming in urban areas and provide the labour required to conduct farming activities in urban areas. The inability of such individuals to gain access to public land in urban areas is another reason to offer more of the publicly-owned open space for farming (Johnson et al, 2009) additionally; it necessitates the need to incorporate farming in urban areas into the process of planning for infrastructure in cities (Lovell, 2010).

Water scarcity is another constraint for urban farming which is a globally significant and accelerating phenomenon which gets demonstrated in both urban and semi-urban locations where the need for water keeps increasing with the rise of the inhabitants and the betterment of living conditions (FAO, 2008). Farmers, therefore, have to be innovative in ensuring they access water through recycling, water harvesting, or using farming practices that require minimum volumes of water such as drip irrigation.

Theft of crops before they reach maturity and damage of plants is another significant issue facing urban farmers, especially in most African metropolitans. The fact that farming in

urban areas is practiced in common land with open spaces and questionable ownership makes it susceptible to theft. It is estimated that at least half of the urban farmers' experience theft daily (Eriksen-Hamel & Danso, 2010). Damage to crops is mostly caused by humans trespassing the farms and livestock that has been left to wander. Prevention of this requires fencing off the farms, which is often unaffordable to most urban farmers. Other limiting factors of urban farming include attacks by pest and diseases, inaccessibility of funds, lack of the needed skills and services, and lack of support from government authorities.

2.4 Innovations in Urban Agriculture

The process of creating something that did not exist is what gets defined as innovation, additionally, in agriculture, coming up with a new solution to the existing problems facing the society of the market still falls under the definition. However, it is critical to note that innovations can be technical, and can involve new items, improving products, or making an adoption to products and services. Additionally, innovations can be social, or have an organizational or institutional incitement, or can comprise the creation and improvement of practices and strategies for entrepreneurs in the field (RUAFA, 2015).

In the nation of Ethiopia, unique ways of practicing agriculture and the management of natural resources are termed as innovations. The innovations involve the modification of the existing ways of doing things or the creation of better methods. These allow for the addition of value to the normal practices without the need to disturb the broader environment. On the other hand, South Africa sees innovations as methods and ideas that are developed by individuals or groups of people without the influence and support of external factors. Therefore, in other words, innovations in South Africa should offer practical solutions to problems that exist in society (Wettasinha et al., 2006).

In a broader sense, individuals who practice farming in urban areas are constantly on the lookout to find better ways to make farming more efficient and productive. This is because of the conditions that exist in urban areas such as the lack of enough space for farming,

limited resources in urban areas, the population and thus the demand increase and the opportunities to utilize the waste for agricultural purposes (RUAFA, 2007).

2.4.1 Technical Innovations

The term technical innovations are used when referring to changes that are made to intensify the horticultural systems in urban areas for the maximum output in their small areas. This can be exemplified best through the use of different varieties of seeds to ensure high yielding capabilities, the employment of techniques that increase water harvesting, and the use of proper methods in the management of farm chemicals. Additionally, the improvement of fertility chemicals can intensify yields from the farms in small areas.

The two main intensification ways employed in the urban farming context include the following:

1. Maximized utilization of resources that exist in nature wherever they had antecedent not been employed for farming. An example is the utilization of waste material, for the supply of water and as a source of nutrients (Buechler et al., 2006), the utilization of composted wastes (Cofie & Pressman, 2006) or the use of abandoned or marginal lands, like previous manufactory or workshop areas, riverbanks or wetlands. Risk factors during this strategy are exposure to pathogens, parasites, and abandoned metals.
2. The intensive use of limited and vertical places: the use of this idea can be through the employment of farming in rooftops, cellars, and even balconies. Additionally, this can be through the usage of different techniques such as the planting of crops in hanging baskets, and the growing of plants on walls. Some methods that do not require the use of soil can be deployed as well to maximize on the available space (Marulanda & Izquierdo, 2003) and “Organopics” (Premat, 2005) and other methods that can be used in areas with limited space.

Furthermore, proper intensification in urban farming ought to take into account the following:

1. A way to reduce both the environmental risks and those associated with health by supporting methods that would combine both the user of pesticides that are organic and the move to organic farming ways as this would, in turn, enhance the ability of farmers to have safe managerial manners and enhance the use of organic wastes for farming.
2. Improving the fertility of the soils which tend to be more infertile as compared to those in rural areas because of the following reasons; competition, trash, and the overuse of the soils. The factors above make the production of large amounts of produce from urban farms almost impossible (Evans et al., 2000) this makes the incorporation of organic wastes in urban areas a necessity. Other materials that can be used to improve the soil fertility include; wastes that are organic, simplified organoponics, and hydroponics.
3. Increased availability of affordable planting material and seeds, that is of great purpose for farmers in urban areas (Scheidegger & Prain, 2000), this could be dealt with through advocating for native seed networks (Arce et al., 2004) and employment of local species that manufacture simply harvestable and storable seeds (Poubom, 1999).

2.4.2 Organizational Innovations

Innovation in farming in urban areas would face a significant increase once analysis and support groups come together with small and other enterprises that take part in the farming process in urban areas. The organizations should work on the way to ensure the promotion of methods that will ensure the support of their initiatives and ensure that their skills in entrepreneurship and the development of businesses are enhanced (Holmer, 2001). In metropolitan environments, agricultural innovations are hugely affected by the establishments, policies, and rules. These influencers are both more pervasive and invasive in metropolitan areas as compared to areas that are in the rural setting.

The informality of urban farming in most cities has a major effect on the innovations in the field as this means the lack of security in the land, and the inadequate technical and financial support that is needed from establishments. The process of innovating in urban

areas would have more chances in succeeding if both the institutional and national policies would have an integrated approach to urban farming.

2.5 Urban Agriculture Related Policies and Acts in Kenya

Notably, urban farming in Kenya has thrived amidst the legal uncertainty on roadsides, railway lines, below power lines, on rivers and nearly in each open public space in the national capital and its outskirts. However, there exists a spread of national legislation relevant to urban agriculture, which supports the practice to some level.

2.5.1 The Agriculture Act Cap 318

Section two of the Act defines agricultural land as that which is employed for agriculture and has not been planned to be used for functions apart from those of agriculture. However, this doesn't rule out the likelihood of urban agriculture inside a town's boundaries.

2.5.2 Land Control Act Cap 302

According to Section, two of the Act, a provision is created to permit for urban agriculture since it additionally defines agricultural land as any land in the Nairobi area or in any municipality, territorial division or municipality that's declared by the Minister, by a Gazette notice to be agricultural land under the Act.

2.5.3 The Public Health Act Cap 242

According to section one hundred and fifty-seven, subsection one of the Act, it empowers the Minister of Health to control or forbid cultivation or irrigation at intervals around townships. The article provides that wherever it's shown to the satisfaction of the Minister upon the recommendation of the Board that the growing of crops or irrigation of any land being at intervals within three miles of the town boundary is unhealthy and unsanitary, the Minister could, in consultation with the Minister for Agriculture, forbid the growing or irrigating of crops and this could lead to cancellation of any permit issued for diversion, obstruction or use of water upon such terms as could seem fair to him.

2.5.4 The Physical Planning Act Cap 286

Section twenty-nine of the Act states that each Local jurisdiction is empowered to:

1. Disallow or manage the employment and development of land within the interest of correct and orderly development.
2. Formulate bylaws to manage sectionalisation in respect of use and density of development.
3. Reserve and maintain all land planned for open areas, parks, urban forests, and belts by the approved physical development format.

2.5.5 Environmental Management and Coordination Act Cap 8 of 1999

The Act gives the District Environment committee power to take measures for the management of specific areas such as hilltops, hillsides, and the mountainous regions because they are likely to suffer from environmental degradation, soil erosion and occurrence of landslides. Section 46(2) states that every District Surroundings Committee shall take measures, through encouraging voluntary help activities in their individual area people, to plant trees or different vegetation in any space nominal underneath segment (1) that are inside the boundaries of its jurisdiction.

2.5.6 National Land Policy Sessional Paper 3 of 2009

According to Article 111 of this policy, coming up with Urban Agriculture and forestry has been thought of. This is often as a result of inadequate Urban Agriculture regulation and expedition. The subsequent principles are to be enforced to produce a framework for the correct finishing up of practice:

1. Promotion of multi-functional urban land use to incorporate various land uses in urban planning.
2. Putting in place an acceptable legal framework to facilitate and regulate Urban Agriculture and forestation.

2.5.7 Draft National Urban and Peri-Urban and Livestock (UPAL) Policy

The final aim of the policy (Gok, 2010) was to facilitate and maintain each the current and peri-urban practices involving animals in the quest to enhance food security, to form employment, increase incomes, and eradicate weak financial conditions by raising the living standards of urban dwellers. The set up was to focus majorly on the atmosphere, the

utilization of land, and public health. The policy provided outlines of interventions that would be placed in situ to eradicate the present problems within the field of urban farming to cause a development of the following. The policy provided directions for the rational development of agriculture in urban areas and insisted on the elemental nature of each the personal and public sector partnerships for growth within the sector.

2.6 Research gaps from the reviewed literature

Empirical studies carried out previously tend to focus mainly on the practice of urban farming as a means of enhancing food security and as a means of alleviating poverty in urban areas. However, this study looked at the broader benefits of crop cultivation aimed at improving the livelihoods of urban dwellers, and the innovative farming practices that have been adopted by urban farmers to increase their output given limited and scarce resources.

2.7 The Theoretical Framework

This study adopts the sustainable livelihood framework that indicates the need to have access to agricultural resources like land as a method of enhancing sustenance ways, which includes urban agriculture. However, institutional and structural factors that intervene in urban farmers' livelihoods tend to limit access to resources used for farming activities. Therefore, this conjointly indicates a necessity to include urban agriculture in policies to enhance the livelihoods of urban households. The framework is further supported by the ecosystem approach that advocates for the inclusion of urban agriculture into the urban system and as a result, if adequately planned and managed, the application may result with improvement of the ecosystem as well as the quality of the whole system.

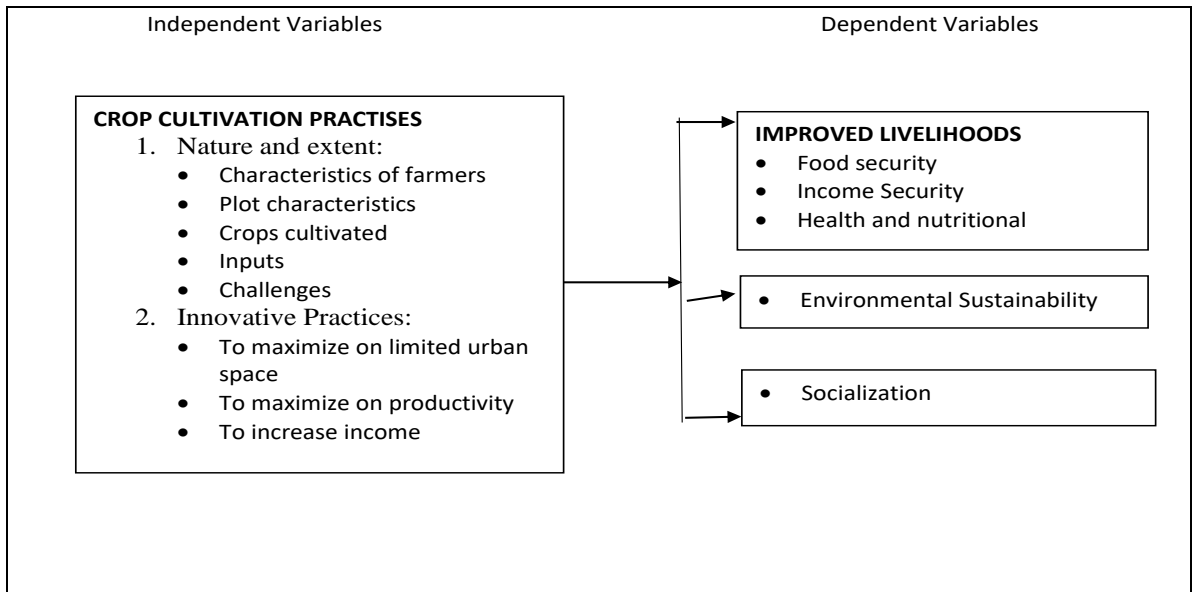
2.8 Conceptual Framework

It is a better-known undeniable fact that farming is being practiced in cities. As such, town directors and planners must take into consideration the very fact that agricultural production happens in urban locations instead of isolated, far-off rural areas. For this to be accomplished, it's crucial that effective and economic policies be designed to reinforce complementary forces between urban development and agriculture within the context of economic and financial wellbeing.

Urban farming involves crop cultivation and livestock keeping in urban areas. There are also those who do mixed farming i.e., combined crop cultivation and livestock keeping. This study was on urban crop cultivation only. The abstract model (Figure 2.1) argues that there's a desire for additional data on the character and extent of urban crop cultivation in terms of understanding the characteristics of crop cultivators, plot characteristics, crops cultivated, inputs for crop cultivation and lastly the challenges in crop cultivation.

However, due to lack of enough space and water in urban areas, urban crop cultivators have adopted innovative crop cultivation practices like innovations to maximize on restricted urban space; changes to maximize on productivity, and changes to extend financial gain. If practiced well, crop cultivation has many benefits like contributing to household's food and financial security; health and biological process values; environmental sustainability; and concrete socialization process.

Figure 2.1: The Conceptual Framework



Source: Researcher

CHAPTER 3: THE STUDY AREA

3.1 Location of the Study Area

The study area is located in Makadara Sub County of Nairobi City County in Kenya (Figure 3.1). Nairobi City County is located at the south-eastern end of Kenya's agricultural heartland, at approximately 1° 9'S, 1° 28'S and 36° 4'E, 37° 10'E. Nairobi City occupies an area of about 696 km² and the altitude varies between 1,600 and 1,850 meters above sea level (UNEP, 2007). Makadara Sub County covers an area of approximately 13 km² and has four central locations, namely Harambee, Maringo/ Hamza, Viwandani and Makongeni.

3.2 Physical Characteristics of the Study Area

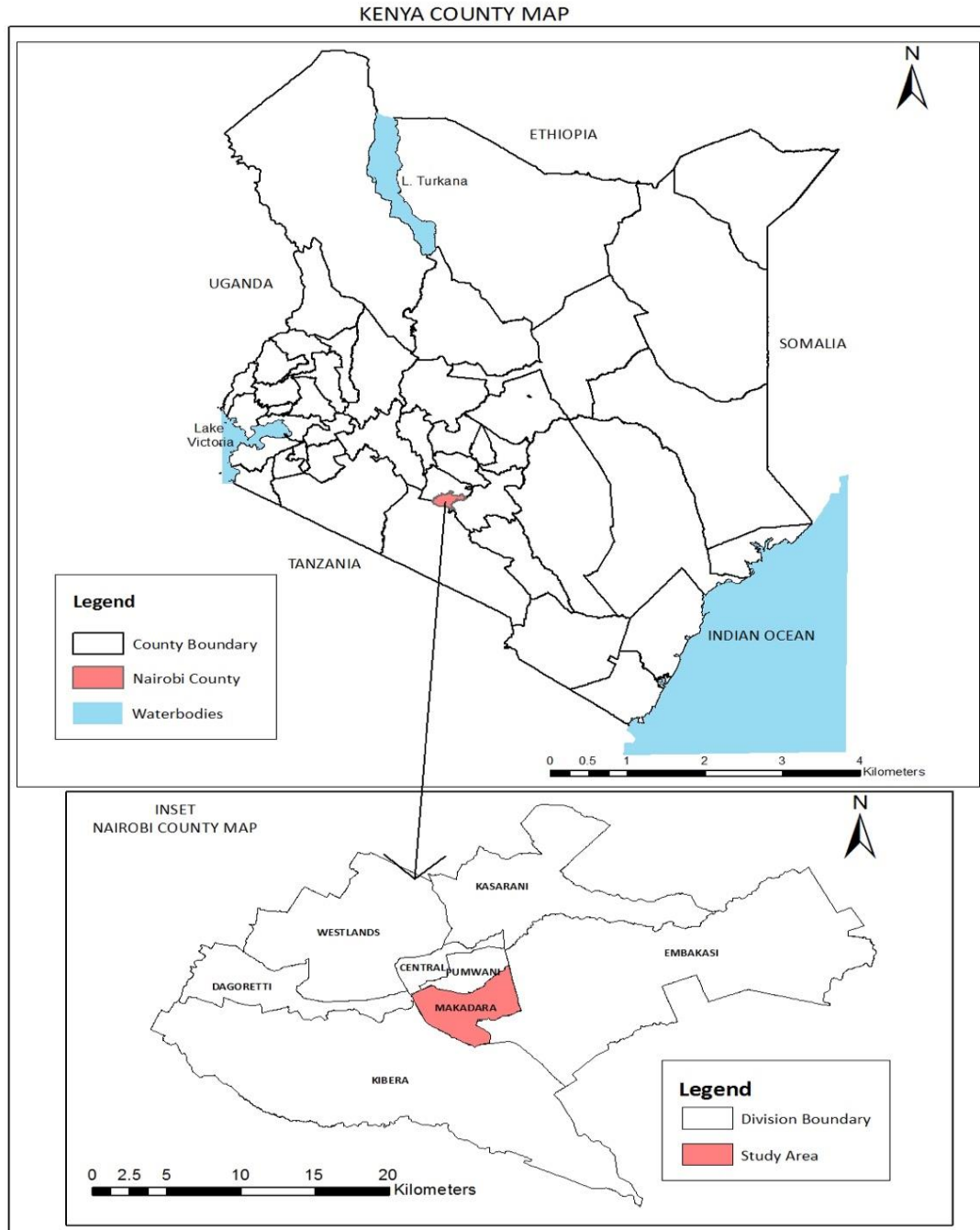
3.2.1 Topography

The western part of Nairobi City is on high ground, approximately 1700 to 1800 meters above the sea level with rugged topography. The eastern side of the city where Makadara lies is generally low, about 1600 meter above sea level (UNEP, 2007) and is relatively flat with gentle slopes. The high altitude creates an environment conducive for farming activities and encourages the growth of various crops.

3.2.2 Climate

The Sub County incorporates a temperate, tropical climate with two rainy seasons. The most significant rain is received between March and April and therefore the short season is between November and December. The mean annual rain ranges between 850 and 1050 metric linear unit (Kenya Meteorological Department, 2014). However, thanks to global climate change, rain seasons are varied and thus became unreliable to urban farmers. The mean daily temperature ranges between twelve and 26°C. It's sometimes dry and cold between July and August, however hot and dry in January and February. The mean daily sunshine hours differ between four and nine.5 hours (Kenya Meteorological Department, 2014).

Figure 3.1: Location of Makadara Sub County



Source: Adapted from Kenya GIS Data (2015)

3.2.3 Soils

The rocks within the Nairobi County principally comprise a succession of lavas and Pyroclastics of the Cainozoic age and overlying the foundation of Precambrian schists and

gneisses of the Mozambique belt (UNEP, 2007). The crystalline rocks are seldom exposed, however, sometimes fragments are found as agglomerates derived from ancient Ngong volcano. The soils of the Nairobi are the products of weathering of principally volcanic rocks. In general, Makadara Sub County has some areas with red soils, whereas others have black cotton soils.

3.2.4 Drainage

Nairobi City is generally served by several rivers, dams, and wetlands which are mainly part of the larger Nairobi River tributaries that traverse through various parts of the city. Ngong River, which measures approximately 8km, is the main river that crosses Makadara Sub County, and it may have several names at different locations. This river acts as a source of water for farmers to irrigate their crops, given the unreliable rainfall patterns that are experienced from time to time.

3.3 Socio-Economic Characteristics of the Study Area

3.3.1 Population

According to the 2009 National Population and Housing Census, Makadara Sub County has a total population of 160,434 people (Table 3.1).

Table 3.1: Population Distribution in Makadara Sub County

Location	Population	Area (in Sq. Km)	Sub Locations
Maringo/Hamza	52,293	2.90	Ofafa Maringo, Hamza and Bahati/ Kimathi
Viwandani	44,881	5.70	Viwandani
Harambee	32,238	2.60	Harambee and Lumumba-Jericho
Makongeni	31,022	1.80	Mbotela, Makongeni and Kaloleni

Source: Independent Electoral and Boundaries Commission (IEBC)

3.3.2 Economic Structure

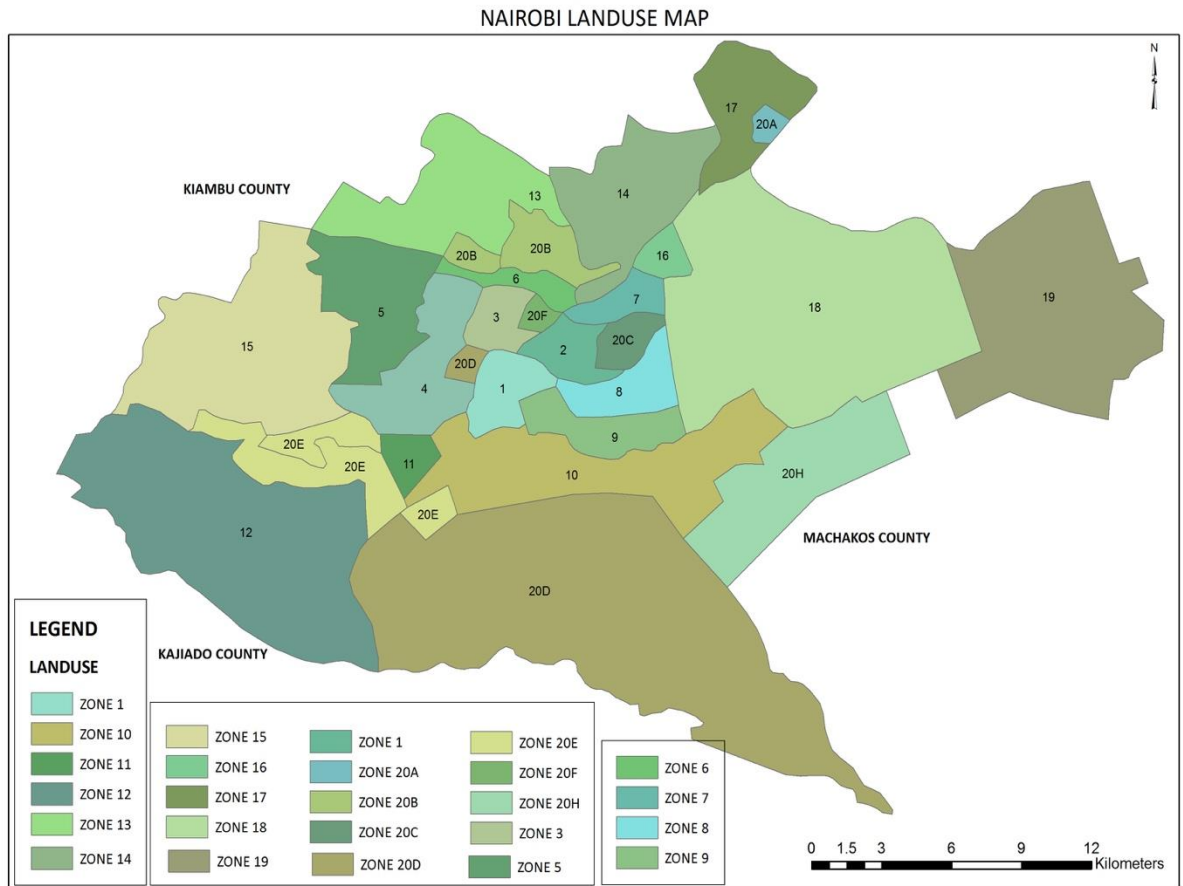
Makadara Sub County is both a residential and business region. Numerous informal sector (*Jua Kali*) sheds and factories are situated in the sub-county. A large number of small-scale

business enterprises thrive in the area. In the industrial area region, large industries and factories manufacturing an assortment of products are located.

3.3.3 Land Use

Makadara Sub County was mainly zoned for mixed residential land use, and the area largely constitutes old city council housing which have spacious backyards where farming activities can be carried out (Figures 3.2 and 3.3). However, in the areas that are more densely populated and have limited land space, urban farmers have come up with innovative farming practices to maximize the scarce amenities while improving their living conditions. Farmers in the sub-county are also seen to farm in public open spaces, along road and rail reserves and also along the river riparian.

Figure 3.2: Spatial Distribution of Land Use in Nairobi



Source: Adapted from Kenya GIS Data (2015), and see Appendix 1 for more details

Figure 3.3: Open Spaces in Makarada Sub County



Source: Google Earth

CHAPTER 4: RESEARCH METHODOLOGY

4.1 The study set up

This study is part of a larger project on “Food Planning and Innovation for Sustainable Metropolitan Regions (FOODMETRES). The main goals of the FOODMETRES project are to identify opportunities for food chain innovation and to assess the economic, social impacts and environmental of food chain systems, among others. One of the components of the broader project was to evaluate the crop cultivation practices that have been adopted by urban farmers in Nairobi, using Makadara Sub County as a case study. The study focused only on crop cultivators in the study area.

4.2 Target Population

The targeted community for the study included all the urban farmers in Makadara Sub County who were registered under the Agriculture, Livestock, and Fisheries Ministry in Makadara Sub County Office. The total number of registered urban farmers in Makadara Sub County at the time of the survey was 300.

4.3 Data needs and requirements

The following research questions guided the data needs set (see Table 4.2):

- What is the nature and extent of crop cultivation in Makadara Sub County?
- What is the importance of crop cultivation in Makadara Sub County?
- What are the innovative crop cultivation practices in Makadara Sub County?

Table 4.2: Data Needs

Nature and extent of crop cultivation	<ul style="list-style-type: none"> • Characteristics of crop cultivators • Plot characteristics • Crops cultivated • Inputs for crop cultivation • Challenges in crop cultivation
Importance of crop cultivation	<ul style="list-style-type: none"> • Contribution to household's food and income security • Health and nutritional value of own grown food • Crop cultivation and environmental sustainability • Crop cultivation and socialization
Innovative crop cultivation practices	<ul style="list-style-type: none"> • Innovations to maximize on limited urban space • Innovations to maximize on productivity • Innovations to increase income

4.4 Sampling Procedure

The study adopted a multi-stage sampling procedure to select 35 crop cultivators for the study (see Table 4.1). First, all the 300 registered urban farmers were classified into the central locations of Makadara Sub County, where they practice urban farming. This was for spatial coverage. These were Viwandani, Makongeni, and Hamza.

Table 4.1: Steps in Sampling Process

Location	No of urban farmers	No of crop cultivators	Sample size
Viwandani	150	130	18
Makongeni	100	80	11
Hamza	50	45	6
Total	300	255	35

Secondly, in each of the three locations, the urban farmers were categorized into those who practiced livestock keeping only, those who practiced crop cultivation only, and those who practiced mixed farming (livestock keeping and crop cultivation). This gave a total of 255 crop cultivators in Makadara Sub County (those practicing crop cultivation only plus the mixed farmers): 130 in Viwandani, 80 in Makongeni and 45 in Hamza.

Thirdly, the 35 crop cultivators included in this study were determined proportionately to the sub-population of crop cultivators in each location. This ended with 18 crop cultivators in Viwandani, 11 in Makongeni and 6 in Hamza. The sample size of 35 was derived using the Krejcie- Morgan formulae:

$$S = \frac{X^2 NP (1-P)}{d^2 (N-1) + X^2 P(1-P)}$$

Where: S=required sample size
 X=Z value (e.g. 1.96 for 95% confidence level)
 N=population size
 P= population proportion, expressed as decimal- 50%
 d= degree of accuracy (5%)

This gave a sample size of 32~35

4.5 Sources and Methods of Data Collection

The study utilized both secondary and primary information to achieve its goals. Necessary data was composed through interviews using a questionnaire, structured in-depth interviews, key informant interviews, and direct field observation. The questionnaire contained both open and closed polls (see Appendix 2). Open-ended questions were used to probe in-depth information, while closed-ended questions were used to encourage quick response, especially where pre-coded answers were expected. Further in-depth interviews were done on selected crop cultivators, while key informant interviews were mainly held with county officials. Direct field observations took place during on-farm visits and in-depth interviews. Digital photographs of the farms were taken to showcase the innovations used by farmers in crop cultivation.

Focus group discussions were also held with the urban farmers, in the Makadara Social Hall. Majority of the urban farmers in the Sub County attended the workshops as well as the Sub County Officials from the Department of Agriculture and Livestock. Issues discussed during the focus group discussion included the type of farming being carried out, innovative crop cultivation practices adopted, food safety issues and benefits of crop cultivation to the farmers.

4.6 Data Processing and analysis

The study relied on both quantitative and qualitative methods. Quantitative research took the form of descriptive statistics to demonstrate how crop cultivation in urban areas is improving the livelihoods of farmers in Makadara Sub County. Qualitative research focused on gathering of information from key informants and farmers especially on parameters that could not be measured in a quantitative manner such as reasons for engaging in crop cultivation and also on the innovations that have been adopted by farmers.

The data collected was checked for gaps, irregularities as well as any outliers and editing was done. It was thereafter coded, and placed into Statistical Package for Social Sciences (SPSS) software spreadsheet. Data was then analysed by generating frequency distributions and cross-tabulations.

CHAPTER 5: RESULTS AND DISCUSSION

5.1 Nature and Extent of Crop Cultivation in Makadara Sub County

5.1.1 Characteristics of the Crop Cultivators

Crop cultivators in Makadara Sub County are of different social and economic features. They vary in age, several years each has practiced farming, household size, education level, employment status, and the number of earnings made from the sale of farm products (Table 5.1). There were as many male crop cultivators as the females. The most active age group of the crop cultivators was between 29 and 50 years (60.6%). Those aged between 18 and 28 years are least involved in crop cultivation (3%). More than half of the respondents (63.6%) had practiced crop cultivation for a period of 1 to 5 years, while (24.3%) of the cultivators had been involved in the practice for 6 to 10 years. More than half of the cultivators (60.5%) had a household size of between 1 to 5 persons, while 27.3% had six to 10 persons.

The vast majority of the cultivators were literate. About one quarter (24.2%) had a primary school education, 24.2% had a secondary school education, 39.4% had post-secondary education, and 6.1% had studied up to the university level. Crop cultivation was practiced mainly by those in either full time or part-time employment. Less than half of the cultivators (42.4%) were employed or self-employed on a full-time basis, while 33.3% were in work or independent on a part-time base. This indicates that the farmers carried out the practices to diversify their income and also to meet their household food needs. Only 9.1% of the cultivators were unemployed. Lastly but not least, earnings from the sale of farm products were varied. Those earning between KShs 1,000 and KShs 5,000 were 15.2%, while those making between KShs 5,001 and KShs 10,000 were 21.2%. Cultivators making between KShs 10,001 and KShs 20,000 constitute 27.3%, while only 12.1% of the farmers received above KShs 20,000.

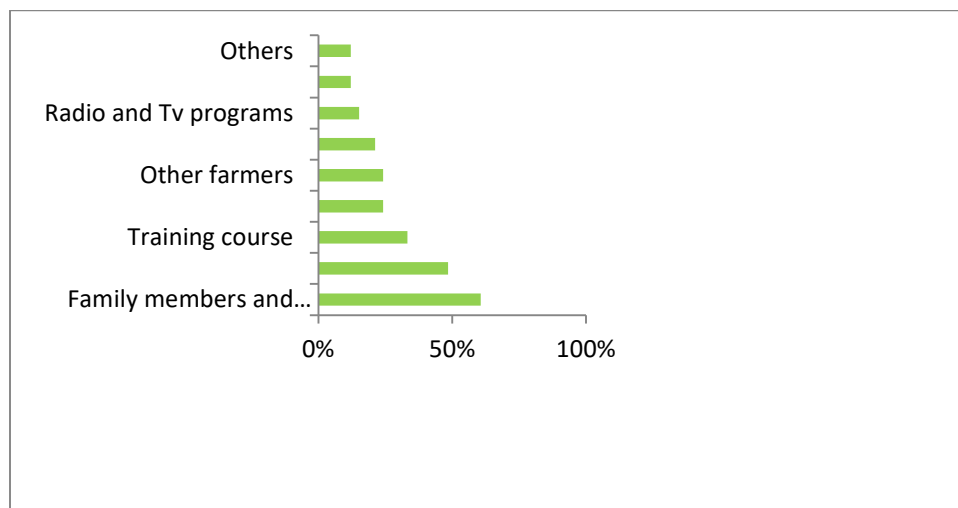
Table 5.1: Characteristics of the Sampled Crop Cultivators

	Characteristics	Frequency	Percentage
Gender of cultivators	Male	17	48
	Female	18	52
Age of cultivators (in years)	18-28	1	3.0
	29-39	10	30.3
	40-50	10	30.3
	51-60	7	21.2
	61-70	1	3.0
	70-80	2	6.1
	Above 80	2	6.1
Number of years practicing crop cultivation	1-5	21	63.6
	6-10	8	24.3
	11-15	0	0.0
	16-20	2	6.1
	Above 20	1	3.0
Household extent (figure of members)	1-5	20	60.5
	6-10	9	27.3
	11-15	1	3.0
Education level	Primary	8	24.2
	Secondary	8	24.2
	Post-secondary	13	39.4
	University (Bachelors)	2	6.1
Employment status	Self/employed a full time	14	42.4
	Self/employed part-time	11	33.3
	Unemployed	3	9.1
	Retired	4	12.1
	In education/training	1	3.0
Earnings from farm products (in KShs)	1000-5000	5	15.2
	5001-10000	7	21.2
	10001-15000	4	12.1
	15001-20000	5	15.2
	20001-25000	3	9.1
	Above 25000	1	3.0

Source: Field Survey (2015)

Also, the crop cultivators were asked how they acquired their crop cultivation skills. According to Figure 5.1, the top three most common sources for obtaining crop cultivation skills were mainly from family members and relatives (61%), personal observation (49%) and by pursuing a training course (33%). Other cultivators indicated to have acquired their skills through other farmers (24%) and through books and magazines (12%). The need of the farmers to acquire farming skills helps in improving their crop cultivation practices as they are able to keep up with new emerging trends in farming thus improving their productivity.

Figure 5.1: Sources of Crop Cultivation Skills



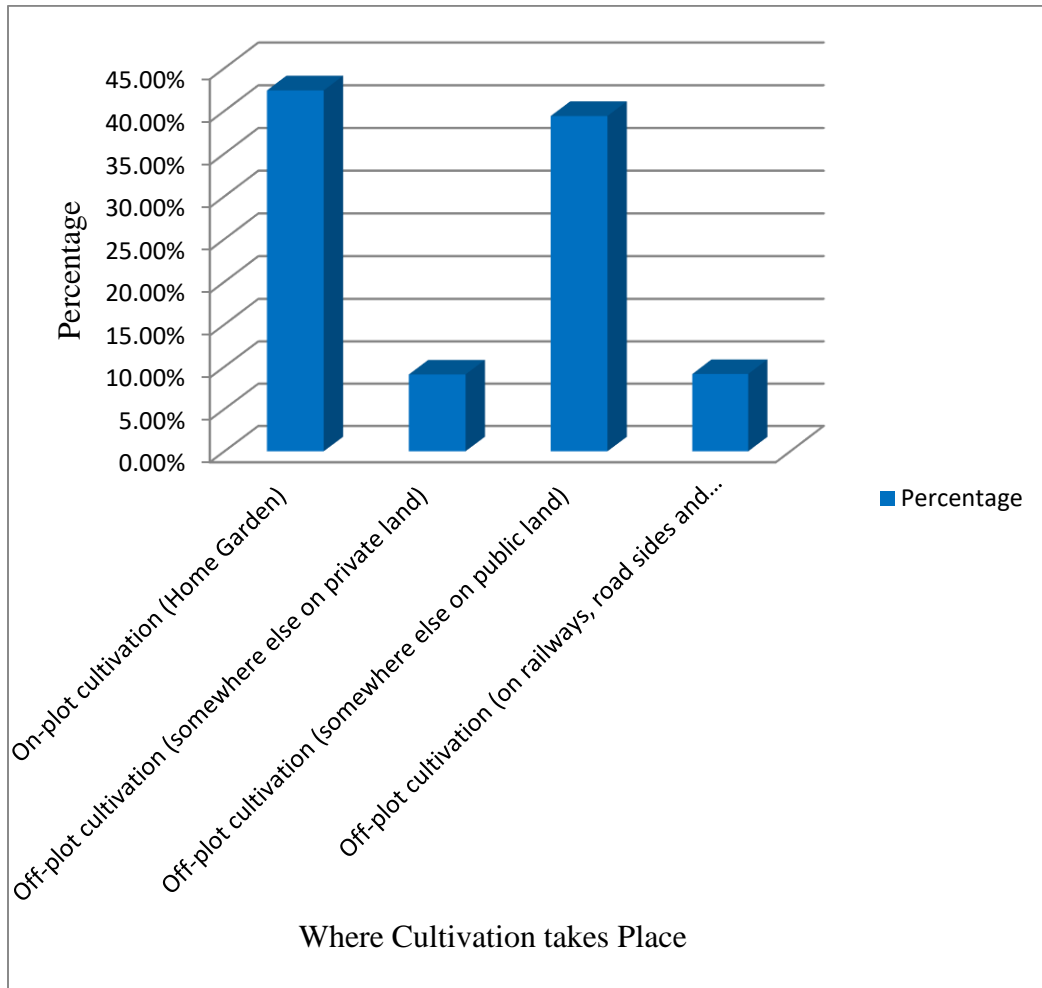
Source: Field Survey (2015)

5.1.2 Plot Characteristics

All crop cultivators in Makadara Sub County practiced either on-plot or off-plot cultivation (Figure 5.2). On-plot farming is preferred by some farmers (42.4%) because it is conveniently carried out at the front or the back of the dwelling units. The produce from on-plot cultivation is usually for household consumption, but the surplus is sold to nearby households. The other common type of gardening is off-plot crop cultivation on public land (39.4% of the cultivators). Those who cultivate on public land are members of organized women and youth group of farmers in Makadara Sub County. They usually approach the Nairobi City County to be permitted to cultivate the unutilized or vacant public land for a

given period – mainly for commercial purposes. A few farmers opt to practice crop cultivation on private property, i.e., in institutions (schools), while others do it on road reserves or reclaimed land along the Ngong River.

Figure 5.2: Type of Plot for Cultivation



Source: Field Survey (2015)

Whether on-plot or off-plot cultivation, more than half of the plots are located on public government land (64%), while others practice crop cultivation on own land (24%) and on the landlords’ area where they rent the dwelling units (12%). This is an indication that crop cultivation is done on any space that is available irrespective of whom the land belongs to. The plot sizes range from 0.028 acres to 6 acres. However, the majority of the plots are below 0.5 acres in area (Table 5.2).

Table 5.2: Plot Sizes

	Frequency	Percentage
0.028-0.134 acres	5	15.0
0.2-0.494 acres	8	24.2
0.5-0.988 acres	3	9.0
1-6 acres	3	9.0

Source: Field Survey (2015)

5.1.3 Crops Cultivated

There is a diverse variety of plants cultivated in Makadara. The common types of food crops grown are maize, beans, Irish potatoes, arrowroots, cassava, and cowpeas, while the vegetables include kale, spinach, cabbage, carrot, onions, pumpkin, tomatoes, *managu*, *kanzira* and *terere*. Commonly cultivated fruit crops are banana, avocado, strawberry, pawpaw, orange, and sugarcane. Cabbage, spinach, tomatoes, and kale are preferred because of their ready market, high demand, and shorter growth cycle. More than half of the crop cultivators harvested between 1-5 (90kgs) bags of maize, 1-5 (90kgs) bags of beans, 1-20 kgs of kale, 1-20 kgs of spinach, 1-20 kgs of *managu*, and 1-50 kgs of tomatoes (Table 5.3).

Table 5.3 Mean Harvest of Major Crops

Crop	Harvest	Frequency	Percentage
Maize	1-5 (90kgs bag)	24	72.7
Irish potatoes	1-5 (50 Kg bags)	14	42.4
Beans	1-5 (90kgs bag)	10	71.4
Kale	1-20kgs	18	54.5
Spinach	1-20kgs	18	54.5
<i>Managu</i>	1-20kgs	18	54.5
Tomatoes	1-50kgs	19	57.6

Source: Field Survey (2015)

The harvested crops are either consumed in the household, sold, or both. The proportion consumed differs from one house to another and is largely predisposed by the household's economic status. Even though most of the harvested crops are for consumption, some of the produce is sold locally with transactions mainly taking place on the farm. The proceeds received from the sale of the surplus produce has been used by the farmers to improve their livelihoods.

5.1.4 Inputs for Crop Cultivation

Most of the farmers (60.6%) indicated that they spent more than 10 hours per week for crop cultivation during the growing season. The rest spend between 4 to 6 hours per week (21.2%) or 1 to 3 hours (18.2%). The hiring of labour for crop cultivation is not frequent in Makadara. Only 30.3% of the cultivators hired workers, 39.4% carried out the crop cultivation activities by themselves, while another 30.3% depended on their family, relative or friend for help. The labor employed in the farms contributes in creating employment opportunities and also the farmers who do not hire labour are kept engaged thus preventing them from engaging in social vices. Half of the crop cultivators indicated that they purchase their seeds or seedlings (Table 5.4). The rest of the cultivators prefer to either grow their seeds (12.1%) or exchange seeds with other farmers (27.2%). The exchange of seeds amongst farmers encourages interaction amongst them hence promoting the social aspect of urban farming.

Table 5.4: Inputs for Crop Cultivation

	Frequency	Percentage
Sources of seeds/seedlings		
Save/grow my seeds	4	12.1
Buy seeds/seedlings	18	54.5
Exchange seeds/seedlings with others	9	27.2
All the above	2	6.1
Type of fertilizer used		
Home-made compost	9	27.3
Bought compost	1	3.0
Manure	18	54.5
Mineral fertilizers	3	9.1
All types	2	6.0
Frequency of watering crops		
Regularly	18	54.5
Only if necessary	14	42.4
Never	1	3.1
Source of water for irrigation		
Rainwater	5	15.6
Tap water at home	8	25.0
Kitchen waste water	11	34.4
Rainwater and tap water	8	25.0

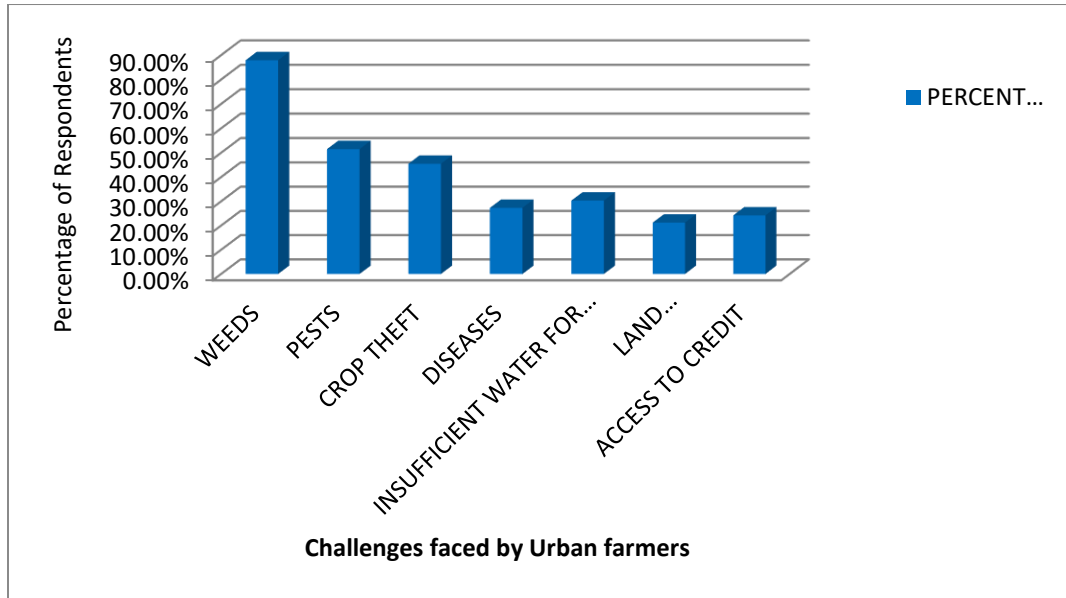
Source: Field Survey (2015)

Half of the cultivators (54.5%) indicated that they mainly use manure when cultivating their crops, 27.3% indicated that they use home-made compost, while 9.1% indicated that they use mineral fertilizer (Table 5.4). The use of home-made compost improves the local environment as waste is put into good use. Likewise, half of the cultivators reported that they water their crops regularly, while 42.4% watered their plants when they thought it was necessary (Table 5.4). Out of those who stated that they watered their plants, 43.8% noted that they took into account how well the plants were growing, 31.3% stated that they looked at how dry the spell was, while 15.6% stated that they took into account the amount of rain received. The primary source of water for irrigation is the use of kitchen waste water from the nearby estates, use of rainwater, and use of tap water. Recycling the kitchen waste water also helps in conserving the environment by ensuring scarce water resources are not wasted.

5.1.5 Challenges in Crop Cultivation

Crop cultivators in Makadara face a host of problems that to limit their potential in urban crop farming (Figure 5.3). Most of the cultivators (88%) complained about the infestation of weeds. This was followed by an attack of the crop by pests (52%) and theft of plants (46%). Theft of plants was a challenge since the land used by the farmers was mainly public land, and thus they could not take the necessary precautions such as fencing. This causes a loss to the farmers since the money they have invested in the farming may not be recouped from the produce left. Other problems cited by the farmers included lack of adequate water for irrigation (30%), various crop diseases (27%) and insecurity of tenure leading to land evictions (21%). Insecurity of tenure really hampers farming activities but most farmers have opted to risk and maximize use of the land before the rightful owner takes full ownership of the land.

Figure 5.3: Challenges in Crop Cultivation



Source: Field Survey (2015)

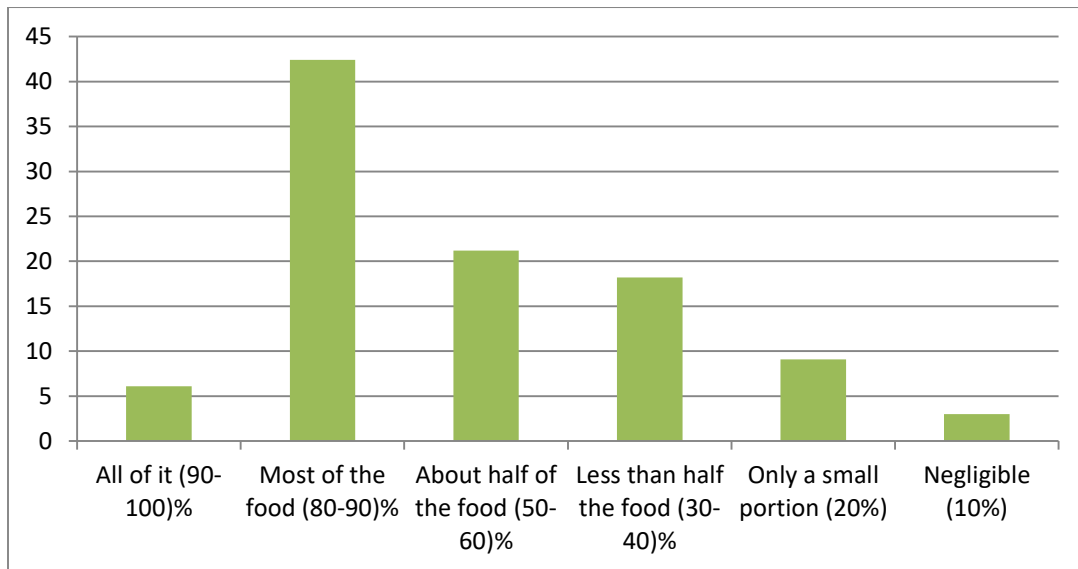
Despite the challenges, farmers in Makadara Sub County are unique in that they liaise very closely with the Department of Agriculture, Makadara Sub County Office, which registers the farmers in the Ministry’s records and also offers extension services to all the farmers in the area. Extension services are mainly in the form of group demonstrations, individual farm visits and demonstrations, field days, *barazas*, exhibitions, seminars, workshops and an information desk at the administrative Chiefs office. The Sub County office on request assists the farmers in getting temporary permits to farm in certain areas. The farmers also indicated that they received assistance in their farming practices from the following significant stakeholders that participate in farming in urban areas: Department of Agriculture; Department of Livestock; Kenya Forestry Service (KFS); Department of Cooperative Development; Provincial Administration; Financial Institutions; Youth and Women Groups.

5.2 Importance of Crop Cultivation in Makadara Sub County

5.2.1 Contribution to Household's Food and Income Security

Household food and income security is a significant priority for crop cultivators in Makadara Sub County, especially for low-income households. Figure 5.4 illustrates the estimated proportion of households' food needs that are covered by produce from their own crop cultivation.

Figure 5.4: Contribution of Produce to Household's Food Needs



Source: Field Survey (2015)

For 42.4% of the cultivators, the produce from crop cultivation meets “most” of their food needs. This was followed by 21.2% of the cultivators, who indicated that crop cultivation met “about half” of their food needs. Only 6.1% of the cultivators acknowledged that the produce met “all of” their food needs. This was attributed to the fact that the spaces the farmers have for cultivating are tiny and hence cannot farm a variety of crops for their household needs.

Besides producing for household consumption, the surplus is customarily sold and therefore earning the households some income. More than half of the cultivators (54.5%) indicated that they sell their surplus produce to generate some income. Furthermore, the money which would have been used to buy extra food is saved (fungible income) through producing their own food. Table 5.5 reveals that 69.7% of the cultivators admitted that

growing food to save money was fundamental to them. On the other hand, 48.5% agreed that growing food for income or do diversify income was very important for them.

Table 5.5: Reasons for Growing Own Food

		Frequency	Percentage
Grow food to save money (i.e.,to get own food)	Not very important	1	3.0
	Important	9	27.3
	Very important	23	69.7
Growing food to sell it (i.e.,for income or to diversify income)	Completely unimportant	1	3.0
	Not very important	4	12.1
	Neither important nor unimportant	1	3.0
	Important	11	33.3
	Very important	16	48.5

Source: Field Survey (2015)

The surplus produce is sold on a farm site or to neighbouring households, shops, and kiosks. Indirectly, urban crop cultivation has promoted employment along the food chain, with farming becoming a part-time or a full-time job for some. The youth have had an opportunity to be gainfully employed in an income generating activity, while women have been economically empowered. To increase their income, some crop cultivators prefer to grow traditional vegetables, which fetch higher prices and do value addition to their products.

5.2.2 Health and Nutritional Value of Own Grown Food

When asked about the importance of growing own food on health and nutrition, 73% of the cultivators noted that own grown food is “fundamental” than purchased feed in terms of safety (Table 5.6). On the other hand, 70% thought that self-grown food is “important” than purchased food in terms of healthiness – that is, their own grown food is healthier than purchased food. Also, more than half of the cultivators agreed that growing their own food is “important” as it is a vigorous exercise that also relaxes the mind. This helps in keeping the farmers in good shape both physically and mentally.

Table 5.6: Importance of Own Grown Food on Health and Nutrition

	Own grown food is healthier than purchased food	Own grown food is safer than purchased food	Growing own is a vigorous exercise	Growing own food relaxes the mind
Very important	18%	73%	30%	30%
Important	70%	15%	52%	55%
Neither very important nor unimportant	12%	12%	18%	9%
Not very important	0%	0%	0%	3%
Completely unimportant	0%	0%	0%	3%

Source: Field Survey (2015)

One of the farmers, Mr. Francis Wachira, explained that he rarely purchases his food crops since he considers the plants he grows to be safer and much tastier as well. He also acknowledged that growing a variety of plants enabled him to have a wide range to choose from, and this ensures that his household has a healthy and balanced diet, a clear indication of being food secure. Mr. Wachira was categorical that homegrown vegetables are tastier than vegetables sold in the store, and that organic or biodynamic farming is the only appropriate method of safe food production.

5.2.3 Crop Cultivation and Environmental Sustainability

About two-thirds of the cultivators (66.7%) acknowledged that growing their own food is “vital” in improving the local environment (Table 5.7). On the other hand, 57.6% admitted that growing their own food is “vital” in reducing environmental impact. According to some of the farmers, crop cultivation helps in enhancing the biodiversity of the area, thus improving the environment, especially on land that would have been otherwise left bare and subject to soil erosion. The farmers argue that those who grow their food tend not to use pesticides and herbicides, therefore contributing to environmental conservation. They also say that those who grow their food do not have to transport their food very far; thus, they contribute to the improvement of air quality.

Table 5.7: Crop Cultivation and Environmental Sustainability

	Growing own food helps to improve the local environment	Growing own food reduces environmental impact
Very important	66.70%	57.60%
Important	27.30%	33.30%
Neither important nor unimportant	3.00%	3.00%
Not very important	3.00%	3.00%
Completely unimportant	0%	3.00%

Source: Field Survey (2015)

5.2.4 Crop Cultivation and Socialization

Another interesting finding is that 87.9% of the cultivators noted that growing own food in the neighborhood provided an essential platform for socializing with people – other farmers, neighbors, researchers, government officials, and buyers. The farmers argue that while working in the garden, chatting and socializing, crop cultivators strengthen the incorporation of people in the society. They also say that through mutual exchange of seedlings or crop surpluses, home food growers create better interpersonal relationships.

5.3 Innovative Crop Cultivation Practices in Makadara Sub County

5.3.1 Innovations to Maximize on Limited Urban Space

These are innovations aimed at enhancing the use of limited and vertical spaces, especially in cases where availability of land proves to be a significant challenge. Some of the crop cultivators in Makadara Sub County have adopted the following innovative ways to maximize on the use of limited space in urban areas: (1) multi-storey gardens; (2) mobile gardens; (3) hanging gardens; and (4) table-top gardens.

Multi-storey gardening (Photo 5.1), using sacks or bags, is an innovative and exciting technology that ensures year-round vegetable farming, especially where land for agriculture is scarce, where there is water scarcity, or where soils are not suitable for conventional agriculture. As such, it uses minimal space and water and requires little technical and financial support. Multi-storey gardens expertise has been used successfully

to grow carrots, indigenous vegetable tubers, tomatoes, cabbages, and green leafy vegetables.

Photo 5.1: Multi-Storey Garden

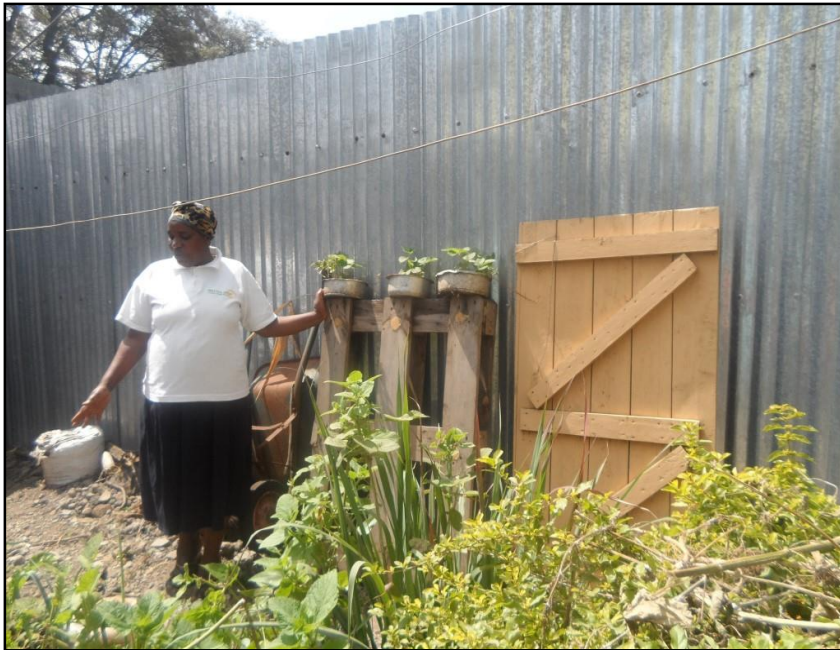


Source: Field Survey (2015)

Mobile gardens (Photo 5.2) is practiced in old tins, buckets and worn out vehicle tires. They are used for growing vegetables like kale, spinach, green (non-bulb forming) onions, black nightshade and crops that do not have tubers. The use of this innovation enables a farmer to save on time and energy as one does not have to till the land or even to have a garden to grow vegetables. All that is needed is a small spot to put the tire, tin, or bucket.

Hanging gardens (Photo 5.3) are those that dangle from a post, a rooftop, or any other structure that can support the plastic bottles or any other material used for that purpose. They are ideal for verandas, balconies as well as a kitchen or backyard gardens and can be used to grow various vegetables such as capsicum, pepper, coriander, leafy vegetables, and herbs. The concept is somehow similar to that of a multi-storey garden only that in this case, the garden is in a hanging position.

Photo 5.2: Mobile Garden



Source: Field Survey (2015)

Photo 5.3: Hanging Garden



Source: Field Survey (2015)

The crop cultivators have also adopted Table-top gardens (Photo 4.4) in Makadara Sub County. It is used to grow a variety of vegetables in one place. It is mostly preferred because it utilizes less space and is less costly to construct. It only requires a small space for a flat surface.

Photo 5.4: Table-Top Garden



Source: Field Survey (2015)

5.3.2 Innovations to Maximize on Productivity

These refer to changes aimed at increasing the productivity of crops given scarce resources such as land and water. Crop cultivators in Makadara Sub County have adopted the following innovative ways to enhance productivity all year through (1) greenhouse farming; (2) drip irrigation; (3) use of household wastewater for irrigation; (4) use of organic waste; (5) use of moist beds; and (6) agro-forestry.

Some farmers have adopted greenhouse farming (Photo 5.5) in Makadara as a way of growing crops all year round. However, greenhouse farming requires vast and secure land, as well as high initial and operational costs. It is mostly practiced in institutional grounds and by a group of farmers to grow tomatoes, kale, spinach, traditional vegetables, coriander, and carrots.

Photo 5.5: Greenhouse Farming



Source: Field Survey (2015)

Drip irrigation (Photo 5.6) is being encouraged by the Makadara Sub County Agriculture Office as a water conservation method and as a way of continuous supply of water to the crops. Although the initial cost of the tank and irrigation pipes is high, farmers who have adopted this method indicated that it has enabled them to grow plants throughout the year and that their incomes from the sale of crop production have increased. The drip kit uses minimal water as compared to sprinkler irrigation, thus enabling a farmer to save on the costs of water.

Use of household wastewater for irrigation (Photo 5.7) is mainly practiced in Mutindwa area of Makadara Sub County where farmers have come together and purchased a water pump for irrigating their farms using waste water from the nearby Buruburu middle-income residential estate. The Makadara Sub County Agriculture Office has also been offering training to the farmers on ways in which they can purify the water to avoid contamination of food if any. The farmers use sand filtration or planting of grass as a means of purifying the water.

Photo 5.6: Drip Irrigation



Source: Field Survey (2015)

Photo 5.7: Irrigation Using Household Waste Water



Source: Field Survey (2015)

Use of organic waste (Photo 5.8) enriches the soil and thus increases productivity. Kitchen waste, crop residue, garden trimmings, animal waste, and other organic matter, if adequately composted, are capable of giving the conditions critical to maintaining biological life cycles present in the farm. The form and the micro-biotic life of the soil get developed by compost, which leads to the creation of improved air circulation and water holding capacity. As the soil's wellbeing is improved, adequate plant wellbeing gets

maintained, so that farm produces get maximized. Some farmers are using this innovation for organic farming.

Photo 5.8: Use of Organic Wastes



Source: Field Survey (2015)

Use of moist beds (Photo 5.9) maintains an appropriate water level that would lead to sufficient plant growth. Wet beds work optimally with vegetables as their roots are relatively shallow. More farmers were noted to adopt this innovation, especially when growing arrowroots.

Photo 5.9: Use of Moist Beds



Source: Field Survey (2015)

Agroforestry (Photo 5.10) is practiced in one of the public lands along Outer Ring Road in Makadara. The farmer obtained a temporary permit from the County Government to carry out this type of farming in the area. He plants trees that are fast maturing and those that are nitrogen fixing. He also grows vegetables such as kale, spinach, traditional greens and beans. He noted that since he started agro-forestry, his crops have become healthier and have higher yields.

The farmer has launched a program where he donates tree seedlings to institutions such as schools and Government offices to encourage the practice of agroforestry, since such institutions tend to have large pieces of land.

Photo 5.10: Agroforestry



Source: Field Survey (2015)

5.3.3 Innovations to Increase Income

These are innovations aimed at increasing the income or profits generated by farmers. Crop cultivators in Makadara Sub County have seen the need to increase their revenue and have adopted the following innovative ways: (1) production of crops with high value; and (2) value addition.

Production of high-value crops (Photo 5.11) like mushrooms is being encouraged by the Makadara Sub County Agriculture Office. The demand for mushroom is very high in Nairobi city, and hence farmers have the potential to obtain high value for their products. According to one of the farmers, mushroom farming is very valuable, requires minimal space, and has fewer costs. Most of the farmers have either converted one of their house rooms to a dark room or have constructed a structure near their houses where they grow mushrooms. The orders for mushrooms are usually from big hotels and supermarkets.

Photo 5.11: Mushroom Farming



Source: Field Survey (2015)

Value addition especially at the processing level is also being encouraged by the Makadara Sub County Agriculture Office. Most of the value addition practiced in Makadara is carried out mostly by women groups and youth groups that have been formed by farmers. The common activities carried out include mushroom processing, fruit processing, vegetable drying, peanut butter processing, making of banana crisps, and processing of tomato jam and paste. Some of the groups in the sub county are PAVIMA Self-help group, Jitegemee Kenya Pamoja initiative amongst others. Photo 5.12 shows a showcase of peanut butter and processed mushroom.

Photo 5.12 Peanut butter and mushrooms



Photo credits: Jitegemee Kenya Pamoja initiative

CHAPTER 6: SUMMARY OF FINDINGS, CONCLUSION, AND RECOMMENDATIONS

6.1 Summary of Findings

Makadara Sub County has several farmers undertaking their crop cultivation activities in both small and large-scale on any piece of land that is obtainable and where the area is limited they would come up with innovative ways to carry out their farming activities. The two commonly used spaces were on-plot cultivation (home gardens) and off-plot cultivation (somewhere else on public land). Off-plot cultivation on public land, however, requires permission to be granted by the relevant authorities to undertake farming activities.

Crop cultivation has improved households' access to food through their own food production. Sufficient food production is a crucial element for food security, and this improves the livelihoods of those who are engaged in the practice and also those in the nearby areas as they can purchase food at a subsidized cost. The contribution of crop cultivation on households' income is such that cash income is earned from the sale of produce, as well as through consumption of food produced in the home which in turn saves income (fungible income). Crop cultivation also has environmental benefits as it can preserve biodiversity. It also tackles waste reduction and reduces the level of power needed to produce and redistribute food. Furthermore, it enhances the aesthetic value of an urban area as a result of having more green spaces.

Given the scarcity of land and water, urban farmers have adopted innovative ways, to practice farming in urban areas. Sustainable use of abiotic resources is significant in urban farming, given the scarcity of land and water. The innovative practices are primarily to maximize the use of limited space in urban areas (multi-storey gardens, mobile gardens, hanging gardens, table-top gardens); to enhance productivity (greenhouse farming, drip irrigation, use of household wastewater for irrigation, purpose of organic waste, use of moist beds, agro-forestry); and to increase income (production of high value crops, value addition).

6.2 Conclusion

Urban farming has been on the increase in the recent past. Even despite the scarce resources such as land, farmers have come up with innovative ways to use the available resources. Urban farming is not only perceived to be beneficial to farming households but also to non-farming homes who benefit from crops being produced in their locality. The non-farmers benefit because of the reduced cost of production which is derived from food being grown within the locality thus decreasing transportation costs. Furthermore, urban farming has a multiplier effect in nearby rural areas. This is the case primarily through value addition of commodities as well as through generating revenues from the sale of produce or employment opportunities that have been created, which thus enhance the purchasing power of those in the rural areas and the country at large.

6.3 Recommendations

Policy recommendations

1. Promote the use of public-private partnerships to enhance the use of innovation technologies in urban crop cultivation.
2. Enhance the capacity of urban farmers through extension services, more training, and encouraging sustainable agricultural practices in urban areas.
3. Integrate urban farming in the national urban policy and establish clear legal and institutional frameworks to regulate the sector and also to address various uncertainties that may arise.
4. Harmonize all the relevant regulatory frameworks, including the Constitution, policy documents, and Acts of Parliament to avoid conflict.
5. Designate specific areas in which urban farming can be practiced, for example, land banks in urban areas that are currently not under use. This will benefit both the consumer and the farmer as the consumer would get guaranteed of a safe product.

Temporary occupancy permits can be issued to willing urban farmers to enable them to carry out their farming activities in private and public open spaces.

Recommendations for Future Research

1. There is a need to study ways of improving the quality of food crops in urban areas. This is because more often than not, food crops are subjected to pollution. Crops cultivated on polluted sites or irrigated with untreated sewage water or polluted with exhaust fumes are thought to be unhealthy.
2. Need to explore further the economic impacts of value addition on urban farmers, local economy, and the national economy.

REFERENCES

- Bakker, N., Dubbeling, M., Guendel, S., Sabel Koschella, U. & de Zeeuw, H., (ed.) (2000). *Growing Cities, Growing food, urban agriculture on the policy agenda*, DSE, Feldafing.
- Barton, H. (ed.) (2000). *Sustainable Communities: The Potential for Eco-Neighborhoods*. London: Earthscan Publications.
- Binns, T. & Lynch, K. (1998). Feeding Africa's Growing Cities into the 21st Century: *The Potential of Urban Agriculture*. *Journal of International Development*, 10: 777-793
- Bradley, K., & Galt, R.E., (2013). *Practicing food justice at Dig Deep Farms & Produce*, East Bay Area, California: self-determination as a guiding value and intersections with foodie logics. *Local Environment*, 1–15.
- Bryld, E., (2003). Potential, Problems, and Policy Implications for Urban Agriculture in Developing Countries. *Agriculture and Human Values*. 20:79-86
- Buechler, S. & Devi, G. (2006). Adaptations of wastewater-irrigated farming systems: a case study of Hyderabad, India. In van Veenhuizen, R. *Cities farming for the future: urban agriculture for green and productive cities*. RUAF Foundation/IDRC/IIRR, Leusden.
- Bush, R., (2010). *Food Riots: Poverty, Power, and Protests*. *Journal of Agrarian Change* 10 (1) 119-129
- Cissé, O., N.F.D. Gueye & M. Sy (2005). Institutional and legal aspects of urban agriculture in French-speaking West Africa: from marginalization to legitimization, *Environment, and Urbanization*.
- Cofie, O., Adam-Bradford, A. & Drechsel, P. (2006). Recycling of urban organic waste for urban agriculture. In R. van Veenhuizen. *Cities Farming for the Future: Urban Agriculture for Green and Productive Cities*, RUAF Foundation/IDRC/IIRR, Leusden.
- Deelstra, T., Girardet, H. (2000). Urban agriculture and sustainable cities. In *Growing Cities, Growing Food: Urban Agriculture on the Policy Agenda*; Bakker, N., Dubbeling, M., Gundel, S., Sabel-Koschella, U., de Zeeuw, H., Eds.; Deutsche Stiftung für Internationale Entwicklung (DSE): Feldafing, Germany.

- Ellis, F., (2000). *Mixing It: Rural Livelihoods and Diversity in Developing Countries*. Oxford University Press, Oxford.
- Ellis, F. & Sumberg, J. (1998). *Food Production, Urban Areas, and Policy Response*. *Food Policy* 26 (2) 213-225.
- Eriksen, H. & Danso (2010). *Agronomic Considerations for Urban Agriculture in Southern Cities*. *Journal of Agricultural Sustainability* 8 (1-2) 86-93.
- Foeken, D.W.J.&Owuor, S.O. (2008). Farming as a livelihood source for the urban poor of Nakuru, Kenya. *Geoforum*,2008, 39, 1978–1990.
- Foeken, D (ed.) (2006). *To subsidize my income: urban farming in an East-African town*, Africa Studies Centre, no. 7, The Netherlands.
- Food and Agricultural Organisation of the United Nations (FAO) (2008). *FAO's Initiative on Soaring Food Prices Guide for Immediate Country Level Action*. Rome: FAO.
- Government of Kenya (2009). *Sessional paper No. 3 of 2009 on National Land Policy*, Nairobi: Government Printer.
- Government of Kenya (1999). *Environmental Management and Coordination Act, CAP 387*, Nairobi: Government Printer.
- Government of Kenya (1996). *Physical Planning Act, CAP 286*, Nairobi: Government Printer.
- Government of Kenya (2010). *Draft Urban and Peri-Urban Agriculture and Livestock Policy*, Nairobi Kenya.
- Government of Kenya (2007). *Kenya Vision 2030*, Nairobi Kenya: Government Printer.
- Haddad, L., M. Ruel & J. Garrett (1998). *Growing urban poverty and undernutrition and some urban facts of life*. International Food Policy Research Institute, Washington.
- Halloran, A. & Majid, J. (2013). *Planning the unplanned: Incorporating agriculture as an urban land use into the Dar es Salaam master plan and beyond*. International Institute for Environment and Development – IIED.
- Johnson, J.M., Hou, J. &Lawson, L.J. (2009). *Greening Cities, Growing Communities: Learning from Seattle's Urban Community Gardens*; University of Washington Press: Seattle, WA, USA, 2009.
- KCO, (1992). *Basic Needs Survey of the Urban Poor: Baseline survey of Nairobi City*, Nairobi. Kenya Consumer Organisation.

- Kinuthia, B.N., (2008). *To investigate the effect of urban agriculture in reducing poverty in urban areas*; a case study of Waithaka Location, Dagoretti Division, Nairobi; Unpublished Project, School of the Built Environment, University of Nairobi.
- KMD, (2014). *Data on climate patterns over the last 20 years*. Kenya Meteorological Department, Nairobi.
- Koigi, B.,(2015). *Value addition births millionaire farmers in Kenya*
- Kutiwa, S., Bonn, E. & Devuyt, D. (2010). *Urban Agriculture in Low Income Households of Harare: An adaptive response to the economic crisis*. Research Project. Human Ecology Department, Interuniversity Council of Belgium.
- Lovell, S.T, (2010). *Multifunctional urban agriculture for sustainable land use planning in the United States*. Sustainability Journal, 2010 (2) 2499-2522.
- Lynch, K., Binns, T. & Olofin, E. (2001). *Urban Agriculture under threat: The land security question in Kano, Nigeria*. Elsevier, Vol.18 No.3 pp 159-171. Elsevier Science Ltd. G. Britain.
- Maxwell, D., Levin, C. & Csete, J. (1998). *Does urban agriculture help prevent malnutrition? Evidence from Kampala*. Food Policy 23 (5) 411-424.
- Maxwell, D.,(2000). *The Importance of Urban Agriculture to Food Security and Nutrition*. Nairobi: CARE-East Africa Regional Management Unit.
- Maxwell, D., (1995). *Alternative Food Security Strategy: A Household Analysis of Urban Agriculture in Kampala*, World Development.
- Mbiba, B.,(1994). *Institutional responses to uncontrolled urban cultivation in Harare: prohibitive or accommodative?* Environment and Urbanization.
- Mougeot, L.J.A, (2000). Urban Agriculture: Definition, Presence, Potential, and Risks. In: Bakker et al. (Eds.): *Growing Cities, Growing Food: Urban Agriculture on the Policy Agenda. A Reader on Urban Agriculture*. Germany.
- Mougeot, L.J.A., (2005). Urban Agriculture and the Millennium Development Goals. In: JA Mougeot (Ed.): *Agropolis: The Social, Political, and Environmental Dimensions of Urban Agriculture*. Ottawa: IDRC.
- Mougeot, L.J., (2006). *Growing Better Cities: Urban Agriculture for Sustainable Development*; International Development Research Centre: Ottawa, ON, Canada.

- Nugent, R., (2000). *Urban and Peri-Urban Agriculture, Household Food Security, and Nutrition*. London: Heinemann.
- Nugent, R. (1999), “*Is Urban Agriculture Sustainable in Hartford, CT?*” in *Contested Countryside: The North American Rural-Urban Fringe*, eds. O. Furuseth and M. Lapping, 207-230. Avebury, UK: Ashgate Publishing Ltd.
- Ober, Allen, J., Alaimo, K., Elam, D., & Perry, E. (2008). Growing Vegetables and Values: *Benefits of Neighborhood-Based Community Gardens for Youth Development and Nutrition*. *Journal of Hunger & Environmental Nutrition*, 3(4), 418–439.
- Onyango, C.L, (2010). *Urban and Peri-urban Agriculture as a poverty alleviation strategy among low-income households: The case of Orange Farm, South Johannesburg*. MA Research Project. Department of Development Studies, University of South Africa.
- Premat, A., (2005). *Moving between the plant and the ground: Shifting perspectives on Urban Agriculture in Havana, Cuba*. In J.A. Mougeot (ed) 2005. *AGROPOLIS: The social, political, and environmental dimensions of urban agriculture*. London Earthscan Publications.
- Ridderstolpe, P., (2004). *Introduction to Greywater Management*, Ecosanre. Publication Series 2004. Stockholm Environment Institute; Stockholm, Sweden.
- RUAF, (2014). *Urban Agriculture as a climate change and disaster risk reduction strategy*; RUAF Foundation: Leusden, The Netherlands, 2014.
- RUAF, (2013). *Land Use Planning*; RUAF Foundation: Leusden, The Netherlands, 2006.
- RUAF, (2007). *Why is Urban Agriculture important?*
- Simatele, D. & Binns, T. (2008). ‘*Motivation and Marginalisation in African Urban Agriculture: The Case of Lusaka, Zambia*,’ *Urban Forum*, 19: 1-21.
- Smit, J., (2002). Community-based urban agriculture as history and future. In *Proceedings of the Symposium on Urban Agriculture: Emerging Opportunities in Science, Education, and Policy*, Dallas, TX, USA, 19–22 May 2002.
- Smit, J., Ratta, A. & Nasr, J. (1996). *Urban Agriculture: Food, Jobs and Sustainable Cities*, United Nations Development Programme: New York.
- Smith, O.B., (2002). *Overview of urban agriculture in West African cities*, Ottawa, IDRC.

- Smith, R.M., Gaston, K.J., Warren, P.H., Thompson, K. (2005). Urban domestic gardens (V): *Relationships between lands cover composition, housing, and landscape*. Landscape Ecology.
- Tevera, D.S., (1999). *Urban agriculture in Africa: a comparative analysis of findings from Zimbabwe, Kenya, and Zambia*. African Urban Quarterly.
- Thys, E., Ouedraogo, M., Speybroeck, N., & Geerts, S. (2005). Socio-economic determinants of urban household livestock keeping in semi-arid Western Africa. *Journal of Arid Environments*, 63 (2), 475-496.
- UNEP (2007). *City of Nairobi Environment Outlook*. United Nations Environment Programme UNEP, Nairobi.
- UNDP, (1996). *Urban Agriculture, Food, Jobs, and Sustainable Cities*. United Nations Development Programme. Publication Series for Habitat II Vol. 1. UNDP New York.
- UN-HABITAT, (2015). *UN-Habitat Global Activities Report 2015: Increasing synergy for greater National Ownership*; United Nations Human Settlement Programme, Nairobi.
- UN-HABITAT (2012). *Annual Report, 2012*: United Nations Human Settlement Programme, Nairobi.
- UN-HABITAT, (2006). *State of the World's Cities Report 2006/2007*, Earthscan: London
- UN-HABITAT, (2006). *The State of the World's Cities: Urbanization: A Turning Point in History*. Nairobi: United Nations Centre for Human Settlements.
- United Nations, (1987). *Our Common Future: Report of the World Commission on Environment and Development*, Oslo.
- Webb, N., (2011). *When is enough, enough? Advocacy, evidence, and criticism in the field of urban agriculture in South Africa*, Development Southern Africa.
- Wettasinha, C., Critchley, W. & Waters-Bayer, A. (2006). *Promoting local innovation in rural agriculture – experience and lessons for urban settings*. Urban Agriculture Magazine19.
- World Bank, (2008). *The little data book on Africa, 2007*, Washington, World Bank.
- World Urban Forum, (2012). *The Urban Future: An East African Perspective*. East African Regional Urban Forum Secretariat.

Zeza, A. & Tasciotti, L. (2010). *Urban Agriculture, Poverty, and Food Security: Empirical evidence from a sample of developing countries*. *Journal of Food Policy* 35 (2010) 265-273.

APPENDIX 1: LANDUSE ZONES IN NAIROBI

ZONE	AREAS COVERED	GC %	PR %	Dept Ref. Map	TYPE (S) OF DEVELOPMENT ALLOWED	MIN AREA (Ha.)	REMARKS/POLICY ISSUES
1A	Central Business District (CBD)			CP/FP/XXX	Commercial/Residential/Light Industry	0.05	
	• Core CBD	80	600				
	• Peri- CBD	80	500				
	• West of Tom Mboya St.	60	600				
	• East of Tom Mboya St.	80	350				
	• Uhuru H/W/University Way/Kipande Rd.	80	500				
1E	Upper Hill Area			CP/FP/XXX	Commercial/Offices/Residential	0.05	
	• Block 1 – Offices (Community)	60	300				
	• Block 2 – Comm/Off	60	250				
	• Block 3 - Offices	60	300				
	• Block 4 – Residential	35	150				
	• Block 5 – Institutional (KNH)						
	• Block 6 – (Mixed: Inst; Htls; Offs)	60	200				
2	Eastleigh			CP/FP/XXX	Commercial/Residential (High-rise Flats)	0.05	
	• Eastleigh District Centre	80	250				
	• Eastleigh Comm/Residential	60	240				
	Pumwani/California	60	240	CP/FP/XXX	Commercial/Residential (High-rise Flats)	0.05	
	Ziwani/Starehe						
	• Commercial	80	150				
	• Residential	35	75				
3	Parklands			CP/FP/XXX	Commercial/Residential (High-rise Flats)	0.05	
	• Commercial	50	100				
	• Residential	35	75				
	City Park Estate/Upper Parklands	35	75	CP/FP/XXX	Commercial/Offices/Residential (High-rise Flats) – Four Storeys Max.	0.05	
	Westlands						
	• Westlands CBD	80	240				
	• Westlands/Museum Hill						
	• Block 1 Commercial	80	200				
	• Block 2&3 Offices & Highrise Residential	35	80				
	• Block 4 Offices	80	200				
• Block 5 Commercial/Residential Hotel							
4	Spring Valley	35(s)	75(s)	CP/FP/XXX	Residential (Apartments allowed on sewer only) – Four Storeys Max.	0.05	• Policy Under Review
	Riverside Drive						
	Kileleshwa						
	Thompson						
	Woodley						
5	Upper Spring Valley	25	25	CP/FP/XXX	Low- Density Residential One- Family House	0.2(u) 0.1(s)	• Maisonettes Allowed On Seward Areas Of Lavington
	Kyuna						
	Loresho						
	Lavington/Bernard Estate						
	• On sewer						
• Unsewed	25	25					
	Muthaiga						

6	New Muthaiga	25	25	CP/FP/XX	Low- Density Residential	0.2	Single Family Dwelling
7	Mathare Valley	50	75	CP/FP/XXX	<ul style="list-style-type: none"> High –Density Residential (Flats) Informal Settlements (Slums) 	0.05 Lower in S&S Schemes	Special Scheduled High-Density Informal Development
	Mathare North						
	Lower Huruma						
	Kariobangi						
	KorogochoDandora						
8	Old Eastlands			CP/FP/XXX	<ul style="list-style-type: none"> These mainly constitute old city council housing-ripe for high-rise high-density redevelopment 		<ul style="list-style-type: none"> Special Scheduled Areas <ul style="list-style-type: none"> NCC Site-and-Service Schemes as Low-Income Housing
	•ShauriMoyo						
	•Maringo						
	•Bahati						
	•Kaloleni						
	•Makongeni						
	•Mbotela						
	•Jericho						
	•Jerusalem						
	Makadara	50	100	CP/FP/XXX	Residential - <ul style="list-style-type: none"> Mixed Development <ul style="list-style-type: none"> Flats Maisonettes Bungalows Site-and-Service Schemes Condominiums (Single Rooms) 	0.05	<ul style="list-style-type: none"> Comprehensive Subdivision Allowed Minimum To Fit a House On Type Plan Design
	DoonholmNeighbourhood (Block 82)	50	75				
	Uhuru (1-3)	50	75				
	Buru (1-6) (Block 72-79)	50	75				
	Umoja (1-2)	50	75				
	UmojaInnercore	50	150				
Komarock							
•Commercial	80	150					
•Residential	50	75					
Kayole							
•Commercial	80	150					
•Residential	50	75					
9	Main Industrial Area	80	300	CP/FP/XX	Industries/Godowns	0.05(on sewer)	Becoming Over Developed
9E	Dandora Industrial Zone	80(s) 50(u)	150(s) 100(u)	CP/FP/XX	Light Industries/Godowns	0.01 if not on sewer	Ruaraka EPZ Covered
	Kariobangi Lt/Industrial	50(u)	100(u)	CP/FP/XX			
	Mathare North Lt/Industrial	50(u)	100(u)	CP/FP/XX			
	Kariobangi Lt/Industrial	80(s) 50(u)	150(s) 100(u)	CP/FP/XX			
10	Nairobi West	35	75	CP/FP/XX	High-Density Residential Development Mixed Residential Development <ul style="list-style-type: none"> Flats, Maisonettes Bungalows 	0.5	<ul style="list-style-type: none"> Comprehensive Subdivision Allowed With Lower Sizes On Type Plan Development Density @ 35 Units Per Hectare
	Madaraka						
	South ‘B’	35	75	CP/FP/XX			
	South ‘C’						
	Nairobi Dam	50	75	CP/FP/XX			
	Ngummo	50	75	CP/FP/XX			
	Highview						
Magiwa							
Golf Course							
Langata Estates							

	<ul style="list-style-type: none"> • Southlands • Otiende • Ngei 1&2 • Onyonka • Masai • Uhuru Gardens • Jonathan Ngeno 	50	75				
10 E	Villa Franca	50(s) 25(u)	75(s) 25(u)	CP/FP/X XX	Residential Mixed Development	0.5	<ul style="list-style-type: none"> • Area not fully sewered • Comprehensive Subdivision Allowed with lower sizes on type plan (max 35 units/Ha.)
	ImaraDaima	50	75	CP/FP/X XX			
	Tassia						
	Fedha						
	Avenue						
	Embakasi village						
<ul style="list-style-type: none"> • Commercial • Residential 	80 50	150 75	CP/FP/X XX				
11	Special Scheduled Area (Kibera Slums)			CP/FP/X XX	Informal Mixed Development Comprehensive Residential Scheme	0.05	<ul style="list-style-type: none"> • NHC Plan Lacking In Social Infrastructure, e.g. Schools,Clinics, Recreation, and Commercial Zone • Comprehensive Subdivision Allowed With Lower Sizes on Type Plan
	National Housing Corporation (NHC) Estate						
	<ul style="list-style-type: none"> • Ayany • Olympic • Fort Jesus • Karanja Road 	50	75	CP/FP/X XX			
12	Karen/ Langata			CP/FP/X XX	Low-Density Residential Development (One-Family Dwelling House)	0.2 0.4	Local Re- Development Plan Under Review/Preparation
	Karen						
13	Gigiri	25	25	CP/FP/ XXX	Low-Density Residential (One-Family Dwelling House)	0.2	Plan Well implemented only pockets of the intensity of developments, e.g. Village, Market & American Diplomatic Housing
	Kitisuru	25	25	CP/FP/X XX			
	Ridgeways	25	25	CP/FP/X XX			
	Garden Estate	25	25	CP/FP/X XX			
	Safari Park/Balozi Housing	25	25	CP/FP/X XX			
14	Roysambu	25	25	CP/FP/X XX	Low-Density Residential (One-Family Dwelling House)	0.2	Intensive Development in Marurui&Roysambu
	Thome	25	25	CP/FP/X XX			
	Marurui	25	25	CP/FP/X XX			
15	Dagoretti	35	75	CP/FP/X XX	Agricultural / Residential Mixed <ul style="list-style-type: none"> • Gap Flats 	0.1	<ul style="list-style-type: none"> • Area Maintains Agricultural Character

	<ul style="list-style-type: none"> Riruta 	35	75	CP/FP/XX	<ul style="list-style-type: none"> Maisonnettes Bungalows 	0.05 on township sewer	<ul style="list-style-type: none"> High –rise Flats developments becoming popular
	<ul style="list-style-type: none"> Kangemi 	35	75	CP/FP/XX			
	<ul style="list-style-type: none"> Mutuini 	35	75	CP/FP/XX			
	<ul style="list-style-type: none"> Waithaka 	35	75	CP/FP/XX			
	<ul style="list-style-type: none"> Ruthimitu 	35	75	CP/FP/XX			
	<ul style="list-style-type: none"> Uthiru 	35	75	CP/FP/XX			
16	Baba Dogo				Industrial Zone Residential (Mixed Residential Development)	0.05 lower if comprehensive	High-Density Residential
	<ul style="list-style-type: none"> Industrial 	80(s) 50(u)	300(s) 100(u)	CP/FP/XX			
	<ul style="list-style-type: none"> Residential 	35(s) 25(u)	75(s) 25(u)	XX			
	Ngumba /Ruaraka						
17	Githurai 44 & 45	50(s)	200(s)	CP/FP/XX	Industrial Zone Residential (Mixed Residential Development)		<ul style="list-style-type: none"> Replete with unplanned developments hence “Blanket approval” vide TP resolution of 18/7/97
	Zimmerman						
	Kahawa West	50	100				
	<ul style="list-style-type: none"> Commercial 	50	100				
	<ul style="list-style-type: none"> Residential Industrial 	50	75	100			
18	Kasarani				<ul style="list-style-type: none"> Agricultural Residential Mixed (Development) 	<ul style="list-style-type: none"> 2.0 0.05 on sewer 0.1 Ha. If not on drain Lower min. size if land buying company 	<ul style="list-style-type: none"> The area has the potential for residential developments (invasion by land buying companies and land speculators) Industrial not attractive here
	<ul style="list-style-type: none"> Clayworks 	50	100	CP/FP/XX			
	<ul style="list-style-type: none"> Clay City 						
	<ul style="list-style-type: none"> Sports View 						
	<ul style="list-style-type: none"> Mwiki 	50	200				
	<ul style="list-style-type: none"> Njiru 	25	25	CP/FP/XX			
<ul style="list-style-type: none"> Ruai 							
19	Special Scheduled Area Outside Nairobi Boundary				Agricultural Residential (Mixed Development)		<ul style="list-style-type: none"> Area thoroughly influenced by city dynamics NCC not in control of development Overwhelmingly dependant on services of the city
	<ul style="list-style-type: none"> GithuraiKimbo 			CP/FP/XX			
	<ul style="list-style-type: none"> Wendani 			XX			
	<ul style="list-style-type: none"> KahawaSukari 						

20	Public/ Strategic Reserved Areas (Gazetted) <ul style="list-style-type: none"> • State House • JKIA Airport • Wilson Airport • Military Sites <ul style="list-style-type: none"> ○ Military Airbase Eastleigh ○ DoD Headquarters ○ Kahawa Barracks ○ Langata Barracks ○ Defense College, Karen ○ Forces Memorial Hospital 			CP/FP/XXX	Special/ strategic facilities and Developments		Boundaries Require to be clearly defined
13	Recreation And Forests <ul style="list-style-type: none"> • City Park • Arboretum • Ngong Forest • Karura Forest National Game Park Stadiums <ul style="list-style-type: none"> • Moi Sports Complex, Kasarani • City Stadium • Nyayo stadium Uhuru Park Central Park Uhuru Gardens			CP/FP/XXX	Public Open Spaces, Reserves and Recreational Facilities		

APPENDIX 2: QUESTIONNAIRE

UNIVERSITY OF NAIROBI
Department of Geography & Environmental Studies
FOODMETRES URBAN FARMING/GARDENING PROJECT

CROP CULTIVATORS

NAME OF RESPONDENT

PLOT CHARACTERISTICS

Q1. Where is your farm/plot located?

- [1] On-plot cultivation (home garden)
- [2] Off-plot cultivation (somewhere else on private land)
- [3] Off-plot cultivation (somewhere else on public land)
- [4] Off-plot cultivation (on railways, road sides and other open spaces)
- [5] Other (specify): _____

Q1B. Who owns the land where you practice crop cultivation?

- [1] Own land
- [2] Family land
- [3] Landlord
- [4] Government
- [5] Don't know
- [6] Other

Q2. Name of estate or locality where farm/plot is located

Q3. How do you get to your farm/plot?

- [1] On foot
- [2] Public transport
- [3] Bicycle
- [4] Personal car
- [5] Other (specify):
- [6] Not applicable (on-plot cultivation)
- [7] Not applicable (on-plot cultivation)

Q4. Do you have a contract with the owner of the plot to use this plot?

- [1] Yes
- [2] No
- [3] Not applicable

Q5. Do you pay rent or any other fees to use this plot?

If yes, specify the amount. If no, please go to Q6

- [1] Yes, I pay a rent of Kshs per
- [2] Yes, I pay some fees of Kshs per
- [3] No

Q6. What is the approximate total size of your plot/shamba?

Q6B. What is the approximate size of the area under crop cultivation?

CROPS CULTIVATED AND AMOUNT PRODUCED IN THE LAST HARVEST

Q7. Please indicate what you produced from your plot during the last harvest/year and estimate the amount harvested

Type of crop grown [Probe for various crops = Maize, Kales, Beans, Onions, Spinach, Tomatoes, Irish potatoes, Bananas, Cowpeas, <i>Saget</i> , Pepper, Sugarcane, Cabbage, Carrots, Pawpaw, Pumpkins, Green peas, Avocado, Cassava, <i>Terere</i> , <i>Managu</i> , Cucumber, <i>Dhania</i> , Citrus, Sweet potatoes, Arrow roots, <i>Mbiringanya</i> , <i>mavaki</i> , Millet, Mushrooms, etc]	Amount harvested [Probe for various units generally used in Kenya: 90kg bag;50kg bag; debe;Kg; number;bunch; heap;2kg tin; 1kg tin;bundle]	Where applicable, the approximate area of plot under each crop	What did you use with the harvest? [1] Consumed all [2] Consumed & sold [3] Sold all
1			
2			
3			

GROWING/CULTIVATION METHODS

Q8. Which term best describes how you principally cultivate your plot?

- [1] Conventional (I want to achieve the greatest possible yield at lower cost)
- [2] Integrated (I try to avoid using chemicals such as artificial fertilizers and pesticides)
- [3] Organic (I use natural methods of pest control, do not use mineral fertilizers and genetically modified organisms)
- [4] Biodynamic (I take note of ecological principles, the seasons and the lunar calendar)
- [5] Permacultural (I take note of organic and biodynamic principles and the natural symbiosis between the plant and animal species)
- [6] Other (specify):

Q9. Roughly how many hours per week during the growing season do you spend cultivating crops?

- [1] 0-2 hours
- [2] 2-4 hours
- [3] 4-6 hours
- [4] 10+ hours

Q10. Do you practice crop cultivation by yourself or does anyone help you with this?

- [1] I work by myself
- [2] Other members of the household help me
- [3] Other relatives help me
- [4] My friends help me
- [5] I hire labour
- [6] Other, please specify:

Q11. Do you use the following fertilizers?

- a. Home-made compost [1] Yes [2] No b. Bought compost [1] Yes [2] No
c. Manure [1] Yes [2] No d. Mineral fertilizers [1] Yes [2] No
e. Other, please specify:

Q12. Do you use the following seeds and seedlings?

- a. I save my own seeds [1] Yes [2] No
b. I exchange the seeds with others [1] Yes [2] No
c. I buy seeds [1] Yes [2] No (If, yes, specify where):
d. I grow seedlings by myself [1] Yes [2] No
e. I exchange seedlings with others [1] Yes [2] No
f. I buy seedlings [1] Yes [2] No (If, yes, specify where):

Q13. Do you use any old or 'heritage' crop varieties?

- [1] Yes, specify types of vegetables: [2] No

Q14. Do you water/irrigate your crop (s)?

- [1] Yes, regularly [2] Only if I think it is necessary [3] No (**Please go to Q18**)

Q15. How do you decide when to water your crops?

- a) I take into account how well the plants are growing [1] Yes [2] No
b) I take into account the air temperature [1] Yes [2] No
c) I take into account the amount of rain we have had [1] Yes [2] No
d) I look at how dry the soil is [1] Yes [2] No
e) Other reason, specify:

Q16. Where do you get water for your crops?

- a) Collecting rainwater [1] Yes [2] No
b) Use the tap water from my home [1] Yes [2] No
c) Other, specify:

Q17. Would you find the advice for watering/irrigation from a smart phone application useful to you?

- [1] Yes, it would be helpful to me [2] Yes, if I would have a smart phone
[3] No, in any case [4] Do not know smart phone application

Q18. Are you faced with any of the following difficulties in crop cultivation? If so, how do you solve or manage them?

- a) Weeds [1] Yes [2] No If yes, specify solution:
b) Pests [1] Yes [2] No If yes, specify solution:
c) Diseases [1] Yes [2] No If yes, specify solution:
d) Crop theft [1] Yes [2] No If yes, specify solution:
e) Water for irrigation/drought [1] Yes [2] No If yes, specify solution:
f) Land insecurity/evictions

- [1] Yes [2] No If yes, specify solution:
 g) Access to credit
 [1] Yes [2] No If yes, specify solution:
 h) Any other problems, please specify:
 If yes, specify solution:

SKILLS AND KNOWLEDGE

Q19. How did you learn crop cultivation?

- a) Personal observation [1] Yes [2] No
 b) In school [1] Yes [2] No
 c) Learning from family members and relatives [1] Yes [2] No
 d) Learning from friends and neighbours [1] Yes [2] No
 e) Learning from other farmers [1] Yes [2] No
 f) Attending a training course [1] Yes [2] No
 g) Learning from books and magazines [1] Yes [2] No
 h) Learning from Radio and TV programs [1] Yes [2] No
 i) Other, specify:

Q20. Would you find a smart phone advice application on gardening helpful to you?

- [1] Yes, it would be helpful to me
 [2] Yes, if I would have a smart phone
 [3] No, in any case
 [4] Do not know what a smart phone application is

MOTIVATION FOR CULTIVATION/GARDENING

Q21. How long have you been growing your own food? Specify (in years):

Q22. What inspired you to start growing your own food?

- [1] Own motives, a pleasure to work in nature [2] Family tradition/custom/hobby
 [3] My friends grow their own food [4] A public notice on growing space
 [5] I had access to land [6] I had no job
 [7] Other, please specify:

Q23. What are the main reasons you grow your own food? Please indicate the extent to which you agree or disagree with the following statements using a scale of:

[1] Completely unimportant [2] Not very important [3] Neither important nor unimportant [4] Important [5] Very Important

	[1]	[2]	[3]	[4]	[5]
a) I grow food to save money (in other words, to get my own food)					
b) I think my own grown food is safer than the food I buy					
c) I think my own grown food is healthier than the food I buy					
d) Growing my own food is good exercise					

e) Growing my own food helps me relax					
f) Growing food helps improve my local environment					
g) Growing my own food is a way of socializing with other people					
h) I grow food to sell it (for income or to diversify income)					
i) I grow food to reduce my environmental impact					
j) I grow food to learn new skills					
k) Other reasons, please specify:					

Q24. Do you have enough space to meet your food growing needs?

[1] Yes, I have just the right amount [2] No, my space is too small [3] No, my space is too large

CONTRIBUTION OF GARDENING TO FOOD SUPPLY AND HOUSEHOLD BUDGET

Q25. Please estimate what proportion of your household food needs is covered by the produce you get from crop cultivation?

- [1] All of it (90-100%) [2] Most of the food (80-90%) [3] About half of the food (50-60%)
 [4] Less than half of the food (30-40%) [5] Only a small portion (20%)
 [6] Negligible (10%) [7] None at all

Q26. Do you think the amount of food you grow justifies the cost of buying seeds, seedlings, fertilizers, pesticides and tools?

- [1] Yes, entirely [2] Yes, partly [3] No, not at all

Q27. If possible, please estimate your personal expenditure on seeds, seedlings, fertilizers, pesticides and tools: Specify the amount per month or year:

Q28. Do you produce only for your own needs and the needs of your household or do you also supply other people and/or sell surpluses from your plot(s)?

- a. Only for own needs [1] Yes [2] No b. Exchange surpluses [1] Yes [2] No
 c. Donate surpluses [1] Yes [2] No d. Sell surpluses [1] Yes [2] No

IMPACTS OF CROP CULTIVATION

Q29. Please indicate to what extent you agree or disagree with the following statements using the scale of:

[1] Strongly disagree [2] Disagree [4] Neither agree nor disagree [6] Agree [7] Strongly agree

	[1]	[2]	[4]	[6]	[7]
a) Through mutual exchange of seedlings or crop surpluses home food growers create better interpersonal relationships					

b) People who grow their own food lack the right skills to produce vegetables, therefore they contribute significantly to environmental pollution					
c) People who grow their own food do not have to transport their food very far; therefore they contribute to the improvement of air quality					
e) When watering, people who grow their own food conserve water, therefore they contribute to the conservation of water resources					
f) Organic or biodynamic agriculture is the only proper way of healthy food production					
i) While working in the garden by talking and socializing crop cultivators strengthen the integration of people in the community					
j) People growing their own food tend not to use pesticides and herbicides, therefore they contribute to environmental preservation					
k) Home grown vegetables are tastier than vegetables sold in the store					

ABOUT THE FARMER AND HIS/HER HOUSEHOLD

Q30. How many members of your household are supplied by the food you grow?
 [1] Enter the number of adults: [2] children: [3] Total:

Q31. Approximately how much do you spend on food in your household?
 Specify the amount per day, week or month:

Q32. What is your average monthly income per month?

Q33. In addition to the food you grow by yourself, where else do you get your food from?

- | | | | | |
|--|-----|-----|-----|----|
| [1] From friends or relatives who produce food | [1] | Yes | [2] | No |
| [2] From local growers, farms | [1] | Yes | [2] | No |
| [3] At a marketplace | [1] | Yes | [2] | No |
| [4] In shops and supermarkets | [1] | Yes | [2] | No |
| [5] Other, please specify: | | | | |

Q34. a) Do you buy mostly organic produce? [1] Yes [2] No
b) Do you buy mostly conventional produce? [1] Yes [2] No

Q35. Are you a member of an association?
 [1] No [2] Yes, specify which one(s):

Q37. Gender of respondent: [1] Male [2] Female

Q38. How old are you? In years:

Q39. Which county do you come from?

Q40. What is your highest level of education?

[0] None

[1] Primary School

[2] Secondary School

[3] Post-secondary school tertiary/college

[4] University (Bachelors)

[5] University (Masters)

[6] University (PhD)

Q41. What is your working/employment status?

[1] Employed / self employed full time

[2] Employed / self-employed part time

[3] Unemployed → **please go to Q43**

[4] Retired → **please go to Q43**

[5] In education/training → **please go to Q43**

[6] Stay at home parent? → **please go to Q43**

[7] Long term sick or disabled

[8] Doing unpaid or voluntary work

[9] Carer

[10] Other, please specify

Please explain the type of occupation

Q42. Please indicate to what extent you agree or disagree with the following statements using the scale of:

[1] Strongly disagree; [2] Disagree; [3] Neither agree nor disagree; [4] Agree; [5] Strongly agree

	[1]	[2]	[3]	[4]	[5]
My job is physically exhausting					
My job is mentally challenging					
My job is stressful					
My job is precarious					

Q43. Please describe your housing type:

[1] Detached house

[2] Semi-detached house

[3] Multi-residential apartments or flats

[4] Other, please specify:

Q43B. Also ask if: [5] Own house [6] Rental unit

ADDITIONAL QUESTIONS

Q44. Marital status of the respondent

[1] Never married

[2] Married

[3] Divorce

[4] Widowed

[5] Separated

Q45. For how long have you been a resident of this area?

- [1] Less than 5 years [2] 5 – 10 years
[3] 11 – 15 years [4] 16 – 20 years [5] over 20 years

Q46. Do you farm as a:

- [1] Individual [2] Corporative Society [3] Youth group
[4] Women group [5] CBO [6] Self help group

Q47. Describe your methods of crop cultivation

- [1] Conventional on the ground [2] In tins [3] In sacks
[4] In green houses [5] Hanging gardens [6] Roof/table tops

Q48. If you sell your crops/produce, who buys your products?

- [1] People come to buy from here [2] I sell it to households and neighbours around
[3] I sell it to shops/kiosks around [4] I supply the supermarkets
[5] Others, specify

Q50 Approximately how much do you earn from selling your produce?

Kindly specify if it is per day, week or month