

LIVELIHOODS, FOOD SECURITY AND ENVIRONMENTAL RISK: SACK  
GARDENING IN THE KIBERA SLUMS OF NAIROBI, KENYA

By

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## ABSTRACT

### LIVELIHOODS, FOOD SECURITY AND ENVIRONMENTAL RISK: SACK GARDENING IN THE KIBERA SLUMS OF NAIROBI, KENYA

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This dissertation research examined the impacts of a particular form of urban agriculture, sack gardening, in the Kibera slums of Nairobi, Kenya. Urban agriculture is often promoted as a means of addressing urban food insecurity, but because slum dwellers in Nairobi generally lack access to plots of land to farm, this activity has remained largely inaccessible to them. Sack gardening, a relatively novel form of urban agriculture in the Kibera slums, involves planting various crops into the top and sides of large plastic sacks filled with soil, which allows people to plant a larger number of plants into relatively small spaces by making use of the vertical space occupied by the sacks. While urban agriculture has great potential to address urban food insecurity, there are also potential risks associated with farming in urban environments that lack formal waste and sanitation systems. Households that consume produce grown in urban environments are potentially exposed to a range of environmental contaminants, including heavy metals and biological pathogens. This dissertation investigated the trade-offs between urban agriculture as a means of improving local livelihoods and increasing household food security, and as an activity that potentially exposes people to a variety of environmental risks. My research on sack gardening in Kibera used a mixed methods approach, drawing on qualitative interviews, household surveys, focus group discussions and an analysis of plant, soil and water samples.

This research demonstrated that sack gardening is a viable livelihood strategy in the Kibera slums that can be integrated with other household livelihood strategies, and that farmers in Kibera were able to successfully integrate sack gardening into their urban livelihood strategies. I found that sack gardening contributed to improved household food security directly. Farming households consumed a greater variety of vegetables than non-farmers, including many indigenous vegetables, which have broader nutritional benefits and are culturally preferred to the kale, swiss chard and cabbage which are consumed by most households in Kibera. Farmers reported feeling more food secure than non-farmers, and sack gardening also resulted in an increase in social capital, which helps food security indirectly.

This research demonstrated that farmers' perceptions of environmental risks focused primarily on visible contaminants, while the major contaminants found in samples of vegetables from their sack gardens were heavy metals, often at concentrations above the recommended levels for human consumption. The disconnect between farmers' perceptions of environmental risk and actual risk raises questions about how to appropriately promote urban agriculture within urban areas as well as the trade-offs inherent with farming in densely populated and polluted urban areas.

While this research is based on a case study of urban agriculture in one slum in Kenya, it demonstrates both the potential benefits and risks associated with farming in an urban environment. Additionally, it suggests that policy makers and development organizations who promote urban agriculture as a means of improving urban food security need to be cognizant of the socioeconomic context and ecology of the urban environments in which this activity will take place.

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# Chapter 1- Introduction

## 1.1 Introduction

The year 2007 marked a major shift in the distribution of the world population. For the first time in history, the number of people living in urban areas outnumbered those living in rural areas. Current estimates suggest that by 2030 the world will be over 60% urban, with most of this urbanization taking place in developing countries. Urban areas tend to concentrate financial, physical and human capital and thus have the potential to spur great economic growth (Kessides 2005). However, as the world becomes increasingly urban and the numbers of urban poor continues to rise, it is important to consider what kind of development is taking place in cities if the urban environment is to reflect sustainable, equitable development.

Urbanization in developing countries is driven by natural population growth in urban areas, rural to urban migration, and the transformation of rural areas into urban centers (Montgomery 2008). Although urban populations continue to grow, especially in sub-Saharan Africa (SSA), the growth of urban poverty is not a direct result of this urban population growth. Rather, political and institutional inequalities have meant that there have been widespread failures in basic infrastructure, housing, and services in urban areas (Kessides 2005). The growth of informal settlements or slums<sup>1</sup> has outpaced the level of urbanization in much of the developing world, and most new urban dwellers now live in slums, particularly in Sub-Saharan

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<sup>1</sup> UN Habitat (2006) defines a slum household as a group of individuals living in under the same roof in an urban area that lack one or more of the following: durable housing of a permanent nature that protects against extreme climate conditions, sufficient living space which means not more than three people sharing the same room, easy access to safe water in sufficient amounts at an affordable price, access to adequate sanitation in the form of a private or public toilet shared by a reasonable number of people, or security of tenure that prevents forced evictions.

Africa where more than 70% of urban populations live in these areas (United Nations Human Settlements Programme 2006, UN Habitat 2006).

Poverty is measured in different ways, including income-based poverty lines, measures of income inequality or relative poverty within a society, and social indicators such as life expectancy or infant mortality (Wratten 1995). Rates of urban poverty, generally based on household income, are often under-estimated in low and middle-income countries. Measures of poverty are often aggregated within countries, and are not disaggregated for urban areas, making it hard to isolate measures of urban poverty from national poverty statistics (ICD 2009). National poverty figures are generally estimated from income-based poverty lines, based on a basic amount of money needed to obtain food. These measures ignore the high prices that urban dwellers must pay for services such as housing, water, health care, education and transportation, as well as overlooking other economic shocks, such as rapid rises in food prices (Jones and Nelson 1999). Thus, urban poverty may be more severe than is generally reported.

Like much of the developing world, Kenya is undergoing rapid urbanization and continues to see a rise in the percentage of the population living in urban poverty. Currently between a third and a half of Kenya's population live in urban poverty, but it is estimated that by 2020 more than half of Kenya's poor population will be composed of the urban poor. For the majority of the urban poor, levels of poverty continue to deepen, as the percentage of urban dwellers in the poorest categories, food poor<sup>2</sup> and hardcore poor<sup>3</sup> continues to rise (Taylor and Goodfellow 2009). More than half of Kenya's total food poor live in slum environments, where the poorest urban dwellers may spend up to three quarters of their total income on food. Poorly

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<sup>2</sup> Inability to meet all nutritional needs due to expenditure on other basic non-food essential.

<sup>3</sup> Refers to households that would not meet their minimum food requirements even if they allocated all their income on food.



constructed housing, high population densities, rising prices for food and other basic necessities, and weaker social support networks all contribute to the vulnerability of the urban poor population in Kenya (Taylor and Goodfellow 2009) because these types of structural failures are very hard for individuals to overcome. Instead, poverty becomes institutionalized, as people must continually confront poor economic opportunities, lack of medical care, and violence (Farmer 2003).

The vulnerability of the urban poor can lead to civil unrest in informal settlements. This happened in Kenya in late 2007, when the Kibera slums of Nairobi became a hotbed of violence during post-election violence that rocked the country. While superficially the violence appeared to be the result of ethnic clashes, many citizens of Kibera were protesting because the presidential election appeared to have been stolen from a candidate who had promised to address issues such as the lack of public services and massive food insecurity in Kibera. During the several weeks of violence and insecurity that took place in late 2007 and early 2008, many people were unable to obtain even basic food staples such as maize meal and sugar (Kenya National Commission on Human Rights 2008).

Following this period of violence and food insecurity, a French NGO called Solidarités began a development initiative that scaled up a form of urban agriculture that had previously been implemented on a very small scale in Kibera (Pascal and Mwende 2009). This form of urban agriculture, called sack gardening, involves planting various crops into the top and sides of large burlap sacks filled with soil. With very little open space in Kibera, typical forms of urban agriculture are not attainable for most households, but sack gardening allows people to plant a larger number of plants into relatively small spaces by making use of the vertical space provided by the sacks. In the first phase of their program, begun in early 2008, Solidarités provided all

farmers with free sacks, training about gardening, and free seedlings, including kale, swiss chard, coriander and green onions. Additionally, all new farmers were enrolled in a food voucher program, and received an upfront payment of KSH 1500 to 2000 (USD 19 to 25), redeemable at a local grocery store for staple goods like maize flour, sugar, cooking fat, and beans. These food vouchers were meant to help address the immediate needs of food insecure households following the post-election violence. At present, Solidarités estimates that between 5,000 and 10,000 households throughout Kibera are engaged in sack gardening in some capacity (Personal communication with Marion Ng'ang'a, Sept. 24, 2010). Because not all sack farmers in Kibera are officially registered with Solidarités, it is possible the number is somewhat higher than this.

While sack gardening on a large scale is recent within the Kibera slums, urban agriculture has taken place within African cities for as long as these cities have existed. The term urban agriculture is used to encompass a variety of agricultural practices in urban areas, including the growing of food crops and rearing of livestock within the city (Baumgartner and Belevi 2001). Historically, this form of agriculture has been practiced on small plots, sometimes in home gardens, sometimes on rented private plots of land, and frequently on public land. The goods generated from urban agriculture are usually used for subsistence, gifting, or barter, but the excess may also be sold (Foeken 2006). Due to the economic crises in most African countries, urban agriculture has expanded over the last three decades (Binns and Lynch 1998). The poor who are most affected by these crises usually farm in town in order to improve their food security and earn extra income by selling their produce. Middle and high income households farm in different ways. Some of these households grow for household consumption or sale on plots in their yards, while other middle and high income households run larger commercial operations. While these households are not directly driven by food insecurity, urban farming is

still a way to subsidize their incomes (Foeken, Sofer and Mlozi 2004, Hovorka 2006, Memon and Lee-Smith 1993).

Urban farmers must contend with several potential problems. Many of these, such as irregular rainfall, drought, flooding, poor soil quality and insufficient access to soil, pests and diseases, crop destruction by animals, and lack of capital and inputs, such as money to buy water, seeds, and chemical inputs, are similar to problems faced by rural farmers. However, urban farming also presents a unique set of challenges, the most pronounced being theft of crops, lack of land tenure and the threat of eviction by urban authorities. In addition, lack of access to water for irrigation is particularly a problem amongst poor farmers in urban areas, many of whom turn to sewer water to irrigate their crops. This has been shown to cause heavy metal and bacterial contamination of their crops (Foeken 2006). Finally, urban agriculture remains illegal in many Sub-Saharan African countries and as a result, farmers lack any legal claim to their crops and are sometimes harassed by the police. Despite these many challenges, numerous studies have demonstrated the potential of urban agriculture to contribute to poverty alleviation and food security (Duressa 2007, Foeken and Owuor 2008, Memon and Lee-Smith 1993, Villavicencio 2009). Food producers benefit directly in terms of improved food security and more varied diets, and urban agriculture overall provides informal employment and income to many of those involved. The growing and selling of food in urban areas also can make food available and affordable to other poor urban dwellers.

Recent interest amongst development organizations, researchers and slum residents in sack gardening in Kibera reflects a larger trend that has seen renewed interest in farming in cities in general. In recent years, government and development organizations have begun paying increased attention to urban agriculture as a viable strategy to address issues of urban food

insecurity. For example, in 2001 the Food and Agriculture Organization of the United Nations (FAO) launched an interdisciplinary initiative called “Food for the Cities” that aimed to improve food access in urban areas through the intensification of horticultural activities (FAO 2011). From 2003 to 2010, the International Potato Center (CIP), which is part of the Consultative Group on International Agricultural Research (CGIAR), ran a special program known as Urban Harvest. This specialty group conducted extensive research on the relationships between urban agriculture, urban food security and urban ecosystem health (Prain, Karanja and Lee-Smith 2010). In 2010, the World Bank began a four-country baseline survey of urban and peri-urban agriculture in South America, Sub-Saharan Africa and Asia, in order to assess how best to support urban and peri-urban agriculture in future development initiatives (Zezza and Tasciotti 2010). As major development organizations become more involved in the promotion of urban agricultural initiatives, evaluations of smaller projects like sack gardening in Kibera can provide valuable in-depth information on how urban agriculture fits into urban livelihood strategies. While the focus of these major organizations has been to support urban agriculture as a means of addressing food insecurity, less attention has been paid to the potential risks associated with farming in urban environments that lack formal waste and sanitation systems. Households that consume produce grown in urban environments are potentially exposed to a range of environmental contaminants, including heavy metals and biological pathogens.

## 1.2 Conceptual Framework of this Dissertation

This dissertation investigates the trade-offs between urban agriculture as a means of improving local livelihoods and increasing household food security and as an activity that potentially exposes people to a variety of environmental risks. The research is situated within

the broader context of human-environment geography, which examines the manner in which humans shape and adapt to their environments. Within this context my research draws from several theoretical frameworks in order to better understand the role of sack gardening in the livelihoods of the residents of the Kibera slums.

The first is the sustainable livelihoods approach. This approach considers different assets used by urban sack gardeners to modify their livelihood strategies, and to help them overcome food insecurity. The term ‘livelihoods’ refers to the capabilities, assets and activities required for a means of living (Chambers and Conway 1992). Carney (1998) suggests that a sustainable livelihoods framework is a tool that can help to identify the main factors affecting livelihoods and the relationships between them. This framework places poor households at the center of the development process, starting with their capabilities and assets, rather than just their problems (Scoones 1998). While the urban poor may not have cash savings, they often have access to other assets, such as their labor, health, knowledge, skills, and friends and family, as well as the natural resources around them, which combined constitute a stock of capitals (Narayan and Pritchett 1999). People’s livelihoods are dependent on their access to five different types of capital; financial, natural, human, physical, and social. The combination of these capitals or assets constitutes a livelihood strategy, and households strive to use their assets in combination to cope with economic, environmental, health, and political changes (Scoones 1998). Further discussion of the use of capital assets as part of a sustainable livelihoods approach is found in Chapter 4.

Another component of my conceptual framework centers on the use of urban agriculture as a coping strategy to improve household food security. While numerous studies in East Africa have demonstrated that households use urban agriculture to supplement household food needs

(Crush, Hovorka and Tevera 2011, Maxwell 1995, Mwangi 1995), the application to space-saving sack gardening has yet to be explored.

Finally, while not explicit in my research, my research questions about the trade-offs between food security and environmental risks were shaped by a broadly defined urban political ecology (UPE). UPE is a theoretical approach that emphasizes how unequal power relations between people and institutions at the local, regional, national, and global scales that result in unequal outcomes (Heynen, Kaika and Swyngedouw 2006, Njeru 2006). Urban political ecology is derived from political ecology, a theoretical framework that encompasses a wide range of research issues concerning human interactions with the environment. Practitioners of political ecology explore ecological or environmental issues in the context of different scales (spatially and in terms of local, regional and global power structures), resulting is a broad range of studies unified by a focus on power and knowledge, regional and global politics, and environmental issues (Robbins 2004).

Perhaps nowhere else in Kenya is the juxtaposition of extreme economic, political and environmental issues clearer than in the Kibera slums of Nairobi. The majority of residents in Kibera are extremely poor, lacking access to clean water, functional toilets, waste and sanitation services, health care and adequate housing. In addition, the majority are casual day laborers who earn low wages, leaving them food insecure. While urban agriculture, such as sack gardening, has the potential to improve food security, it must be understood in the context of poor environmental conditions, lack of secure land or housing tenure, and Nairobi's zoning laws, which technically render urban agriculture illegal. Urban agriculture is clearly a part of a livelihoods strategy for the residents who participate in sack gardening, but it is also an activity that is affected by broader national policies (zoning laws and lack of agricultural extension

services), economic inequalities, and environmental contamination (lack of sanitation facilities and the fact that the river running through Kibera is polluted by upstream industries).

To date, most studies of UPE in developing countries have dealt largely with issues surrounding unequal access to waste and sanitation services. For example, Moffat and Finnis (2005) look at how peri-urban squatter communities in Nepal, living near a large dump, are unable to advocate for improved sanitation services because of they lack land tenure, they are of poor socioeconomic status, and they are of a lower caste. A similar example can be found in work by Sarah Moore (2008) on the politics of garbage in Oaxaca, Mexico. Wealthier residents have greater power to negotiate the location of dumpsites, so poorer residents are exposed to potentially greater risk living near these dumps. A third example can be seen in research by Njeru (2006) who studied the political ecology of plastic bag waste in Nairobi. He compared exposure to plastic bag waste in poorer and richer neighborhoods in the city, showing that poorer residents are exposed to greater waste and lack of sanitation facilities. In addition, his work illustrated how the rhetoric surrounding plastic bag waste placed blame on poor consumers who littered the bags, while in reality arrangements had been made between the plastic bag manufacturing companies and the Nairobi City Council to promote the use of plastic bags, and prevent a proposed ban on certain types of flimsier plastic bags.

Although urban political ecology has been effective in relating the local environmental inequalities of urban areas to broader political and economic conditions, it also has several shortcomings. The first issue relates to the relationship between political ecology and environmental justice movements. Political ecology is an explanatory framework, used to relate different concepts for the purpose of explaining a problem. In contrast, environmental justice movements have typically relied minimally on research, instead focusing on inciting action by

juxtaposing issues of racism or classism with environmental causes. Urban political ecology has tried to align these two factions, yet it seems to fall short in meeting the goals of environmental justice movements. While urban political ecology has been a useful framework for exploring the broader contexts of these environmental problems, it is not evident in the literature that this research has translated into action.

The other, perhaps more serious, shortcoming of urban political ecology thus far has been that few studies have included any strong measures of urban ecology. Some urban political ecologists have explicitly prioritized politics in their studies of the urban built environment (Keil 2003, Swyngedouw and Heynen 2003, Moore 2008). Others have been less explicit but nonetheless only minimally included measures of ecological health (Moffat and Finnis 2005, Njeru 2006).

Given that the stated purpose of environmental justice and urban political ecology is to explain uneven exposure to environmental risk, it seems important to be able to justify this claim by quantifying that risk in some way. In other fields of study, there are examples of political ecology that have drawn strongly on ecological measures such as soil sampling, remote sensing, and climatological data. For example, Turner's work on livestock populations in the Sahel has linked shifting power relations between different cultural groups to empirical studies of the ecological impacts of grazing (Turner 1998, Turner 1993). In his work on soil conservation in the Bolivian Andes, Zimmerer (1993) demonstrated that increases soil erosion was related to shifts in peasant labor away from traditional conservation practices to non-farm employment opportunities. Nonetheless, political ecology has tended to focus more on the social and institutional aspects of environmental problems, often ignoring concrete ecological measures, leading some to ask whether political ecology as a field of study should try to remain grounded



in the ecological sciences or whether it should focus more on environmental politics (Walker 2005). In particular, studies in urban political ecology have tended to focus strongly on environmental politics, ignoring measures of the natural environment, and reinforcing the long-held distinction between nature and the built environment (Castree and Braun 2001). While urban political ecology has acknowledged that urban environments constitute a form of nature, to date most researchers have avoided integrating ecological measures into their work. By drawing on measures of soil, plant and water contamination, my research attempts to integrate ecological measures into discussions of urban political ecology.

My dissertation research on urban agriculture in the Kibera slums was situated within the context of these various factors. By quantifying people's exposure to environmental risks via sack gardening, I intended to strengthen arguments about environmental justice and inequitable access to resources. Overall, using political ecology as a general framework to examine urban agriculture adds greater context and meaning to understanding the issues faced by local residents who participate in sack gardening, adding to the finding of an empirical study that purely examines urban agriculture as a livelihood strategy.

Drawing on a sustainable livelihoods framework and urban political ecology, my research on sack gardening in the Kibera slums asks:

1. *How does participation in sack gardening serve to improve the livelihoods of gardeners in the Kibera slums of Nairobi?*
2. *Are households in Kibera who participate in sack gardening more food secure than households that do not garden?*
3. *To what extent does participation in sack gardening expose people to environmental risks, and how do farmers understand these environmental risks?*

### 1.3 Outline of the Dissertation

This study is divided into eight chapters, three of which are manuscripts in various stages of submission and review. Chapter Two provides an overview of the study area, the Kibera slums, in order to provide context in terms of the region's socioeconomic and political history. Chapter Three provides an overview of the various research methods used throughout this study, including data collection and analyses, and is meant as a reference for the following chapters which describe individual pieces of the study. Chapter Four discusses the ways in which households in Kibera have integrated sack gardening into their overall livelihood strategies. This chapter is in the initial stages of becoming a manuscript to be submitted to a policy oriented journal. Chapter Five describes the implications of sack gardening in the Kibera slums on household food security and social capital. This chapter has been submitted to and is currently under review with the journal *Agriculture and Human Values*. Chapter Six illuminates some of the trade-offs inherent in farming in a slums environment. It discusses the implications of sack gardening in the Kibera slums in terms of people's perceptions of and actual exposure to various environmental risks, including heavy metal contaminants and biological pathogens. This chapter has been submitted as a manuscript to the journal *Ecohealth* and is currently under review. Chapter Seven, discusses the relationship between gender and urban agriculture in the Kibera slums. Data from this chapter may later be integrated with other data from the focus group discussions to be published as a manuscript. Chapter Eight, the conclusion, summarizes the implications of sack gardening in the Kibera slums on household livelihood strategies, improvements in household food security, and the trade-offs inherent in farming in densely populated urban environments. It then discusses the broader policy implications of this project for urban agriculture in Kenya and beyond.

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## Chapter 2- Study Area

*[Note: This chapter provides a study area description. Each of the following chapters, since they are manuscripts in varying states of publication, contain shorter study area descriptions.]*

The research for this dissertation was conducted in the Kibera slums of Nairobi, Kenya. This location was ideal for my study of sack gardening as residents of Kibera have participated in sack gardening since 2006, many beginning after the post-election violence of late 2007 and early 2008. Sack gardening is now practiced by upwards of 5000 households in the Kibera slums (Personal communication with Marion Ng'ang'a, 2010). The great diversity of Kibera slum dwellers allows comparisons to be made concerning the impact of sack gardening on livelihood strategies and exposure to environmental risk amongst a wide variety of household structures, income levels, and ethnic backgrounds. As the largest informal settlement in Nairobi, it characterizes of the most challenging issues faced by residents in informal settlements in Kenya today.

### 2.1 Location

Kibera is located about 7 km southwest of downtown Nairobi, within the legal city boundary (Figure 2.1). It is East Africa's largest slum, with approximately half a million residents occupying about 2.5 square kilometers, making it one of the most densely populated urban settlements in the world (UN Habitat 2006). Kibera is situated amidst several affluent neighborhoods, and next to Nairobi's Royal Golf Course. To the south, Kibera is bordered by the Nairobi River and the Nairobi Dam. This dam once provided drinking water to residents of Nairobi, but an invasion of the exotic plant water hyacinth has clogged the dam and it is no

longer in use. In addition, the Kenya Rail-Line cuts through the center of Kibera, dividing older villages such as Makina from the newer squatter settlements (Midgley and Livermore 1998).

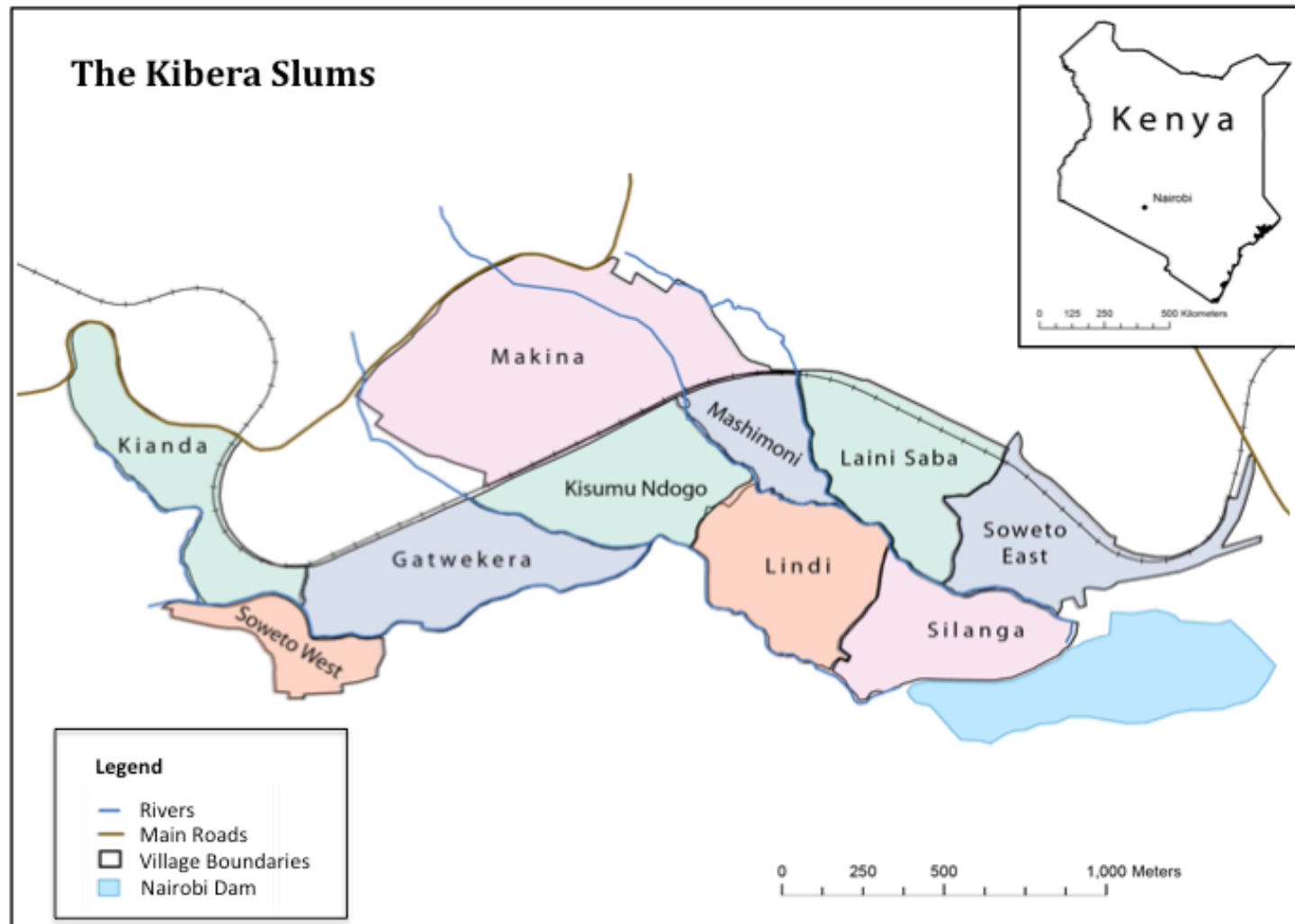
Kibera is comprised of 10 to 13 villages, depending on how boundaries are drawn, many of which are divided along ethnic lines (UN Habitat 2009) (Figure 2.1). For the purposes of this research, we used the 10 most commonly recognized villages in Kibera: Makina, Mashimoni, Laini Saba, Soweto East, Lindi, Silanga, Soweto West, Kianda, Gatwekera, and Kisumu Ndogo.

## 2.2 Administration

Kibera is located in the Langata Division of Nairobi Province. This division falls under the jurisdiction of the Nairobi City Council, and it shares administrative boundaries with Karen and Langata subdivisions, some of the most affluent neighborhoods in Nairobi (Midgley and Livermore 1998). The Kibera sub-location is currently represented by Raila Odinga, who is also the Prime Minister of Kenya. During the 2007 contested presidential elections, Kibera witnessed much of the ethnic violence, partly because of its ties to the Prime Minister. Villages are the smallest administrative unit in Kibera, with estimated populations ranging from 70,000 to 80,000 people. Within Kibera, each village has its own chief and tribunal, used to solve local disputes. However, the general lack of governmental involvement has resulted in a large degree of lawlessness or gang control of different parts of the slum (Bickel et al. 2000).



**Figure 2.1.** Maps of Kenya and the Kibera slums. For interpretation of the references to color in this and all other figures, the reader is referred to the electronic version of this dissertation.



## 2.3 Historical background

Kibera's history dates to Kenya's colonial period when urban areas were racially segregated into different enclaves for Europeans, Asians and Africans. Following World War I, the Kenyan colonial government designated a forested area that is now Kibera as a military reserve and site of temporary residence for Sudanese (Nubian) soldiers who had served as part of the King's African Rifles (KAR) during the First World War and who were unable to return to Sudan after their service (Martin et al. 2004). The British colonials made no effort to repatriate or resettle the Nubians to their country, nor did they give them official title deeds for the land in Kibera. Residents of Kibera had little opportunity for income generating activities aside from farming. During the 1920's, Kibera's reputation grew as a site for receiving stolen property and illegal distribution of "Nubian Gin," so the Kenyan colonial government attempted to relocate the Nubian reserve to a smaller 2000-acre area outside of Nairobi, but plans floundered due the associated costs. Instead, the government stopped distributing residency permits to family members of former soldiers with the aim of eventually dismantling Kibera as a housing site (Parsons 1997).

Beginning in 1928, Kibera was placed under civil rather than military administration for the first time. However, because there was no clear local authority to administer the area, Kibera became an administrative grey area which the colonial government did not oversee or tax, and thus became a haven for large numbers of non-Sudanese East Africans that moved to Nairobi in search of work, many of whom participated in illegal activities such as burglary and prostitution (Parsons 1997). By 1932, more than two-thirds of the residents of Kibera were Kenyan-born Africans, rather than Sudanese immigrants. Although the government continued to tolerate the

Sudanese presence in Kibera, they felt no obligation to develop the area, as they still viewed it as only a temporary residence for the former soldiers. Thus, by the late 1930's, Kibera had begun to slide into poverty, with one of the most pronounced difficulties being a shortage of clean drinking water, when springs in the nearby Ngong Road Forest Reserve ran dry. The government continued to refuse assistance to the Nubian community, under the belief that neglecting the community would eventually force residents to resettle elsewhere, and that providing a steady water supply would have encouraged the illicit production of Nubian gin and rising crime rates in Kibera (Parsons 1997). Although attempts were made to modernize Kibera during the late 1940's, the government's policy continued to be one of neglect. After World War II, severe housing shortages in Nairobi caused a large influx of Africans into Kibera, and Nubians began renting out parts of their farms or houses to these other Africans. The Sudanese continued to lobby the Kenyan government for permanent title deeds for their land, and resisted all attempts by the colonial government to resettle their community elsewhere. When Kenya achieved independence in 1963, the new African government 'upgraded' Kibera by dividing it into neighborhood units, with piped water supplies, sewers and roads. These neighborhood units may or may not overlap with villages as they are recognized today in Kibera. Nubian residents were given houses within the new settlement, but not land tenure. The government also annexed large portions of Kibera to build the Kenya Science Teachers' training college, leaving only the smaller housing blocks behind. Other parts of the original reserve were annexed to build a railroad, and Langata housing estate to the south (Parsons 1997). The remaining land continued to be informally developed and built by non-Sudanese immigrants in the area that is now the Kibera slums. While the Sudanese no longer have a special status within the Kenyan government, Kenyan-Nubians are still clearly identifiable within Kibera, as their language and

culture continue to persist. They are also the predominant landowners and landlords within the slums to date.

## 2.4 Population

Kibera has long been recognized as the second largest slum in sub-Saharan Africa, with an estimated population of a million people inhabiting 2.3 square kilometers (Davis 2006). Accurate population estimates of Kibera, however, are difficult to come by, and estimates range widely, even amongst various official sources. UN Habitat officially estimates the population of Kibera to be 700,000 people, although the agency acknowledges that the population may range from 350,000 to 1 million people (Maxwell 1999). The Kenyan government has estimated the population of Kibera to be upwards of half a million people, and within the development literature, the population is widely cited to be upwards of one million people. However, recent census results from the Government of Kenya have caused some to reconsider the widely cited population figures. The results of Kenya's 2010 census put the population of Kibera at only 170,000 people (Weinreb et al. 2002). There are reasons to believe that the census underestimated the population of Kibera because many people in Kibera say that they were not actually surveyed as part of the census (Kassim 2009, Maxwell and Frankenburger 1992). However, other organizations such as the Map Kibera Project have used satellite imagery to estimate the population of Kibera between 200,000 to 250,000 people (World Bank 1986).

The overall population of Kibera can be divided into 2 groups: temporary residents who have come to Nairobi in search of work, but who retain ties to their rural areas where they own land, and permanent residents such as the original Nubians and residents who have no rural land to return to. Among the permanent residents, the Nubians and Kikuyus tend to be landlords

while the other rural landless residents are tenants. Both sub-groups have generally lived in Kibera for a long time, and have stronger ties to the community than do the temporary residents. Because of the high number of males who are seasonal laborers in Nairobi's nearby industrial area, slightly more men than women live in Kibera (Midgley and Livermore 1998).

## 2.5 Socioeconomic Background

The population of Kibera is composed of many ethnic groups and social backgrounds. The predominant ethnic group in Kibera varies by village, but the major groups that are represented in Kibera include Luo, Luya, Kikuyu, Kalenjin, Kamba and Nubian. At present, the dominant groups in most of Kibera are Luo and Luya, although most landlords are Kikuyu and Nubian.

Poverty is endemic in the Kibera slums, with over half of the households in Kibera living below the official poverty line of \$1 (80 shillings) per day (Sampson, Raudenbush and Earls 1997). In reality the number of households experiencing poverty is actually much higher. The income level on which poverty lines are set in Kenya often ignore the cost of non-food essentials in urban areas, such as the cost of water, health care and education (Putnam 2001). While people in Kibera may earn more than 80 shillings per day, this is not nearly sufficient to cover other costs associated with life in Kibera. A study by Umande Trust (2007) used focus groups to collect information on the cost of various goods in Kibera, for an average family of five in Gatwikera, Kianda, Makina, Mashimoni, Kisumu Ndogo, Laini Saba and Soweto villages (Table 2.1). People in Kibera living on \$1-2 per day (80-160 shillings) still struggle greatly to pay for the cost of essential goods and services, with family members combining their incomes and borrow heavily in order to cover the cost of essential goods and services, meaning that many

families in Kibera are heavily in debt. While these families are not officially living below the poverty line, they still struggle to meet basic needs, particularly food, health and education.

**Table 2.1** The cost of basic goods and services by village in Kibera per month, in Kenyan shillings (USD 1= KSH 80). Table adapted from Umande Trust et al., 2007.

	<b>Gatwikera</b>	<b>Kianda</b>	<b>Makina</b>	<b>Mashimoni</b>	<b>Kisumu Ndogo</b>	<b>Laini Saba</b>	<b>Soweto</b>
Food	6000	6000	7,350	3,020	7,860	6,120	7,500
Water	560	1,200	900	1,500	300	450	1,500
Education	2,500	3000	4,500	3000	1,500	3,000	3,000
Health (treatment)	3,500	3,000	1,000	500	200	1,000	1,500
Rent	600	1,000	1,000	800	500	500	2,500
Sanitation	350	100	200	100	50	900	1500
Garbage	150	660	80	80	0	50	250
Total	13,660	13,360	14,080	9,000	10,410	11,210	13,750

## 2.6 Housing

Most houses in Kibera are non-permanent structures, constructed of mud walls and wooden support poles with corrugated tin roofs. Homes are constructed and maintained by landlords, although informal discussions with tenants suggest that it can be difficult to get landlords to repair problems with their homes. Houses are usually arranged in rows of single room structures, with each room rented by a single household. This creates a situation of overcrowding and lack of privacy among and between members of households in Kibera (Midgley and Livermore 1998).

The majority of residents in Kibera are tenants, with the cost of renting a room ranging from 500 to 2000 shillings (6 to 25 USD) per month, depending on the size and location of the house. Renters are at the mercy of landlords, who often force them to pay for electricity and

repairs on the home and nearby latrines in addition to their rent, or face eviction. Given the lack of affordable housing within Kibera, tenants must usually comply with landlords' demands. Blocks of houses share a single compound, so multiple families must negotiate the use of small communal spaces for bathing, laundry and activities like sack gardening (Focus Group Discussions, March 5 and 9, 2011). The relationship between tenants and landlord is further complicated since no landlords hold legal titles to the land on which they have constructed housing units, and 80-90% of these structure owners are absentee landlords who live in middle-class housing estates elsewhere in Nairobi. Additionally, more than half of structure owners are public officials in the Kenyan government (Syagga, Mitullah and Karirah-Gitau 2002). Because the majority of structure owners are Nubian or Kikuyu and renters are of Luo, Luya and Kamba ethnicities, property disputes can turn violent as they are intertwined with ethnic identities, socioeconomic status and political patronage (Joireman and Sweet 2008).

Structure-owners in Kibera who lack property rights to the land on which they have built houses have little incentive to maintain the environment of Kibera, and the Kenyan government's policy towards Kibera has historically been to deny residents basic services in an effort to force them to vacate the land. This has contributed to widespread environmental degradation and contamination in the slums due to lack of formal sanitation services.

## 2.7 Sanitation and Waste Disposal Services

Like most informal settlements around the world, Kibera lacks formal sanitation services, including reliable access to latrines and solid waste management services. For at least 20 years after independence, the national government's policy and plan was to demolish informal settlements in order to clean up the cities. Therefore, Nairobi City Council (NCC) did not

provide any basic services to areas such as Kibera because it did not want to recognize them as legitimate settlements (Schippers 2000). Now, the government is focusing on upgrading the slums in collaboration with UN Habitat, but existing slum upgrading projects have thus far been relatively ineffective.

Safe and secure access to latrines is a major problem for most residents of Kibera. A report by the Water and Sanitation Programme (2002) suggested that of the 2,300 pit latrines that exist in Kibera, at least 1,500 (65%) of them were not in use, and that each functioning pit latrine was shared by at least 150 people. More recent reports suggest that the situation has not improved much, and that pit latrines remain the primary sanitation facilities available, used as both toilets and showers. In general, residents of Kibera must pay to use these latrines. The costs vary by village and latrine, but a cost of 5 shillings (0.065 USD) per use is not uncommon. Some latrine owners allow a family to pay a flat fee of 100 shillings per month. Either way, difficult access, high costs, and insecurity, including a fear of mugging at night, mean that many residents resort to urinating and defecating in open spaces, near the river or railway, or into plastic bags, dubbed ‘flying toilets’, which are then thrown into the sewage ditches (Bickel et al. 2000, Omambia 2010, Njeru 2006).

Solid waste disposal is another major challenge for residents of Kibera, with less than 1% of households being served by a public garbage collection system in the slum. Most households dispose of their waste by dumping it elsewhere in their own neighborhoods, or burning or burying it in their own compound. Many residents simply sweep the trash into the drainage ditches that cross Kibera, and the trash continues to get swept or pushed downstream towards the river. A small number of residents in villages such as Soweto East, Laini Saba and Kianda, now pay for private waste removal services. In these villages, youth groups have formed trash



collection services as income generating activities. Households pay the groups approximately 10 shillings per week for trash removal. These youth groups then dispose of the trash by dumping it in the river, or at illegal dumpsites (Bickel et al. 2000).

Most residents dispose of waste water, or grey water, by dumping it into open drainage ditches outside their house. These drains are also used as dumping points for emptying waste water from latrines, and for households to dispose of grey water from bathing in their house. Drains in Kibera are inadequate in size and are poorly maintained and operated, resulting in extensive environmental pollution, health risks and danger to the inhabitants. These drains follow the same narrow footpaths or footpaths between houses that people walk on every day, and which children play in. The majority of drainage channels in Kibera are open drains, which are often filled with uncollected trash. This creates stagnant pools of water that form breeding grounds for mosquitoes and large numbers of flies outside of people's houses (Bickel et al. 2000).

## 2.8 Access to water

Irregular access to water is a major challenge faced by residents of Kibera. Because the government policy post-independence was to demolish informal settlements rather than provide infrastructure, Kibera still lacks major distribution outlets for water which results in frequent and acute water shortages throughout the slums. This has led to an informal water system within the slum, whereby people access water through small, individually owned pipes which are illegally connected to small mains that serve nearby residential areas. These pipes crisscross Kibera, passing through sewage-filled drainage ditches, or through people's homes. More than 85% of residents receive their water from water vendors, who have pipes connected to these informal

systems. Because of the frequent water shortages, most water vendors have invested in large tanks which they fill to continue to provide water when taps run dry (Schippers 2000).

The price of water varies between villages but normally costs between 2-5 shillings (0.03-0.06 USD) per 20 liters. However, during times of prolonged water shortages, vendors will raise the price to 10-20 shillings (0.13-0.25 USD) per 20 liters. Findings from the focus groups that I conducted indicate that during water shortages, the amount of time it takes to collect water also increases as many pipes run dry, and women often must wait several hours to collect water during these times (Focus group discussion, March 9, 2011). As a result of the increased costs and efforts required to obtain water during frequent water shortages, slum residents often limit bathing, cleaning and even cooking due to lack of water.

## 2.9 Summary and Conclusion

This study area description was meant to provide the reader with a greater understanding of life in Kibera, a large informal settlement. As residents of Kibera pursue different livelihood strategies, they must contend with challenges on many fronts including insecure land tenure, inadequate access to basic services including health care, education, water and sanitation, and general insecurity. These issues are both the result and cause of poverty as people become trapped in cycles of food insecurity, unemployment or underemployment, low education and debt. However, despite the many challenges that people face in informal settlements like Kibera, there are also examples of incredible innovation as people survive and adapt in these challenging conditions. Sack gardening is an example of such an innovation, as people have figured out how to grow food and create a greener environment in an area that is known for being overcrowded and polluted. Yet, sack gardening must also be understood in the context of the urban

environment in which it is practiced, an environment full of risk due to lack of waste removal services and plagued by problems with water shortages.

The next chapter provides an overview of the methods used as part of this research project in order to investigate the role that sack gardening has played in the livelihood strategies of Kiberans, the impact of sack gardening on household food security, and the extent to which sack gardening has exposed people to environmental risks. My choice of methods and the way in which they were implemented was shaped to a certain extent by the geographic (physical and social) constraints of working in a large slum environment.

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## Chapter 3- Overview of Methods

*[Note: The chapter is a general discussion of all the methods used in the research for this dissertation. Summaries of relevant methods are included in the three manuscripts that follow.]*

### 3.1 Introduction

The field research for this dissertation project was conducted over a period of seven months, from September 2010 to March 2011. I returned to the field in May of 2011 to conduct two feedback workshops. My research was facilitated by my association with Professor Nancy Karanja of the Department of Land Resource Management and Agricultural Technologies at the University of Nairobi. This project used a mixed methods approach, combining qualitative, semi-structured interviews, quantitative household surveys, analysis of soil, plant and water samples, and focus group discussions to collect information about the tradeoffs between sack gardening as a livelihood strategy and environmental risks in the Kibera slums of Nairobi, Kenya. Below I present the different types of data collection and methods used in this dissertation project.

This research was made possible with the help of several research assistants who worked with me during various phases of my project. Mary Njenga, a doctoral student under Professor Nancy Karanja at the University of Nairobi, served as my overall project coordinator and assisted me with a wide variety of tasks, including collaborating in the design of my household survey, hiring field assistants, and organizing the feedback workshops. Dennis Mwaniki, a master's student in the Department of Geography at the University of Nairobi, helped me to conduct my qualitative interviews and oversaw the implementation of my household survey. Catherine Wangui, a farmer from Kibera, served as my logistical coordinator in Kibera, helping to schedule household interviews and surveys, organize focus group sessions, coordinate the

plant, soil and water collections, and organize the feedback workshop in Kibera. Numerous other individuals assisted me with other phases of my project and they are mentioned in the relevant portions of this chapter.

### 3.2 Qualitative Interviews with Farmers

Because sack gardening is a relatively new phenomenon in Kibera, there has been little formal documentation of sack gardening practices in Kibera prior to my study. Qualitative interviews are an excellent means of gathering information about *how* a particular practice is occurring, whereas structured household surveys are useful in terms of providing quantitative data about *what* and *how many* people are engaged in a particular practice (Maxwell 1996b, Winchester 2005). Therefore, I decided to conduct semi-structured, qualitative interviews with farmers about their general farming practices in order to gain a basic understanding of how sack gardening was being used as a livelihood strategy in Kibera.

From September to October 2010, my assistant and I conducted 31 qualitative semi-structured interviews with farmers from Makina and Mashimoni villages in Kibera. The purpose of these interviews was to collect basic information about the experiences farmers had with sack gardening in order to help prepare for a large household survey that would be conducted later. Interviewees were selected with the help of a local assistant from Kibera, Catherine Wangui, selecting farmers to get a range in length of time sack gardening, and the number of sacks the farmer owned. As I will demonstrate later in this dissertation the majority of sack farmers are women. Therefore, not surprisingly, we interviewed 29 women and 2 men. Table 3.1 provides more detailed background information about the interview subjects. The longer length of



farming time in Mashimoni than in Makina is likely because Solidarités began actively working in Mashimoni nearly a year before introducing sack gardening to Makina.

**Table 3.1 Background information about farmers who were interviewed**

	<b>Makina Village</b>	<b>Mashimoni Village</b>
Number of Farmers Interviewed	22	9
Average Age of Famers	30	35
Median Level of Education	4 <sup>th</sup> grade	4 <sup>th</sup> grade
Average Length of Time Sack gardening	19 months	31 months
Average Number of Sacks	4.7	5.4

Interviews took place at the farmers' houses and were conducted in Kiswahili by Dennis Mwaniki. I observed each interview, and asked additional questions as they arose. Farmers were informed about the purpose of the research project and permission was obtained to conduct and make an audio recording of the interview<sup>4</sup>. The interviews typically lasted between 30 to 90 minutes, including a few minutes spent after the interview observing the farmers' sacks. During the interview, we asked farmers a range of questions about their experiences with sack gardening in order to understand how they had begun sack gardening, the types of crops they grew, the benefits and challenges of gardening and any concerns they had about environmental risk (Appendix A contains the interview guide).

Following the interview, the audio recording was first transcribed in Kiswahili and then translated into English by Dennis Mwaniki. I then analyzed the translated transcripts using thematic analysis for key themes that appeared in the data. After reading through all the transcripts, I first created a set of codes for the major themes discussed by all the farmers (Appendix B). Using NVivo software (version 9), I then coded the transcripts for major themes

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<sup>4</sup> Human subject clearance for this research was obtained from MSU's IRB. My protocol number was 10-568; r036781.

and aggregated the data by theme (Appendix C). From there, I created summary statements to summarize the data for each theme at the interview level, and then grand summary statements to summarize the data across all interviews (Appendices D and E).

### 3.3 Household Survey with Farmers and Non-farmers

Based on the information obtained as part of the qualitative interviews with farmers, I then conducted a household survey of 153 farmers and 153 non-farmers in 9 villages in Kibera in order to collect basic demographic data and more detailed information about farmer's livelihood strategies, the impact of sack gardening on household food security, and people's understanding of environmental risk. **Farmers** were defined as any household actively participating in sack gardening, while **non-farmers** were households that were not involved in any agricultural activities. The survey instruments were based loosely on a previous survey of urban and peri-urban farmers throughout Nairobi in June 2010, conducted by Professor Nancy Karanja of the University of Nairobi, but were modified to reflect specific knowledge of sack gardening obtained during the qualitative interviews (Appendix F).

Although Kibera consists of 10 villages, we selected only 9 of the villages to be part of the survey for safety reasons as it was too insecure to have a team of assistants entering Lindi village<sup>5</sup>. The villages surveyed as part of this project were Makina, Mashimoni, Laini Saba, Gatwekera, Silanga, Soweto East, Soweto West, Kianda, and Kisumu Ndogo.

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<sup>5</sup>Lindi village was originally included in our study, but at the end of our first day of household surveys in Lindi, we were mugged at gunpoint. We lost all the household surveys from that day, as well as completed surveys from Makina and Mashimoni villages the previous day. We redid the household surveys from Makina and Mashimoni villages, but decided it was unsafe to return to Lindi village to redo the surveys.

Sampling frames<sup>6</sup> of non-farmers and farmers in each of nine villages in Kibera were created with the help of a local assistant in each village. The assistants compiled lists of 35 farmers and 35 non-farmers in each village, and we randomly selected 17 people to interview from each list. The selected interviewees were contacted to confirm that they would be participating in the survey and to inform them of the time of the survey interview.

Our survey took place from January 24 to February 14, 2011. Surveys were administered with the help of four enumerators<sup>7</sup>, all of whom were local university students. In addition, there was a field coordinator<sup>8</sup> who helped with the logistical arrangements and did quality control, a local assistant<sup>9</sup> who helped with setting up contacts in each village, and three additional local assistants from each village who escorted the enumerators to the households for purposes of security. Interviews lasted approximately one hour, and usually took place at the interviewee's house or place of business (e.g. vegetable kiosk). Following the farmer interviews, enumerators collected GPS coordinates for the location of the sack gardens, the source of the soil used to build the sacks, and the source of irrigation water. GPS coordinates were also collected at the neighborhood level for non-farmers.

Data from the completed surveys were entered into M.S. Access and then analyzed using SPSS statistical software. Statistical analyses are discussed in greater detail in the following three chapters.

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<sup>6</sup> *Sampling frame* is a statistical term referring to a list of all individuals in a population that can be sampled.

<sup>7</sup> Household interviews were conducted by the following enumerators: George KaranjaAchiengAloo, Joel NurgriaBoboti, Baraka Mwau, and Jack OmondiOdero.

<sup>8</sup> Field coordination and quality control was done by Dennis Mwaniki

<sup>9</sup> Local coordination and logistical arrangements were done by Catherine Wangui

### 3.4 Analysis of Plant, Soil and Water Samples

In order to measure the actual exposure of farmers to environmental risks from sack gardening, I collected soil, plant and water samples from a subset of farmers (n=50) to be analyzed for heavy metal contamination and total coliform bacterial counts. To select farmers, they were stratified by source of soil (open field, railroad, river bank, dumpsite, and other) and then randomly selected in proportion to the actual number of farmers in the household survey who had collected soil from these sources. At the time of collection, soil was sampled from the top 6 to 8 inches from each of the farmer's sacks, mixed and then a sub-sample of 500 g was collected for heavy metal analysis. Two samples of kale (200 g and 300 g each) were also purchased from the farmer to be analyzed for heavy metals and fecal coliform bacteria. The youngest mature kale leaves were picked for the sample, as kale accumulates heavy metals near the growth point (Itanna 2004b). Finally, two water samples (500 mL each) were collected from the source of irrigation water used for the sacks, to be analyzed for heavy metals and fecal coliform bacteria. Samples were collected by a team of research assistants<sup>10</sup>, placed in an ice chest, and taken to the laboratory for analysis the same day.

Soil, plant and water samples were analyzed for a composite of heavy metals using inductively coupled atomic emission spectrometry (ICP-AES) by the Crop Nutrition Laboratory in Nairobi (Li et al. 1995). Soil and plant samples were analyzed for boron (B), cadmium (Cd), cobalt (Co), chromium (Cr), copper (Cu), mercury (Hg), molybdenum (Mo), nickel (Ni), lead (Pb), and zinc (Zn). Plant and water samples were also analyzed for total coliform bacteria using

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<sup>10</sup> The following field assistants helped with collection of soil, water and plant samples: Elisha Kutto, Baraka Mwau and Catherine Wangui.

by Analabs Inc. in Nairobi. Total coliform in water was determined using the most probable number (MPN) method, while total coliform for plant samples was determined based on a count of colony forming units (CFUs) at 30°C (Gronewold and Wolpert 2008). Because Analabs was only able to process 15 total coliform samples per week, samples were collected over a period of 4 weeks in late March 2011 and early April 2011. I attended the first day of sample collection and the remaining three sample collections were undertaken by my team of research assistants after I had returned to Michigan.

### 3.5 Focus Group Discussions with Farmers and Non-farmers

Focus group discussions are a type of qualitative research method that are used to elicit discussions amongst a group of people about a particular topic. These group discussions are useful at generating information in a manner that individual interviews may not because one participant's response may trigger a chain of responses from other participants. Focus groups are also useful in terms of identifying disagreements or controversy about a particular issue (Cameron 2005).

In order to gather more information about how farmers and non-farmers understand environmental problems in Kibera, and their exposure to environmental risk, we conducted seven focus group sessions with farmers and non-farmers, grouped accordingly: 2 with male non-farmers, 2 with female non-farmers, 2 with female farmers and 1 with male farmers. We were unable to hold a second focus group with male farmers because of the limited number of male farmers who had participated in our household survey. Focus groups were separated by gender for two reasons. First, men and women often pursue different livelihood strategies and may have different insights into how sack gardening can be integrated into their livelihood strategies, or

more generally about their relationship to the environment in Kenya. Second, culturally, women in Kenya are often submissive to men in a group setting, and so holding separate focus groups sessions created a space where women's voices could be heard. In order to balance the gender of the facilitator, half of the sessions were facilitated by Dennis Mwaniki and half were facilitated by my other assistant, Catherine Wangui. Each focus group session consisted of 5-12 people, and lasted approximately an hour and a half. The discussions were held at the Kibera Girls Soccer Academy School in Kibera, because it is well known and centrally located.

In order to choose which farmers and non-farmers to invite to the focus group, we selected from the people who participated in the household survey. The lists<sup>11</sup> were stratified by village and then randomly selected from among the remaining farmers and non-farmers. Because not all those selected were available to attend, the focus groups varied somewhat in size, but were still representative.

Focus group sessions were recorded (audio), transcribed in Kiswahili, and then translated into English with the help of Dennis Mwaniki. I then analyzed the transcripts of the focus group sessions using thematic analysis, as with the qualitative interviews, to look for key themes that appeared in the data. I first created a set of codes related to the major themes that were raised during the focus group discussions (Appendix F). Using NVivo software, I coded the transcripts based on these themes, and aggregated the data by theme (Appendix G). I then created summary statements to summarize the data for each theme at the level of a single focus group, and then grand summary statements to summarize the data across all the focus group discussions (Appendices H and I).

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<sup>11</sup> I removed all households without contact information (telephone numbers) as it was too difficult to make contact with these participants to invite them to the focus group sessions.

### 3.6 Feedback Workshops

An important component of research is making sure that the information learned during the course of a study is returned to the research participants and to relevant policy makers. In addition to helping maintain ties with the community, it can be a valuable way to check your research findings against the understanding of the community (Smucker et al. 2004). In May 2011, after having completed preliminary analyses of my household survey data and receiving the results of the soil, plant and water contamination data, I returned to Kenya to organize and participate in two feedback workshops. The first feedback workshop was held on May 25, 2011 at the All Africa Conference of Churches in Nairobi. It was attended by approximately people from various NGO's, the Ministry of Agriculture, Nairobi City Council, as well as five farmers from Kibera. The workshop lasted half a day and included presentations about my own research as well as other research on urban agriculture in Kenya and the United States (Appendix J). The workshop concluded with a panel discussion with the five invited farmers who were able to share their experiences as sack gardeners with the policy makers and ask them questions relevant to the challenges they had experienced farming in the Kibera slums.

Following the feedback workshop with policy makers, we held a second feedback workshop on May 27, 2011 in Kibera to share the results of our research with the study's participants. All farmers and non-farmers who were interviewed as part of the qualitative interviews or household survey were invited to attend. Approximately 75 farmers and 20 non-farmers attended the workshop, as well as a field staff member from Solidarités. At this half-day workshop, we first introduced the overall research project for those who were still unaware of what our goals had been. We then invited several farmers to share their experiences (benefits and challenges) as sack gardeners with the others, and the staff member from Solidarités share some relevant

technical expertise related to planting and pest management with the farmers. Two of the farmers who had attended the policy workshop then shared what they had learned at the workshop with the workshop attendees. Next, I presented the results of my research to the farmers. I introduced myself and the overall goals of the project in Kiswahili but then, in order to make sure I was understood, I explained the results in English and Catherine Wangui translated to Kiswahili for the group. Finally, we ended with a short question and answer period, where several non-farmers asked to be paired up with farmers so they could learn how to plant sack gardens.

The majority of people who attended our workshop were employed as casual laborers, and attending an event like ours could mean forfeiting an opportunity for wages that day. Therefore, we chose to compensate all attendees with a small per diem of KSH 200 (USD 2.50). In addition, we provided light refreshments of sodas and *mandazi* (donuts) to everyone at the end of the presentations. The feedback workshop was well received by the study participants and many of them thanked us for taking the time to share the results of our research with them.



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## **Chapter 4- Creating Space: Sack gardening as a livelihood strategy in the Kibera slums of Nairobi, Kenya**

*[Note: This chapter is a manuscript in preparation that will be submitted to a policy-oriented journal.]*

### **4.0 Abstract**

With the growth of the urban population, countries in Sub-Saharan Africa are also seeing a growing number of people joining the ranks of the urban poor. Because most cities are unable to keep up in term of infrastructure and formal employment, urbanization often leads to the growth of informal settlements and the informal jobs sector. Current estimates suggest that more than 1 billion people worldwide now reside in informal settlements or slums, without good access to food, shelter, water and sanitation. Cities are centers of political, social and economic opportunity in most countries, but they are also home to growing numbers of poor people. If countries are to address rapid urbanization and the growth of urban poverty, they need to support and empower livelihood strategies that the urban poor have developed to survive.

Urban agriculture is one livelihood strategy used by the poor to improve their wellbeing, in combination with other strategies, but it has remained largely inaccessible to inhabitants of slums who generally lack access to land to farm. However, in the Kibera slums of Nairobi, Kenya, a relatively new form of urban agriculture has emerged, called sack gardening, in which farmers plant crops into the sides and tops of large sacks of soil. Our research asked how participation in sack gardening served to improve the livelihoods of farmers in the Kibera slums of Nairobi. We demonstrate that urban agriculture can be a viable and important livelihood strategy for households, even in slum environments. By demonstrating the importance of this

form of small-scale urban agriculture, we intend to inform more general debates about urban agriculture and urban livelihoods in general.

## 4.1 Introduction

In 2007, the world population hit a landmark with more than 50% of people now residing in urban areas. While sub-Saharan Africa remains predominantly rural, most countries are projected to be more than fifty percent urban by the year 2030 (UN Habitat 2004). With urban growth, countries in Sub-Saharan Africa are also seeing a growing number of people joining the ranks of the urban poor. Because most cities are unable to keep up in term of infrastructure and formal employment, urbanization often leads to the growth of informal settlements and the informal jobs sector. Current estimates suggest that more than 1 billion people worldwide now reside in informal settlements or slums, without good access to food, shelter, water and sanitation (UN Habitat 2004).

The United Nation's eight Millennium Development Goals (MDGs) aim to address the needs of the world's poorest by reducing extreme poverty, improving household food security, and increasing access to education, amongst other goals (United Nations 2000). The MDG's are meant to stimulate pro-poor development strategies, and many development organizations and governments have used these goals to shape local and national policies. Cities are centers of political, social and economic opportunity in most countries, but they are also home to growing numbers of poor people<sup>12</sup>. If countries are to meet the Millennium Development Goals and to address rapid urbanization and the growth of urban poverty, they need to support and empower livelihood strategies that the urban poor have developed to survive.

Urban agriculture is one livelihood strategy used by the urban poor to improve their wellbeing, in combination with other livelihood strategies. Numerous studies of urban and peri-urban agriculture worldwide have demonstrated that it is effective at improving household food

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<sup>12</sup> 'Urban poor' refers to the proportion of the urban population living below the poverty line.

security (Binns and Lynch 1998, Crush et al. 2011, Egziabher et al. 1994, Maxwell 1995, Mwangi 1995) and as an income-generating activity (Baumgartner and Belevi 2001, Drakakis-Smith, Bowyer-Bower and Tevera 1995, Mlozi 1996). In Sub-Saharan Africa, studies of urban agriculture have been limited, but suggest overall that approximately one third of households are engaged in some form of urban agriculture, of which two thirds of the farmers are women (Prain et al. 2010).

While urban agriculture is a fairly common urban livelihood strategy, it has remained largely inaccessible to inhabitants of slums who generally lack access to land to farm. However, in the Kibera slums of Nairobi, Kenya, a relatively new form of agriculture has emerged, called sack gardening, in which farmers plant crops into the sides and tops of large sacks of soil. These sack gardens allow farmers to grow twenty to forty plants in the space previously occupied by just a few plants by making use of the vertical space occupied by the sack. While sack gardening (sometimes called ‘vertical gardening’) is not new to Kibera, it has become more popular since 2008 because a local NGO called Solidarités has provided free seedlings and technical advice to new farmers. Now several thousand households in Kibera practice some form of sack gardening (Karanja and Njenga 2011). This form of urban agriculture is a relatively new livelihood strategy for most households in Kibera, and it is practiced on a smaller scale than urban agriculture is typically practiced in other urban and peri-urban parts of Nairobi.

Our research asked how participation in *sack gardening served to improve the livelihoods of farmers in the Kibera slums of Nairobi*. We demonstrate that urban agriculture can be a viable and important livelihood strategy for households, even in slum environments. In particular, sack gardens are important to women in Kibera as they fit well with their current livelihood strategies and allow them to provide for their households while building a greater sense of community

amongst the farmers. By demonstrating the importance of this form of small-scale urban agriculture to households in the Kibera slums, we intend to inform more general debates about urban agriculture and urban livelihoods in general.

#### 4.2 Sustainable Livelihoods Approach

In order to evaluate the impact of sack gardening on household livelihood strategies, we used a sustainable livelihoods approach. The term ‘livelihoods’ refers to the capabilities, assets and activities required for a means of living (Chambers and Conway, 1992). A sustainable livelihoods approach considers different assets used by urban farmers to modify their livelihood strategies, and to help them overcome food insecurity. Carney (1998) suggests that a sustainable livelihoods framework is a tool that can help to identify the main factors affecting livelihoods and the relationships between them. This framework places poor households at the center of the development process, starting with their capabilities and assets, rather than just their problems (Scoones 1998). While the urban poor may not have cash savings, they often have access to other assets, such as their labor, health, knowledge, skills, and friends and family, as well as the natural resources around them, which combined constitute a stock of capitals (Narayan and Pritchett 1999). People’s livelihoods are dependent on their access to different types of capital, including financial, natural, human, physical, and social. The combination of these capitals or assets constitutes a livelihood strategy, and households strive to use their assets in combination to cope with economic, environmental, health, and political changes (Scoones 1998). In the Kibera slums, sack farmers draw upon different forms of capital to modify their livelihood strategies to include urban agriculture as a means of improving their food security or generating income.

*Natural capital* consists of the natural resources useful to livelihoods, including land, soil, water, and other environmental resources. This form of capital is generally considered to be less significant in cities, but in the context of urban agriculture, natural capital is critical as land is at a premium (Rakodi 2002). For those practicing urban agriculture, their livelihoods are particularly dependent on their access to land, soil and water.

*Physical capital* is the basic infrastructure for transportation, shelter, water, energy and communications, as well as the equipment which enables people to pursue their livelihoods (Rakodi 2002). The ability of different households to obtain this physical capital, such as sacks, seeds and fertilizer, may influence the extent to which they participate in sack gardening. Additionally, lack of physical infrastructure in Kibera, such as piped water, impedes a household's ability to participate in gardens, as they must use the informal sector to obtain water, from streams, wells or have enough financial capital to purchase water from water vendors, who possess the physical capital to transport it (Villavicencio 2009).

*Human capital* refers to the quantity and quality of labor resources, education, skills and health status of household members (Rakodi 2002). The ability of households to manage their labor assets in order to engage in economic activities is often constrained by the educational levels or health status of individuals within the households. Lack of education or skills forces households to rely on informal labor markets, or to participate in activities such as urban agriculture to supplement their incomes (Foeken 2006). Although sack gardening does not require formal education, it does require a particular set of knowledge and skills. Households with recent ties to rural agricultural areas may have more human capital in this area than households whose members have lived for multiple generations in the slums (WinklerPrins and de Souza 2005, Linares 1996).



*Financial capital* is defined as the financial resources available to people, including savings, credit, pensions and remittances, which provide them with different livelihood options. In the context of urban agriculture, financial capital refers to the financial resources available to begin sack gardening, such as money needed to purchase water, sacks, and potentially seeds and soil (Rakodi 2002). Financial capital is strongly dependent on relationships of trust, and is closely related to the next type of capital, social capital (Prain et al. 2010).

*Social capital* encompasses the social resources, including networks, membership in formal groups, relationships of trust and reciprocity, and access to wider institutions of society, on which people rely when pursuing their livelihoods (Rakodi 2002). Sack gardening takes place in a densely populated, urban environment. People may draw on their social networks for help in building sacks, maintaining the gardens, sharing harvested goods, protect sacks against theft, among other activities.

Households practicing urban agriculture make use of these different forms of capital assets in the broader context of policies, institutions and process that are applied to and exist in the Kibera slums and the city of Nairobi. They also draw on their assets in response to vulnerability that results from engaging with urban ecosystems (Prain et al. 2010). Our research looked at the ways in which farmers in the Kibera slums made use of these different capital assets to examine how sack gardening has been integrated into household livelihood strategies, and the extent to which this has proven beneficial for the households involved in this type of farming.

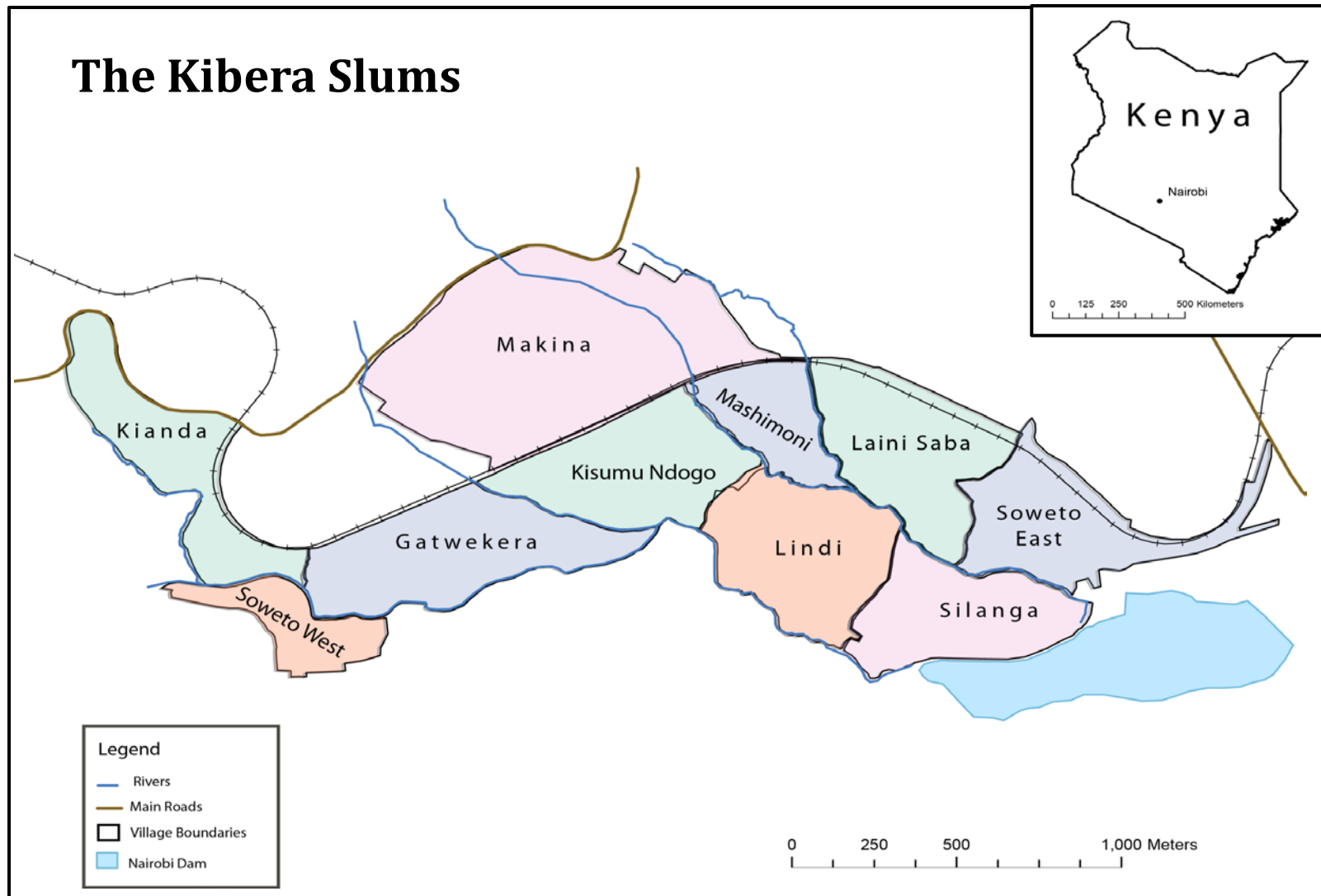
## 4.3 Methods

### *4.3.1 Study Area*

The Kibera slums were selected as our research site because it is the largest informal settlement in Nairobi, and it represents some of the most challenging issues faced by residents in informal settlements in Kenya today. Residents of Kibera have participated in sack gardening for several years, with many beginning to garden after the post-election violence of early 2008, and sack gardening is now practiced by upwards of 5000 households. The great diversity of Kibera slum allows comparisons to be made concerning the impact of sack gardening on livelihood strategies amongst a wide variety of household structures, income levels, and ethnic backgrounds.

Kibera is located about 7 km southwest of downtown Nairobi, within the legal city limits (Figure 4.1). It is East Africa's largest slum, with approximately half a million residents occupying about 2.5 square kilometers, making it one of the most densely populated urban settlements in the world. Kibera is situated amidst several affluent neighborhoods, and next to Nairobi's Royal Golf Course. It consists of 10 villages or neighborhoods, defined loosely along ethnic lines. The villages included in our study were Makina, Mashimoni, Laini Saba, Kianda, Kisumu Ndogo, Soweto East, Soweto West, Lindi, Gatwekera, and Silanga. The population of Kibera is composed of many different ethnic groups and social backgrounds. The predominant ethnic group varies by village, but the major groups that are represented include Luo, Luhya, Kikuyu, Kalenjin, Kamba and Nubian. At present, the dominant groups in Kibera are Luo and Luyia, although most landlords are Kikuyu and Nubian.

**Figure 4.1** Map of the Kibera slums



Over half of the households live below the poverty line (Sampson et al. 1997) but in reality the number of households experiencing poverty is much higher. The income level on which poverty lines are set in Kenya often ignores the cost of non-food essentials in urban areas, such as the cost of water, health care and education (Putnam 2001). For example, many poverty estimates are based on a cost of living of \$1 per day (80 shillings). While people in Kibera may earn more than 80 shillings per day, this is not nearly sufficient to cover other costs associated with life there. A study by Umande Trust (2000) used focus groups to collect information on the cost of various goods in Kibera, for an average family of five in Gatwekera, Kianda, Makina, Mashimoni, Kisumu Ndogo, Laini Saba and Soweto villages. People living on \$1-2 per day (80-160 shillings) still struggle to pay for the cost of essential goods and services, with family members combining their incomes and borrowing heavily in order to cover the cost of essential goods and services. This results in many families being heavily in debt. While these families are not officially living below the poverty line, they still struggle to meet basic needs, particularly food, health and education.

#### *4.3.2 Data Collection*

Research on the impacts of sack gardening on livelihood strategies was conducted over a period of seven months in late 2010 and early 2011. Data on the impact of sack gardening on people's livelihoods was collected using three methods that built on each other, including qualitative interviews with farmers, a household survey of farmers and non-farmers, and focus group discussions with farmers and non-farmers. Initial interviews were qualitative, open-ended interviews with 31 farmers from Makina and Mashimoni villages. Farmers were chosen for the qualitative interviews using purposeful sampling in order capture a wide variety of factors,

including the number of sacks farmed, as well as the age, gender, educational attainment and length of time farming of the urban farmers. Interviews took place at the farmers' houses and were conducted in Kiswahili by the first author and a research assistant. Farmers were informed about the purpose of the research project and permission was obtained to conduct and make an audio recording of the interview<sup>13</sup>. During the interview, farmers were asked a range of questions about their experiences with sack gardening in order to understand how they had begun sack gardening, the types of crops they grew, the benefits and challenges of gardening and any concerns they had about environmental risk.

Using the information from these initial interviews, we crafted and then conducted a survey of 306 households in 9 villages in Kibera (n= 153 farmers; 153 non-farmers). The survey asked more specific quantifiable questions about the how sack gardening was being used as a livelihood strategy, including questions related to the various capital assets, including human, financial, natural, physical and social capital. Sampling frames<sup>14</sup> of non-farmers and farmers in each of 9 villages in Kibera were created with the help of a local field assistant from each village. The assistants compiled lists of 35 farmers and 35 non-farmers in each village, and we randomly selected 17 people to interview from each list. The selected interviewees were contacted to confirm that they would be participating in the survey and to inform them of the time of the survey interview. Surveys were administered in Kiswahili with the help of four enumerators, all of whom were local university students.

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<sup>13</sup> Human subject clearance for this research was obtained from MSU's IRB, protocol number was 10-568; r036781.

<sup>14</sup> *Sampling frame* is a statistical term referring to a list of all individuals in a population that can be sampled.

**Table 4.1 Demographic overview of household survey.** \* Indicates a statistically significant difference between farmers and non-farmers.

	<b>Farmers</b>	<b>Non-Farmers</b>
Sample Size	153	153
Age (years)	34.4*	29.5*
Time in Kibera (years)	14.8*	11.6*
Family Size	5.2*	4.2*
Level of Education	Upper Primary	Upper Primary

Finally, we conducted focus group interviews with both farmers and non-farmers who had participated in the initial interviews and/or household surveys. Participants were invited to participate based on a stratified random sampling by village of the household survey and initial interview lists. Groups were divided into men and women, and farmer or non-farmer, and were made up of ten to fifteen participants per group. Because not all those selected were available to attend, the size of the focus groups varied somewhat, but were still representative. The focus group sessions were facilitated in Kiswahili by two local field assistants, a man and a woman, and the first author.

#### *4.3.3 Analysis of Data*

Initial qualitative interviews were recorded, transcribed, translated from Kiswahili and analyzed using thematic analysis using the software NVivo in order to determine the major themes that participants identified related to sack gardening as a livelihood strategy. Data from the household survey were analyzed using the statistical software package SPSS (Version 15). We used a series of independent t-tests and Pearson's correlations to test the significance of mean values between farmers and non-farmers at a 95% confidence level ( $p < 0.05$ ) for differences in the ways in which they engaged with natural, physical, financial, social and human capital to use sack gardening as a livelihood strategy. Focus group interviews were recorded and

analyzed in relation to the research questions, although no formal transcription or coding was carried out.

#### 4.4 Sack gardening as a sustainable livelihood strategy

Sack gardening is a livelihood strategy now pursued by thousands of households in the Kibera slums of Nairobi (Karanja and Njenga 2011). As discussed earlier, it is advantageous because it allows households to plant a large number of crops in a relatively small amount of space by taking advantage of the vertical growth of plants. The majority of farmers we surveyed grew a combination of four crops in their sack gardens: kale (*Brassica oleracea*), swiss chard (*Beta vulgaris*), known locally as ‘spinach’, green onions (*Allium* spp.), and coriander (*Coriandrum sativum*). A small number of farmers also reported planting pumpkin, harvested for the leaves, (*Cucurbita* spp.), tomatoes (*Lycopersicon esculentum* spp.), “managu” (*Solanum scabrum*), “nderema” (*Basella alba*), and “murenda” (*Corchorus* spp.). The last of these are indigenous African vegetables. Farmers who grow kale, swiss chard, onions or coriander all eat the crops that they grow. A smaller number also sell or share the crops (primarily kale and swiss chard). Of the farmers who sell their crops, about 80% sell the crops informally to friends and family while only 10 to 20% percent sell their crops to vegetable vendors or at their own vegetable stalls.

Sack farmers in Kibera have an average of five sack gardens, although this varies somewhat by village within Kibera. Land in the slum is extremely scarce. Thus, farmers with larger numbers of sacks tend to situate them on public or unclaimed land, rather than land owned by the household or their landlord. Many of these sack gardens are located in close proximity to a pit latrine, an open sewage drain, under a clothesline or next to a road. Farmers frequently

fence off their sack gardens in order to protect them from theft by people passing, livestock such as chickens, and from trash that is swept into the garden area. At the time of our household survey, farmers in Kibera had been planting sacks for an average of 1.6 years (19 months). Length of time gardening varied somewhat by village within the Kibera slums. Sack gardening was first introduced in Silanga, where farmers have been planting sacks for an average of 2.1 years, while farmers in Makina and Kianda have been planting sack gardens for the least amount of time, approximately 1 year.

#### 4.5 Assets of households practicing sack gardening

##### *4.5.1 Natural Capital*

Access to natural capital, including soil, water, and access to land was very challenging for many farmers in Kibera. While it did not deter them from planting sack gardens, they were often forced to plant fewer sacks than desired, or to forgo caring for their sack gardens because they could not get enough water to irrigate them.

*Soil-* Farmers obtained their soil from a variety of sources, including open fields near their house, old construction sites, the railroad that passes through the slums, old dumpsites, the riverbank and various other locations. The village where the farmers lived was roughly correlated with the source of their soil, with farmers from Mashimoni, Kisumu Ndogo and Soweto West being more likely to take soil from the nearby railroad or dumpsites, while farmers from Soweto East, Gatwekera, Laini Saba, Makina and Silanga tended to dig soil from open fields near their house. Only farmers from Gatwekera collected soil from the riverbank, as this village is located closest to the Nairobi River, which passes along the southern boundary of the Kibera slums. Nearly all



the farmers collected their soil for free, but about 5% of farmers paid to have someone transport the soil to their houses. These farmers paid an average of 50 shillings (0.063 USD) for the soil to fill a sack, with the cost ranging from 25 to 200 shillings per sack. Only about a third of farmers reported asking permission to collect soil from a location, while the others did not ask.

Collecting soil was a challenge for many farmers because soil is heavy, there are limited collection sites given the high density of the housing in the slums, and because it can be difficult to get permission to collect the soil from public land. During qualitative interviews, many farmers expressed concerns about being caught while collecting soil from the railroad, as this is an illegal activity. One farmer explained,

*“We usually get the soil from near the railroad. It’s not easy to go and dig the soil because it’s an offense if you are caught. We go to the railroad in the evenings, as if we are stealing, because if you go during the day and you are caught, you will be sent to jail.”*

Not surprisingly, most of the farmers we surveyed who collected soil from the railroad reported that they did not ask permission. A few people responded that they had gotten permission from a local official, but it is possible that these farmers reported getting permission because they felt uncomfortable admitting to an illegal activity.

*Water-* Obtaining water to irrigate their sacks was another a major challenge faced by farmers in Kibera. Because the government policy post-independence was to demolish informal settlements rather than provide infrastructure, Kibera still lacks major distribution outlets for water which results in frequent and acute water shortages throughout the slums. This has led to an informal water system, whereby people access water through small, individually owned pipes that are illegally connected to small mains that serve nearby residential areas. These pipes crisscross

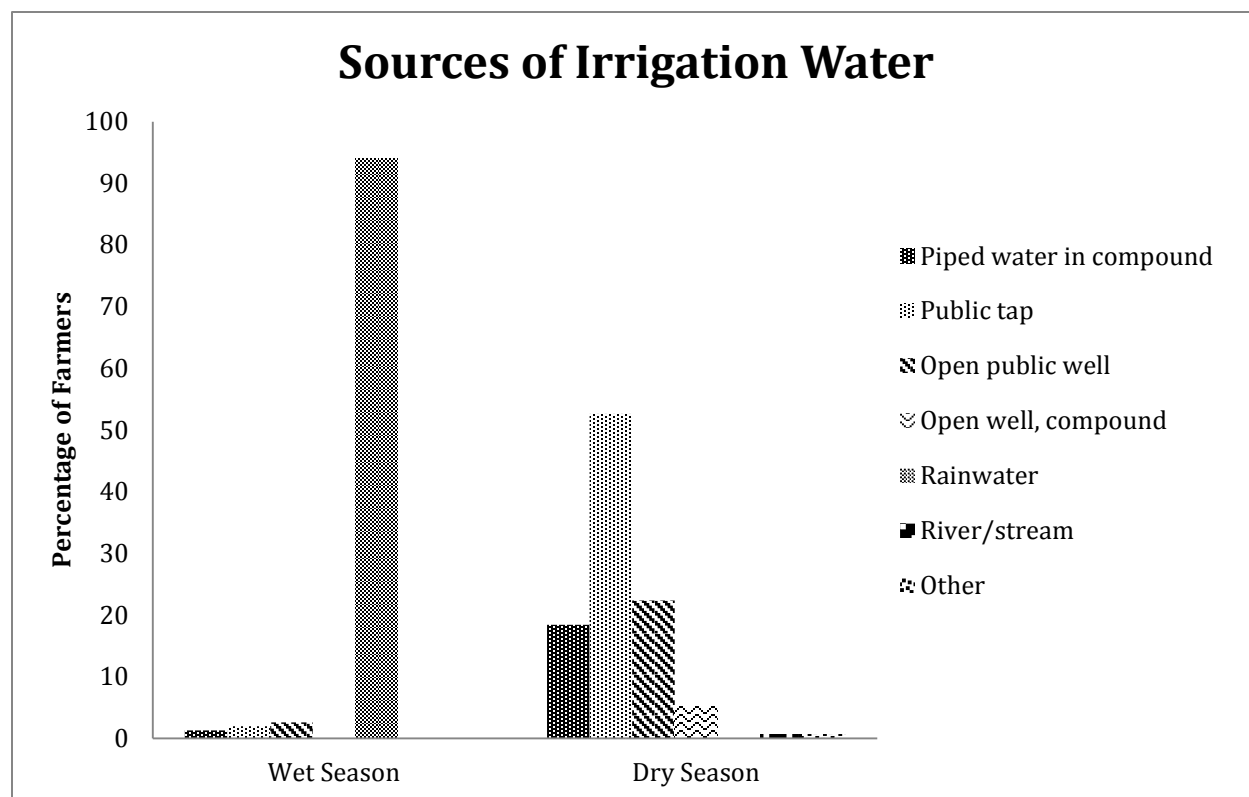
Kibera, passing through sewage-filled drainage ditches, or through people's homes. More than 85% of residents receive their water from water vendors, who have pipes connected to these informal systems. Because of the frequent water shortages, most water vendors have invested in large tanks which they fill to continue to provide water when taps run dry (Schipper 2000).

The price of water varies between villages but normally costs between 2-5 shillings (0.03-0.06 USD) per 20 liters. However, during times of prolonged water shortages, vendors will raise the price to 10-20 shillings (0.13-0.25 USD) per 20 liters. Findings from our focus group discussions indicate that during water shortages, the amount of time it takes to collect water also increases as many pipes run dry, and women often must wait several hours to collect water during these times. As a result of the increased costs and efforts required to obtain water during frequent water shortages, farmers often forgo irrigating their sack gardens in order to prioritize domestic water needs.

Irrigation water for sacks was obtained from a variety of sources, depending on the season (Figure 4.2). During the wet season, 94% of farmers relied exclusively on rainwater to irrigate their sacks, with the remaining farmers supplementing the rainwater with water from an open public well (3%), piped water in their compound (1%), or with water purchased from a public tap (2%). However, during the dry season, farmers were more dependent on water from other sources. More than half of farmers (53%) we interviewed purchased water from a public tap within Kibera, with the next most common sources of irrigation water being open public wells (22%) or taps within a housing compound (18%). The cost of irrigation water was a substantial issue for farmers. During qualitative interviews, many farmers discussed rationing water to their sacks multiple days per week because they were unable to afford purchasing irrigation water and because of water shortages in Kibera. During the dry season, farmers use an

average of 90 L per day on their sack gardens, at an average cost of 3 shillings for 20 L of water. However, depending on how severe water shortages were, water could cost up to 10 shillings for 20 L of water. Water cost significantly less during the wet season, with farmers purchasing water for an average of 1 shilling for 20 L of water. Overall, the cost of water could be substantial and during the qualitative interviews, a small number of farmers reported feeling it was too expensive to maintain their sack gardens during the dry season.

**Figure 4.2** Sources of irrigation water for sack gardens in Kibera during the wet and dry seasons



Few farmers reported using grey water from their homes in order to water their sacks because they were concerned about contaminating the food in their gardens with soap residue from washing clothes or doing dishes. Although grey water is likely safe to use, their concern likely stemmed from the training they received from the NGO Solidarités, which instructed them that soap residues would kill the plants in their sack gardens.

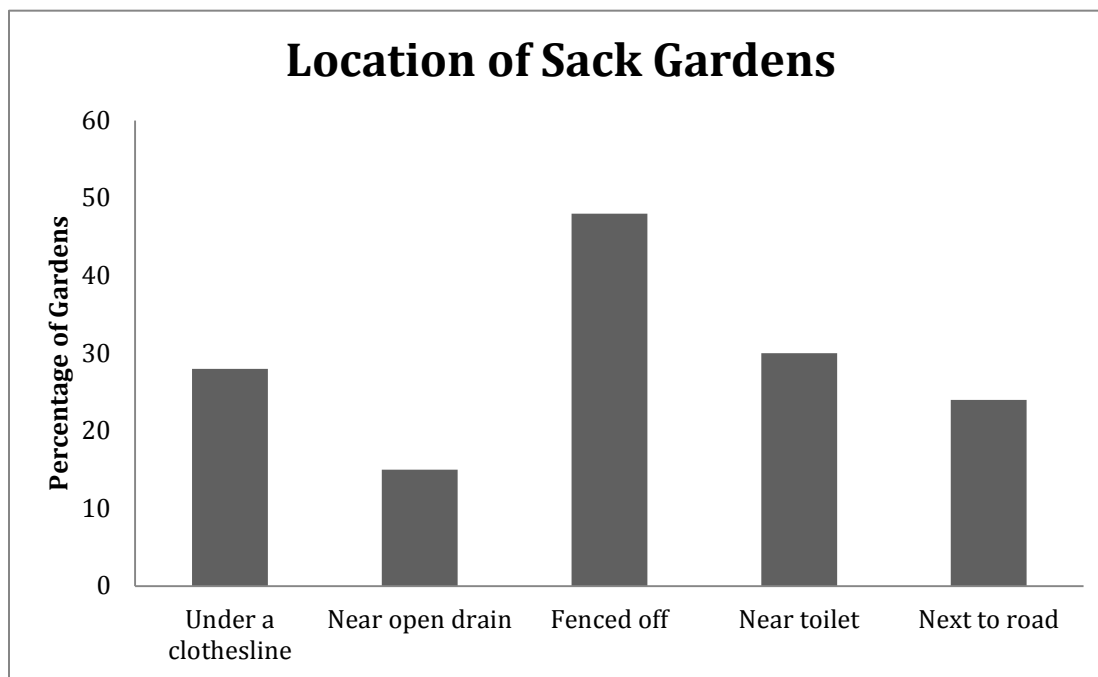
*Access to land-* During the qualitative interviews, nearly half of the farmers we spoke with said that finding enough space to put their sacks was a major challenge (Figure 4.3). Several farmers said that they would have planted a greater diversity of plants, particularly indigenous vegetables, if they had more room to build more sacks. In addition, a few women said they had taught their friends how to construct a sack garden, but their friends did not have enough space to actually build them. The lack of space in Kibera also meant that farmers often were forced to place their sacks in potentially unsanitary locations. Nearly 30% of farmers placed their sack gardens under a clothesline or next to a latrine, 23% of farmers reported placing their sacks next to a drainage ditch with raw sewage, and 25% of farmers placed their sacks next to a road (Figure 4.4). Lack of space may also lead to conflicts between farmers and their neighbors. As one farmer explained,

*“Our plots here in Kibera are very squeezed so sometimes you place your sacks on your neighbor’s doorstep. They may not be interested in building their own sacks, but they will pick your vegetables when you are not there. But I don’t quarrel with my neighbors because Kibera is very sensitive. Just one little thing can build and explode.”*

**Figure 4.3** Finding adequate space to place the sack gardens is one of the major challenges faced by farmers in Kibera. This row of sacks is shared by four different households and occupies the front yard (alley) shared by these houses. Photo by C. Gallaher, 2010.



**Figure 4.4 Location of farmers' sack gardens in relation to potential sanitation hazards in Kibera**



#### *4.5.2 Physical Capital*

In contrast to the difficulties reported in obtaining natural capital, farmers generally had an easy time acquiring the physical capital needed to participate in sack gardening in Kibera.

*Sacks-* Farmers obtained sacks from multiple sources. Sacks are generally made of a nylon mesh material, and are originally used for transporting grains such as rice and maize to shopkeepers. The sacks come in two sizes: 50kg and 90kg, referring to the quantity of grain originally shipped in the sack. Once the grains have been repackaged and sold, shopkeepers may sell the used sacks to residents of Kibera. About 80% percent of farmers purchased at least some of their sacks to build their sack gardens at an average cost of 20 shillings (0.25 USD) per sack. Nine percent of farmers already owned some of the sacks they used and about thirteen percent were given sacks by friends or family members. Sack farmers had an average of 5 sacks in their gardens, although this varied somewhat by village. Farmers in Gatwekera, Laini Saba, Kianda and Soweto West had an average of 6-7 sacks per household while in the other villages within Kibera, farmers had only 3-5 sacks per household.

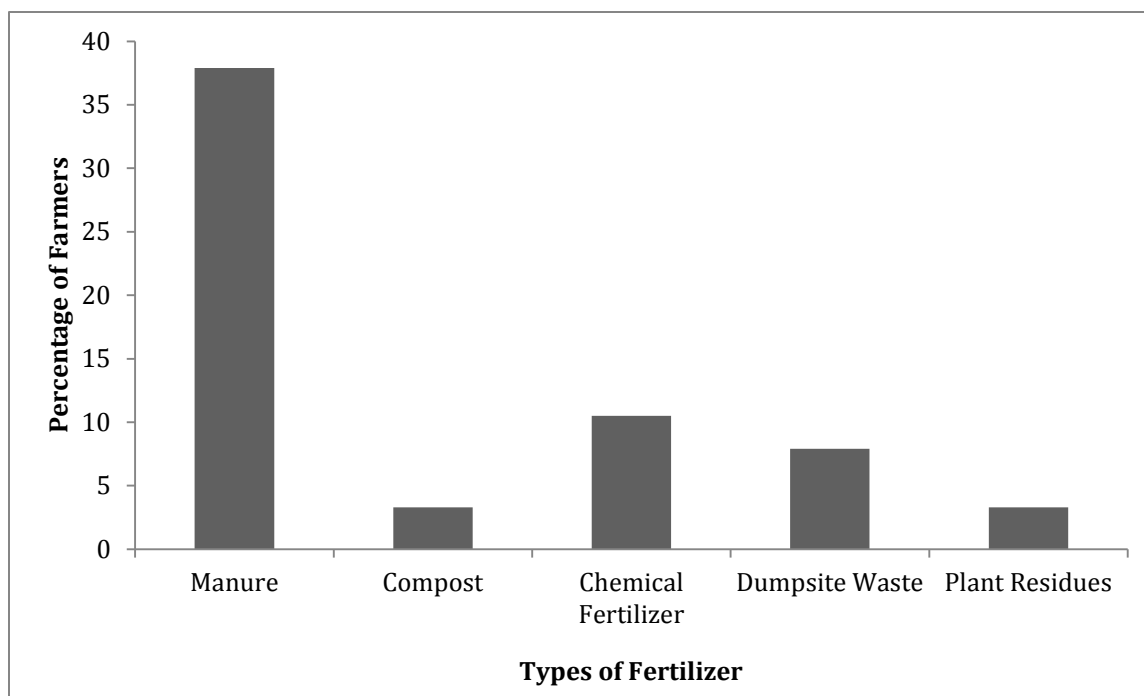
*Seeds-* Nearly all farmers reported obtaining seeds and seedlings for their crops from a local NGO (Solidarités), that has been active in promoting sack gardening within the Kibera slums. This NGO has offered free kale and swiss chard seedlings, and green onion and coriander seed packets, to all farmers who register with their organization. As such, many farmers who were trained by family members later registered with Solidarités in order to obtain the plant material. When Solidarités ran out of seedlings or seed packets, farmers then resorted to purchasing seeds/ seedlings from local markets. Anecdotal accounts also suggests that farmers have begun to plant



suckers (offshoots) from other farmers' existing kale plants rather than obtaining new seedlings from the Solidarités nursery. These suckers are considered to be a heartier variety of kale plants than those available from the nursery, and are less prone to diseases or insect damage.

*Fertilizers-* Farmers apply a variety of fertilizers to their sack gardens, including chemical fertilizers, compost, dumpsite waste, plant residues and manure from cows, goats, chickens and rabbits (Figure 4.5). Farmers often mix manure into the soil at planting, while other forms of fertilizer may be applied post-planting. Over one third of farmers apply manure to their sacks, while only ten percent use chemical fertilizers, and less than ten percent use compost, plant residues or waste from dumpsites. Farmers most commonly obtained manure from their friends and family or from Solidarités. Another common strategy was to purchase the manure as part of a group in order to bring down the cost of the purchase. During interviews, farmers often complained that manure is hard to get, so sometimes they chose to use compost or dumpsite waste instead. In these cases, farmers generally had their own source of these types of fertilizers. Chemical fertilizers were purchased by the farmers, or given to them by Solidarités. No farmers reported using night soil (human waste) to fertilize their sacks as they had been warned by Solidarités that this could spread disease.

**Figure 4.5 Fertilizer use among sack farmers in Kibera**



*Pesticides*- About 80% of all farmers applied some form of pesticides to their crops, sometimes applying combinations of different types of pesticides. The most commonly applied pesticides include chemical pesticides and ash. Ash was collected from charcoal stoves and sprinkled on leaves as a traditional form of pest control. About twenty percent of farmers interviewed had applied a different type of traditional pesticide, which involved mixing hot pepper, soap and garlic in a water solution and spraying it on the crops. Chemical pesticides were generally given to farmers by Solidarités or purchased as part of a group, where each farmer contributed 20 to 100 shillings for a tin of pesticides. In Mashimoni village, some of the women farmers we interviewed had formed a gardening group called the Big Five<sup>15</sup> women's group. This group is comprised of several neighbors who share space for their sack gardens and who help with agricultural labor, including carrying the soil for the sacks together, as well as planting, watering, and weeding. They also collaboratively purchase fertilizer and pesticides for their sacks, with the chairperson of the group purchasing and applying the pesticides to each member's sacks.

#### *4.5.3 Human Capital*

While sack gardening does not require any formal education, it does require a certain amount of knowledge related to farming and caring for plants. Thus, we hypothesized that households with stronger ties to rural agricultural areas or previous experience farming would be more likely to be involved in sack gardening.

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<sup>15</sup> The name of the women's group is a reference to the Big Five wild animals of East Africa animals, which include the lion, elephant, cape buffalo, rhinoceros, and leopard. These animals are known for being the fiercest and rarest of the wild animals in East Africa, and the name of the women's group was likely chosen to reflect this resilience.

*Previous Experience with Agriculture-* Both sack farmers and non-sack farmers who were interviewed as part of the survey had previous agricultural experience, although these experiences differed. The majority of farmers and non-farmers (85% and 75% respectively) have had previous experience with mixed farming in rural areas, mostly before they migrated to Kibera. A smaller number of households (13% and 7% respectively) were previously involved in some form of vegetable farming in urban areas. Overall, respondents with previous agricultural experience were more likely to currently practice sack gardening than were non-farmers. There was no significant correlation between whether or not a respondent had previous agricultural experience, rural or urban, and the length of time they have resided in Kibera, gender, and household wealth. However, older respondents were more likely to have had previous urban farming experience than were younger respondents. In terms of labor for sack gardening, the majority of farming tasks were carried out by women. Of the men farmers surveyed, nearly all received help from their spouse or children with some farming related tasks, including building the sacks, planting, weeding, watering, applying fertilizers and pesticides or harvesting the crops.

*Education-* There was no significant difference in the average level of formal education between household members of farmer and non-farmer households. However, beyond formal education, we did see a difference in terms of training related to sack gardening. Survey respondents received training about sack gardening from a variety of sources. About 86% of farmers received some form of training from Solidarités, and an additional one third received training from friends or family within Kibera. A small number (less than 5%) also received training from other NGO's, church groups, or friends and family outside of Kibera. About 12% of non-farmers

have also been trained by Solidarités, and 8% by friends or family in Kibera, but have chosen not to adopt sack gardening for various reasons. About 87% of farmers reported teaching someone else about some aspect of sack gardening.

About 75% of farmers first learned about sack gardening through Solidarités, with the rest of the farmers split equally between friends and family members (12.6% each). One farmer had learned about sack gardening from Mizuka, a youth group project outside of Kibera that has sack gardens and sells seedlings from its nursery. Comparing how farmers learned about sack gardening, by village, it is clear that Solidarités has had a stronger presence in some areas than in others. While Solidarités has been the only source of training in Soweto West, in farmers in Gatwekera were almost as likely to have learned about sack gardening from friends or family members as they were from Solidarités. This is most likely because sack gardening has had a much longer presence in Gatwekera, so farmers have had time to teach other farmers how to plant sacks.

*Building human capital-* An interesting issue that was raised repeatedly during the qualitative interviews was the extent to which sack gardening had contributed to the creation of human capital among farmers. Many farmers found sack gardening to be a beneficial activity because they were able to share the knowledge with their friends and family in Kibera or other parts of Kenya. A few farmers had already showed their relatives upcountry how to plant sack gardens, and some farmers had taught their children how to plant and maintain sack gardens. One farmer we spoke with explained that she had been frustrated when she saw her neighbor's young children picking leaves from her kale plants. But then she realized the children had been collecting small piles of soil and were pretending to plant her kale leaves into their 'garden'.

Through their play, these children were showing an interest in farming, so she was no longer upset they were harvesting her kale.

Related to an increase in knowledge about urban farming, farmers reported feeling proud or more confident as a result of sack gardening. They felt healthier, happier, and more confident because they were better able to provide for their families or share their vegetables with their friends. They also felt that sack gardening had given women more confidence because of the challenges they undergo as part of farming.

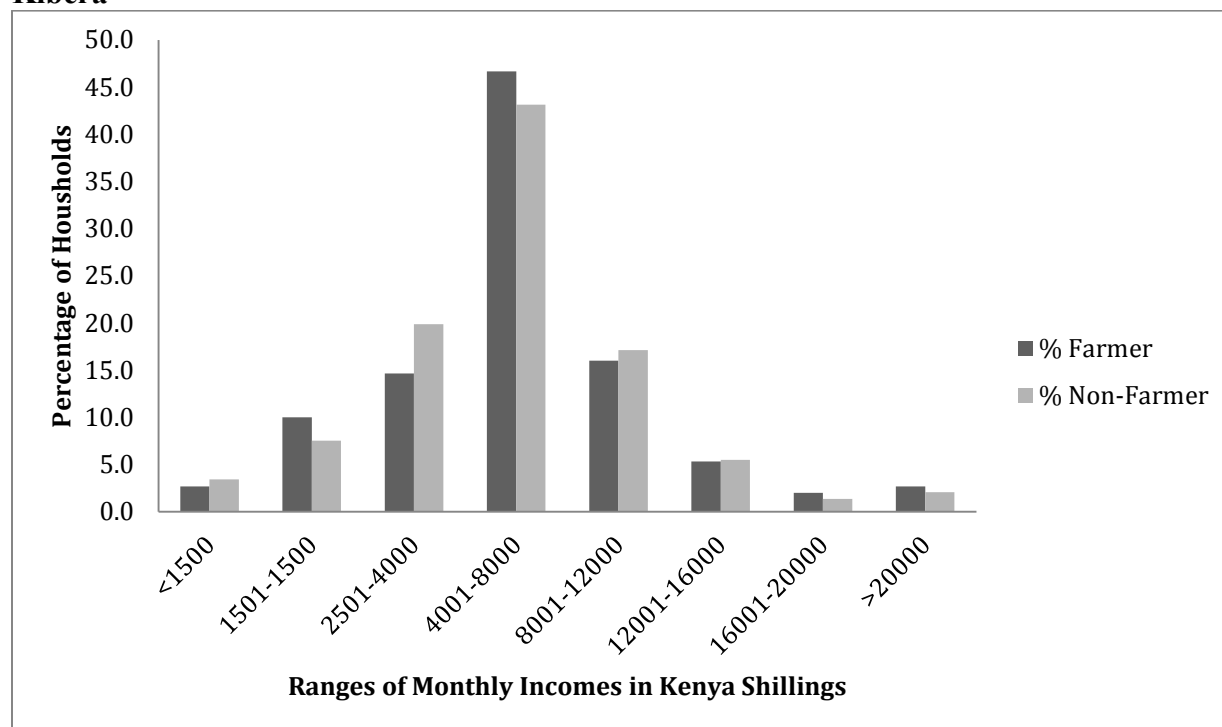
#### *4.5.4 Financial Capital*

As mentioned, in the context of urban agriculture, financial capital often refers to the financial resources available to start gardening, such as money to purchase soil, seeds, water and tools (Rakodi 2002). Asking households directly about their income and expenditures can be challenging because it is a sensitive subject and because people often have a poor understanding of their household's income and expenditures. Few urban poor have salaried employment, so household incomes fluctuate according to business revenues or the availability of casual labor. Likewise, prices for goods in the slums also fluctuate frequently. Thus, overall measures of household wealth are often approximated based on proxy assets, such as ownership of various household items, land or housing tenure, as well as expenditures on basic needs like food. Our survey compared financial capital available to farming and non-farming households to see what financial assets are available to these households and to see if sack farming had any impact on overall household wealth.

*Housing Tenure-* The longer a respondent has lived in Kibera, the more likely they are to own their home. This is because the housing market in Kibera is extremely tight, and most homes are owned by a small number of landlords. Only the families who have lived in Kibera for a long time, like the Nubian families, would be able to own homes there. However, families who rent their homes may have acquired some degree of wealth despite not owning their house or plot of land. The majority of households (93%) interviewed during the survey rent their houses, while only 6-7% were owners. We found no significant difference between farmers and non-farmers in terms of housing tenure. The average house in Kibera is 2 rooms, although frequently this is a single room that has been divided by a curtain into 2 separate living spaces. Interestingly, other measures of household wealth correlate poorly with housing tenure, but the length of residence in Kibera we found to be a strong predictor of housing tenure.

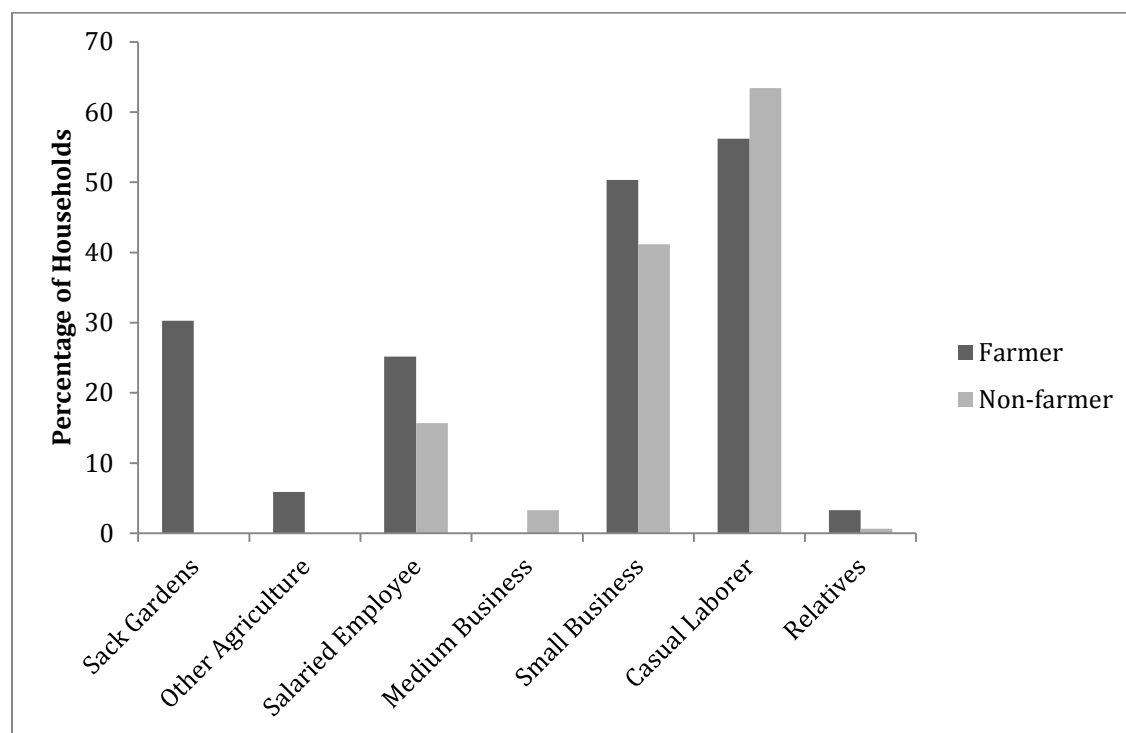
*Household Income-* Most households reported that they earned between 4000-8000 shillings (50-100 USD) per month. Reported household incomes ranged from less than 1500 shillings (18 USD) to more than 20,000 shillings (250 USD) per month (Figure 4.6). While we saw no significant difference in total household income between farmer and non-farmer households, the sources of this household income differed (Figure 4.7). The majority of households interviewed earned income from a small business or as casual laborers, and about 30% of farming households reported receiving some income from sack gardening. Farmers were significantly more likely to have a salaried employee contributing income to the household, and marginally more likely to have relatives contributing to household income, while non-farmers were significantly more likely to earn an income from medium to large sized businesses.

**Figure 4.6 Average Monthly Incomes for Farming and Non-Farming Households in Kibera**





**Figure 4.7 Sources of household income for farmers and non-farmers in Kibera**



### *Household wealth-*

Household income is not always a good indicator of the long-term financial well being of a household, especially since income can vary widely amongst households who depend on casual labor and small business, where the amount of income fluctuates (Deon and Pritchett 2001). Instead, researchers often measure long term household wealth by looking at proxy assets, such as whether or not a household owns a television, mobile phone, or radio, to assess the long term financial capital of a household. Our research asked about ownership of a set of items that have previously been identified as good indicators of household wealth in Kibera (Ngongo et al. 2007). These assets were assigned a weight based on the inverse proportion of the number of households that owned the item. Items that were more commonly owned were assigned lower weights than those that were owned by a smaller number of households. A household wealth index was then created by summing the weighted assets owned by each household.

We found no significant difference in household wealth between farmer and non-farmer households in Kibera. These findings were not surprising given that sack gardening contributes relatively little income to farming households. Additionally, interviews with farmers revealed that they were most likely to invest money earned from selling their vegetables on household expenditures, such as food or cooking charcoal, rather than on durable goods that were counted as part of a household's total assets. While sack gardening may be important financially to a household in terms of supplementing their food supply or providing extra spending money for things like school supplies for children, we were not able to demonstrate any impact on a household's long term wealth.

*Income spent on food-* The proportion of total income that a household spends on food is another important indicator of a household's financial capital. During our qualitative interviews, many farmers explained they had benefited from sack gardening by being able to get food from their gardens. Others expressed feeling more secure because they knew that if they did not have money to purchase food, at least they could pick vegetables from their gardens to eat or to sell in order to purchase flour or cooking fat. Our survey found that food is a major expense for most households in Kibera, with farmers and non-farmers spending 50-75% of their total income on food. On days that farmers harvest food from their sack gardens, they spend significantly ( $p = 0.000$ ) less of their total monthly household income on food compared to days they do not harvest. This indicates that farming does provide some financial savings to farming households.

*Savings-* A final important aspect of financial capital is savings. Many of the farmers we talked to viewed sack gardening as a means of saving money in their household budgets. One farmer, Beatrice<sup>16</sup>, began sack gardening in 2008 and had 7 sacks at the time of our interview. In addition to keeping some vegetables for home consumption, she was able to sell her vegetables once a week at the local market. She used the money she saved from not purchasing vegetables, and the extra money she earns from selling them, to buy household items like soap, cooking fat and flour. Beatrice felt she had benefited from sack gardening so much that she also formed a women's group that shared space for their sack gardens, and helped each other with labor such as watering and weeding the gardens. As this case illustrates, sack gardening has provided farmers with an opportunity to save money by setting aside the money they would normally spend buying vegetables in the market. Based on our qualitative interviews, farmers chose to save their

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<sup>16</sup> The names of all study participants have been changed to protect their identity.

money in different ways. Some women have set aside the money for an unspecified goal. Others save the money to buy household items, things like clothing, shoes, or pens for their children, or to pay their rent each month. Several farmers contribute their savings to microfinance organizations, called merry-go-rounds, and they use the loans from the merry-go-rounds to invest in household goods. One farmer we interviewed reinvested the money saved from her sack gardens to in her business. By investing her savings of a KSH 200 (USD 2.50), she was able to generate over KSH 1000 (USD 12.50) in profits by the end of the month from her dried fish business.

#### *4.5.5 Social Capital*

In the densely populated slum environment of Kibera, residents must navigate a complex landscape where people from different regions of Kenya, of different ethnicities, speaking different languages, must co-exist. People's lives are often governed by informal rules and regulations that dictate interactions between different groups of people. Social capital refers to norms and networks that enable people to act collectively, and these norms and networks draw upon notions of trust and reciprocity between individuals or groups of people. Our research investigated how people used social capital to facilitate sack gardening as well as whether or not sack gardening helped to strengthen farmers' social capital.

*Group Membership-* One measure of social capital is membership or involvement in different types of social groups. Farmers were significantly more likely to participate in a social group, agricultural or not, than were non-farmers. As part of sack gardening groups, farmers frequently discussed farming issues, shared the cost of farm inputs, received training together, and planted

or harvested together. Other social groups frequently centered around religious activities, contributions to a merry-go-round (microcredit organization), or other activities such as business training, with the most common group activity being a merry-go-round. Participation in all these types of groups allows members to meet new people and form new social networks within Kibera.

*Shared Farming Activities-* During our qualitative interviews, farmers reported that they now share their vegetables with their friends, and cooperate with other farmers by helping to carry soil for their sacks or buy giving them seedlings. They also bought water from each other, and consulted about different farming issues. Outside of participating in a social group, these activities were important in terms of helping to build friendships or cooperation. Farmers interviewed during the household survey were asked about whether they participated in a number of shared farming activities, including sharing seeds or seedlings, helping other farmers to carry soil for their sacks, helping to construct the sacks, sharing space for placing the sacks, and consulting each other about other farming issues.

Sharing seeds or seedlings with each other was negatively correlated with age, meaning that younger farmers tended to share with each other more than older farmers ( $p = 0.043$ ). It was also strongly correlated with the farmer's province of birth, which suggests that farmers tend to share seeds more with people of the same ethnic group ( $p = 0.018$ ). Sharing labor for constructing sacks was marginally negatively correlated ( $p = 0.064$ ) with household income, suggesting that poorer households tend to help each other to construct their sacks while wealthier households may be able to afford to pay someone to help them. Whether or not farmers owned the land their sacks were placed on strongly predicted whether or not they shared the space

where they placed their sacks ( $p= 0.002$ ). Shared garden spaces were more likely to be on public land, or land owned by another landlord, rather than on land owned by the farmer. Birth province was also marginally significantly correlated, suggesting that farmers were more likely to share garden space with farmers from the same ethnic group ( $p= 0.072$ ).

Importantly, farmers who were members of social groups that engaged in a wider variety of issues (e.g. farm training and religious activities) were also more likely to help with informal shared farming activities, including sharing seedlings, helping to carry soil, constructing sacks, and sharing space for planting. Finally, farmers were more likely to consult with other farmers about farming related issues if they first learned about sack gardening from Solidarités. This is likely because this NGO requires farmers to participate in training sessions together to learn how to construct and care for their sack gardens, which seems to facilitate forming social ties between the farmers.

*Relationship with their neighbors-* During qualitative interviews with farmers, many reported that sack gardening had strengthened friendships or cooperation amongst people in Kibera. Some farmers, they felt gardening was beneficial because they were now able to share their vegetables with their friends, while others cooperated with friends or neighbors by giving them extra seedlings, helping each other to carry soil or build their sacks, or by pooling money to buy fertilizer and pesticides. Sack gardening has helped to create a sense of community because it has given people reasons to talk to their neighbors. They buy water from each other, consult with each other about problems, and create employment for each other. Sack farming has been a way to bring the women of certain neighborhoods together, and according to one farmer, has decreased tensions between different ethnicities in Kibera. Following the post-election violence

of 2007 that took place between different ethnic groups in Kibera and throughout Kenya, it is significant that sack gardening has brought women of different ethnic groups together.

Respondents who were part of the household survey were asked to rate their relationships with their neighbors, from very good (speak every day) to poor (do not get along). Farmers reported having significantly ( $p = 0.003$ ) better relationships with their neighbors than non-farmers. In addition, almost one third of farmers (32%) reported that they now interact with their neighbors more frequently than they did before they began sack gardening. In Kibera, where it is normal for multiple households to share a single housing block, having a good relationship with your neighbors is important for a household's safety and survival, and is thus a good measure of a person's social capital.

*Exchanges of Goods-* Exchanges of goods and services between friends and neighbors in urban areas is another important measure of that household's social capital. Because our research demonstrated that sack gardening had strengthened friendships and improved many farmers' relationships with their neighbors, we expected that farming households might give and receive goods more frequently than non-farming households. We found significant differences in terms of the types of goods and services that households received from urban friends and neighbors. Farmers were significantly more likely than non-farmers to receive harvested goods (vegetables), labor for agriculture, and information from their neighbors. Both farmers and non-farmers were equally likely to receive cash, loans, cooked foods, or services such as child-minding. Not surprisingly, both farmers and non-farmers were more likely to receive goods or services from their urban friends or neighbors if they reported having a good relationship with their neighbors. Farmers who reported that their relationship with their neighbors had improved since beginning

sack gardening were significantly more likely to receive information, labor for agriculture, and cash loans from their neighbors. The greater availability of cash loans was particularly important because this demonstrates that farmers had improved their social safety net as a result of beginning farming.

Farmers were significantly ( $p=0.06$ ) more likely than non-farmers to give goods or services to their urban friends or family members. Non-farm households were significantly more likely to give their urban neighbors or friends cooked foods or other household items, while farm households were significantly more likely to give their neighbors information and harvested foods (vegetables). Farm households also gave their urban friends and neighbors a wider variety of goods than did non-farm households.

Farmers and non-farmers who report having a better relationship with their neighbors were more likely to give goods or services. Farmers with good relationships were more likely than those with bad relationships to give cash, cooked foods, and harvested foods, and loans, while non-farmers with good relationships were more likely to give cash loans or cooked foods. Amongst farmers who report an improved relationship with their neighbors since beginning gardening, they were also significantly more likely to give their friends and neighbors child care, labor for agriculture. This indicates a greater sense of trust and cooperation between these households and their neighbors.

#### 4.6 Summary and Conclusions

This research on sack gardening in the Kibera slums of Nairobi demonstrates that urban agriculture is a viable livelihood strategy that residents of the slum have successfully integrated with other existing urban livelihood strategies. Households draw on their capital assets in a



variety of ways as they practice urban agriculture. Farmers drew on both physical and natural capital to enable them to set-up and maintain their sack gardens. Physical capital, such as sacks and seeds, was relatively easy for farmers to obtain. However, insecure access to natural capital, including land, soil, stones and water, was one of the major limiting factors in determining how many sacks a farmer had, or whether they were able to begin farming. Farming households with greater human capital, mainly those with previous agricultural experience, were more likely to participate in sack gardening. Sack gardening also helped to build human capital by teaching farmers a new skill that they were able to share with others. In terms of financial capital, sack gardening did not have a significant impact on overall household wealth. However, it did contribute to household savings and was a source of additional income for approximately a third of the farming households. Finally, sack gardening positively contributed to farmers' social capital by creating stronger social networks between those involved in gardening groups, creating a greater sense of community, and by strengthening friendships between farmers and also between farmers and their non-farming neighbors. These findings have broader implications for urban agriculture in Kenya, and other developing countries, because they demonstrate that slum dwellers are able to successfully integrate sack gardening into their urban livelihood strategies, but that particular consideration must be given to access to natural capital if farming is to succeed.

In the context of increasing urbanization and the growth of urban poverty, development programs need to support a variety of livelihood strategies that are accessible to the urban poor to improve their overall well-being. While urban agriculture is often inaccessible to slum dwellers because they lack access to land, our research has demonstrated that low-space agriculture is a viable livelihood strategy for slum dwellers. This has implications for development policy not

just in Kenya, but in other areas of the world as well. However, if urban agriculture is to be viewed as a viable option for urban development and promotion of urban food security, more needs to be done for this to be formally recognized as a legal activity. In Kenya, although a new policy on urban agriculture has been drafted, urban agriculture is still considered an illegal activity by the Kenyan government (Foeken and Owuor 2008). As such, it does not receive the attention it deserves in the context of urban planning, agricultural extension, and overall development initiatives.

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## **Chapter 5- Urban agriculture, social capital and food security in the Kibera slums of Nairobi, Kenya**

*[Note: This chapter is a manuscript that is under review by the journal Agriculture and Human Values.]*

### **5.0 Abstract**

Much of the developing world, including Kenya, is rapidly urbanizing. Rising food and fuel prices in recent years have put the food security of the urban poor in a precarious position. In cities worldwide, urban agriculture helps some poor people gain access to food, but urban agriculture is less common in densely populated slums that lack space. In the Kibera slums of Nairobi, Kenya, households have recently begun a new form of urban agriculture called sack gardening in which vegetables such as kale and Swiss chard are planted into large sacks filled with topsoil. This paper examines relationships among sack gardening, social capital and food security in Kibera. We used a mixed methods approach, combining qualitative interviews with a household survey, as well as focus group discussions with both farmers and non-farmers. We present evidence that sack gardening increases social capital, especially for those households that undertake sack gardening in groups. We also find that sack gardening in the Kibera slums has a positive impact on household food security by improving household dietary diversity and by reducing the need resort to painful coping mechanisms that are used during food shortages.

## 5.1 Introduction

The first decade of the 21<sup>st</sup> century marked a major shift in the distribution of the world population. For the first time, the number of people living in urban areas outnumbered those in rural areas. Current estimates suggest that by 2030 the world will be over 60% urban, with most urbanization taking place in developing countries (UN Habitat 2003). Kenya is one such rapidly urbanizing developing country. With urbanization, the proportion of the urban population living below the poverty line continues to rise. Currently between a third and a half of Kenya's population live in urban areas, but by 2020 more than half of Kenya's poor population is expected to be urban. Levels of urban poverty continue to deepen, as the percentage of urban dwellers in the poorest categories, those considered to be 'food poor' and 'hardcore poor'<sup>17</sup> continues to rise (Taylor and Goodfellow 2009). Urban poverty can be particularly debilitating because while the rural poor are often able to obtain or produce their own basic needs such as food, water and shelter, the urban poor become increasingly dependent upon the cash economy to obtain these goods, rendering them more vulnerable. More than half of Kenya's total 'food poor' live in slum environments, where the poorest urban dwellers may spend up to 80% of their total income on food (Taylor and Goodfellow 2009). Rising food and fuel prices in recent years have made it increasingly difficult for the poor to afford food (Erulkar and Matheka 2007, Satterthwaite 2004, IRIN 2009).

While food insecurity historically was viewed as a result of inadequate agricultural production and food supply at the regional or national level, Sen (1981) showed that a

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<sup>17</sup> Taylor and Goodfellow (2009, p.2) define 'food poor' as the "inability to meet all nutritional needs due to expenditure on other basic non-food essentials" and 'hardcore poor' as "households that would not meet their minimum food requirements even if they allocated all their income on food".



household's food security status depends on its ability to access food by producing or purchasing it with its own assets. Deveraux and Maxwell (2001) characterize the causes of food insecurity in Africa in this way as well. Recent literature characterizes household livelihood strategies as an effort to combine different assets, or capital types, including financial capital and human capital but also natural capital (e.g. soil and water), physical capital (e.g. machines or tools), and social capital (social relationships that support productive efforts (Swift and Hamilton 2001, Bebbington and Perreault 1999).

In this paper we examine urban agriculture as part of livelihood strategies in the Kibera slums of Nairobi, Kenya. In densely populated Kibera a new form of urban agriculture called sack gardening has spread during the last several years, with farmers planting kale and Swiss chard<sup>18</sup> in sacks filled with soil<sup>19</sup>. Urban agriculture can be an important part of an urban livelihood strategy; various studies have demonstrated that it can have some impact on household food security, either by providing an additional income source, increasing dietary diversity, or helping to protect against seasonal unavailability in the food supply (Maxwell, Levin and Csete 1998, Vall and Shalizi 2006). An early study of urban agriculture in Nairobi (Freeman 1991) found that although active urban farmers were often part of the upper or middle class, farming by the urban poor was particularly important as it was frequently used to supplement household food consumption rather than as a business venture.

Within the context of the livelihood framework we focus in particular on interactions between urban agriculture and social capital as they contribute to food security. Social capital

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<sup>18</sup> In Kenya, Swiss chard is commonly referred to as spinach.

<sup>19</sup> Soil for sacks is collected from any available open spaces, such as open fields, former dumpsites, or next to the railroad. Farmers sometimes mix soil with manure before filling the sacks with the soil, poured around a central column of stones to improve filtration.

encompasses the social resources on which people rely when pursuing their livelihoods, including social networks, membership in groups, relationships of trust and reciprocity, and access to wider institutions of society (Rakodi 2002). Social capital can enable households to become urban farmers, helping them gain access to needed supplies and allowing them to work together for increased efficiency and security. Participating in urban agriculture can also influence a household's social capital. This relationship could be positive, for example if households work together as farmers and build stronger relationships, or it could conceivably be negative if a household farms alone, becomes more food secure, and neglects ties with neighbors who have become less important in the household's livelihood strategy. We will explore such relationships below. Social capital in turn can have other effects on food security independent of urban agriculture, for example by having people to turn to in times of need, or contacts through whom to gain employment (Swift and Hamilton 2001).

Following this introduction we briefly review the literature on urban agriculture in Sub-Saharan Africa and then we present a conceptual framework for examining the interaction of urban agriculture and social capital in contributing to household food security. We introduce Kibera, present our research methods, and then report our findings regarding the contribution of sack gardening to household food security and the interaction of sack gardening and social capital. We find that sack gardening in Kibera has positively impacted household food security by improving household dietary diversity and reducing the need for various coping mechanisms that are used in times of food shortages. We also find that sack gardening increases social capital among farmers.

## 5.2 Urban agriculture in Kenya and elsewhere in Sub-Saharan Africa

Urban agriculture is a feature of most if not all cities in sub-Saharan Africa, but the literature on urban agriculture is of relatively recent origin. People have been farming in African cities since these cities were born; however, colonial and post-colonial governments often discouraged or outlawed the practice of urban agriculture because it did not fit with their conceptions of modern cities. This resulted in very little attention to urban agriculture and little formal support.

Urban agriculture generally plays a smaller role in providing food security in very dense informal settlements such as Kibera with a shortage of land for farming (Crush et al. 2011). This has changed, however, with the recent advent of sack or vertical gardening. By planting vegetables into both the top and sides of sacks, farmers in Kibera can grow a large number of vegetables in the small spaces available to them (5.1).

**Figure 5.1** Sack gardens allow farmers to grow food in limited spaces by planting crops into both the top and sides of the sack. Kale and Swiss chard are the most commonly grown crops, and are advantageous because they can be continuously harvested by picking the larger leaves at the bottom of the stem and allowing the upper leaves to continue growing. Photo by C Gallaher, 2010.



Sack gardening has been practiced in a limited way for many years, but since 2008 it has spread greatly due to the availability of free seedlings and technical advice from a non-profit organization called Solidarités. Farmers, however, must purchase inputs such as fertilizer and water for their sacks, which can be costly for families with limited financial capital. Anecdotal evidence suggests that sack gardening in Kibera has had a positive impact on household food security.

Early studies of urban agriculture in Kenya were mostly descriptive in nature, focused on documenting who was involved in urban crop and livestock production and the ways in which urban agriculture contributed to household food security. These early studies clearly showed that agriculture was an important part of the urban landscape with a third or more of households practicing some form of agriculture (Freeman 1991, Egziabher et al. 1994, Maxwell 1995, Mwangi 1995).

The urban landscape of Kenya has changed greatly over the past two decades, with rapid urbanization and an increase in the population of the urban poor. It is now more important than ever to understand the contributions of urban agriculture to household livelihood strategies and food security, because many of the urban poor are unable to afford food, spending up to eighty percent of their household income on food (Maxwell 1996). However, there have been few recent studies on the contributions of urban agriculture to household food security in Kenya. More recent research on urban agriculture in Kenya has tended to focus on the broader contributions of urban agriculture to income generation and household livelihood strategies (Foeken 2006, Foeken and Owuor 2008) or the role of urban agriculture in nutrient waste cycling (Njenga et al. 2010, Karanja et al. 2010).

As sack gardening grows in popularity and spreads throughout Kenya, it is important to understand how people are using and potentially benefiting from this type of urban agriculture. Sack gardening has been discussed anecdotally in newspapers and books as being a beneficial activity (Pascal and Mwende 2009, Karanja and Njenga 2011, Ayieko 2008) but there have been no formal studies of its practice nor information about the extent to which it contributes to household food security.

A meta-analysis of 49 communities throughout southern and eastern Africa found that increasing poverty and conflict in many communities was linked to a decrease in social coherence and social capital, leading to increasing vulnerability and food insecurity in these communities (Misselhorn 2005). The high levels of food insecurity in Kibera likely reflect the intense levels of poverty and prevalent violence within the Kibera slums, along with a lack of livelihood strategies that allow households to meet their food needs. Urban agriculture is sometimes practiced as a community activity, and if sack gardening were to strengthen relationships among households, it could positively impact household food security beyond just providing an additional food source for the household.

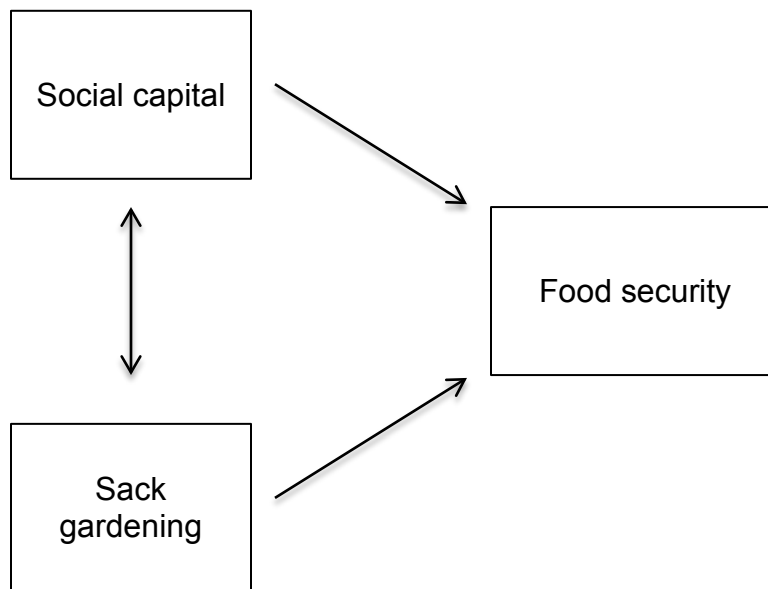
### 5.3 Social capital, sack gardening and food security

We examine the relationships among social capital, sack gardening and food security as characterized in Figure 5.2. We suggest that social capital and participation in sack gardening can affect each other, and that each in turn has its separate effects on household food security.

First, for a household to engage in sack gardening requires access to materials and inputs, including the sacks, seeds, soil, manure and water; it also requires space to locate the sacks and the ability to guard them against theft. These requirements can be achieved individually, but for

many people they will be easier with the help of others. For example, the NGO Solidarités provides seeds and sacks, so a relationship with Solidarités facilitates participation in urban agriculture. Similarly, topsoil is scarce in Kibera and at times households may obtain it through local organizations, such as churches or mosques. Topsoil is heavy, so transporting it may require assistance from a friend. Perhaps most importantly, space is very limited in Kibera, so much so that some households lack private space even to place a sack. Many households engage in sack gardening in groups using shared space.

**Figure 5.2** Relationships among social capital, sack gardening and food security



Second, households that work together in sack gardening may be expected to strengthen relationships with each other, thus building their social capital, particularly if their work is successful. These relationships in turn may enhance a household's livelihood and help it gain greater access to food. On the other hand, one might hypothesize that if a household becomes more self-sufficient in food thanks to sack gardening, it might allow its social capital to weaken due to reduced reliance on social networks to access food. In reality, however, such a situation is unlikely in Kibera, where sack gardens are small and serve more as a way for a household to fill gaps in its food supply rather than serve as a major food source (Karanja and Njenga 2011).

Other literature from a range of contexts tells us that building social capital is likely to have wider livelihood benefits. Studies have suggested that higher levels of social capital are related to improved economic development of communities (Midgley and Livermore 1998), decreased crime rates (Sampson et al. 1997), and a variety of positive health outcomes, including



improved child welfare and lower levels of teen pregnancy (Putnam 2001). In Ecuador, Bebbington and Perreault (1999) demonstrated that increased social capital was also correlated with improved community access to other important assets such as land, credit and new technologies.

Remarkably few studies have explicitly examined the relationship between food security and social capital. One study of food insecure households in Hartford, Connecticut, USA found that social capital was associated with decreased risk of hunger, even after controlling for various socio-economic factors (Martin et al. 2004). A study in Peru found that families with higher measures of social capital were more likely to be able to obtain food when they needed it (Díaz et al. 2002). Given that communities with higher levels of social capital have greater wealth and greater senses of trust and reciprocity, we expected to find that households in the Kibera slums with higher levels of social capital would correspondingly have greater measures of household food security.

In our research in Kibera we examine a third relationship more closely: the direct effect of sack gardening on a household's food security. Although sack gardening cannot provide all or even a large proportion of a household's food supply due to its small scale, it can play an important role in allowing access to leafy greens that otherwise would have to be purchased. In this way it can expand overall dietary diversity and the diversity of vegetables consumed, and it can alleviate the need to engage in various coping mechanisms associated with hunger. We examine these effects below.

## 5.4 Study Area

As the largest informal settlement in Nairobi, it characterizes some of the most challenging issues faced by residents in informal settlements in Kenya, and arguably the world, today. Kibera is located about 7 km southwest of downtown Nairobi, within the legal city boundary. It is East Africa's largest slum with approximately half a million residents occupying about 2.5 square kilometers, making it one of the most densely populated urban settlements in the world. Kibera is comprised of 10 to 13 'villages,' depending on how boundaries are drawn, many of which are divided along ethnic lines (UN Habitat 2009). For the purposes of this research, we recognized the following 10 villages in Kibera: Makina, Mashimoni, Laini Saba, Soweto East, Lindi, Silanga, Soweto West, Kianda, Gatwekera, and Kisumu Ndogo (Figure 5.3).

Over half of the households in Kibera live below the poverty line of one dollar per day (Erulkar and Matheka 2007), but in reality the number of households experiencing poverty is actually much higher. The income level on which poverty lines are set in Kenya often ignores the cost of non-food essentials in urban areas, such as the cost of water, health care and education (Satterthwaite 2004). Many poverty estimates are based on a cost of living of \$1 per day (80 shillings)<sup>20</sup>. While people in Kibera may earn more than 80 shillings per day, this is not nearly sufficient to cover other costs associated with life in the slum. People in Kibera living on \$1-2 per day (80-160 shillings) still struggle to pay for the cost of essential goods and services, with family members combining their incomes and borrowing heavily, leaving many families with heavy debt burdens. (Umande Trust 2007). Gulyani and Talukdar (2010) suggest that in reality more than three quarters of the households in Kibera live below the poverty line, when the

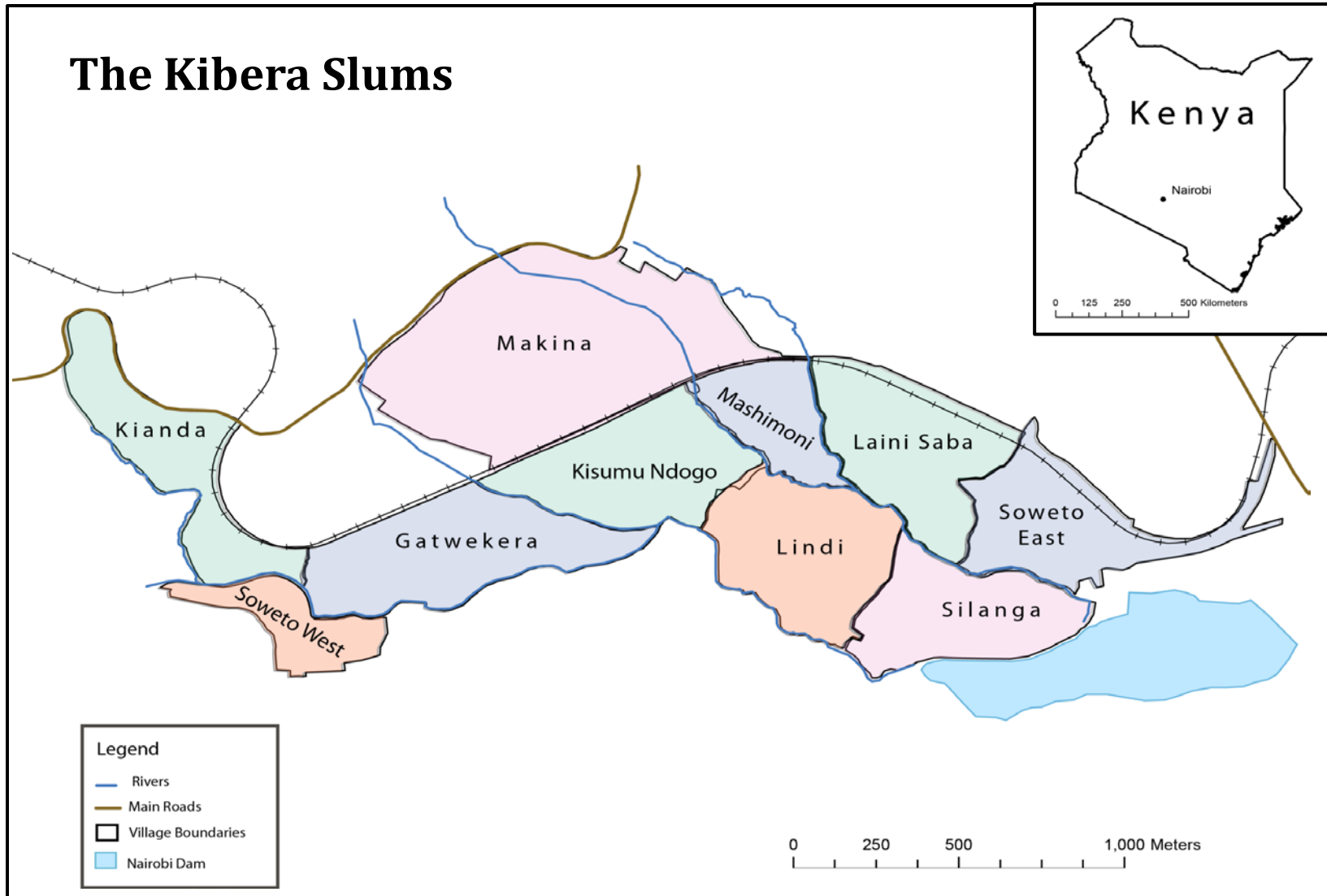
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<sup>20</sup> At the time of fieldwork in 2010-2011, the exchange rate was approximately 1 US dollar to 80 Kenya shillings.

poverty line is defined based on the urban poverty threshold set by the Kenyan government of 3,174 Kenya Shillings (KSH) per month (USD \$40), excluding rent.

Many Kibera residents began to garden after the post-election violence of early 2008, and sack gardening is now practiced by upwards of 5000 Kibera households (personal communication with Solidarités, 2010; Karanja and Njenga 2011). The great diversity of the Kibera slums allows comparisons to be made concerning the impact of sack gardening on household food security amongst a wide variety of household structures, income levels, and ethnic backgrounds.

**Figure 5.3 Map of Kibera** The Kibera slums are located in Nairobi, Kenya. Approximately half a million residents occupy about 2.5 square kilometers, making it one of the most densely populated urban settlements in the world. Kibera is comprised of 10 villages or neighborhoods.



## 5.5 Methods

The research presented in this paper was part of a larger study conducted during 2010-2011 that examined the impact of sack gardening on farmers' livelihood strategies, household food security, and exposure to environmental risks.<sup>21</sup>

### *5.5.1 Measures of social capital and food security*

There is no consensus on the best way to measure social capital because it involves trying to measure social structures and relationships, and it has been measured in a number of different ways in the literature, depending on the scale of interest. At an individual or household level, it is often measured using individual interviews or household surveys, at a community level by using household surveys or focus groups, and at a regional study by using case studies or key informant interviews (Krishna 2002). Measures of social capital need to be culturally relevant, so we chose to focus on exchanges of goods and services between households as well as the quality of relationships people had with their urban neighbors.

Measuring household food insecurity can be complicated. A number of methodological approaches are present in the literature, including measuring household production and purchases, measuring food consumption using 24-hour recall, or using indirect indicators such as rainfall and marketing data, or anthropometric measurements (Maxwell and Frankenburger 1992). Data for these measures are often time consuming to collect and unreliable. Thus, other types of indicators have been developed to measure household food security. One measure looks

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<sup>21</sup> Findings regarding exposure to environmental risk will be published elsewhere.

at coping strategies that households use when they do not have access to sufficient food (e.g. Maxwell 1996). Coping strategies consist of behavioral modifications such as eating foods that are less preferred, limiting portion sizes, and skipping meals. Our study measured coping strategies used by households using a tool developed by the USAID Food and Nutritional Technical Assistance (FANTA) Program (Bilinsky and Swindale 2010), that asks households whether they have used a series of 8 different coping strategies over the past year.

Another method for measuring household food security involves quantifying the diversity of the diet consumed by household members. Hoddinott and Yohannes (2002) examined dietary diversity in urban and rural sectors of ten developing countries, including Kenya. They found a strong correlation between dietary diversity and total food consumption, as measured by 24-hour caloric intake records. A one percent increase in dietary diversity corresponded with a one percent increase in per capita food consumption. Thus, they recommend that dietary diversity is a suitable proxy for measuring food security. We used a modified version of a tool developed by USAID FANTA to measure overall dietary diversity as well as the diversity of vegetable consumption amongst households in Kibera.

### *5.5.2 Research Design*

We used mixed methods to understand the impact of sack gardens on household food security in the Kibera slums, drawing on qualitative interviews, household surveys and focus group discussions with farmers and non-farmers (Cameron 2005, Dunn 2005). Farming households were defined as any household currently practicing sack farming, and the farmer was

the primary caretaker for the sack gardens. Non-farming households were not involved in any form of urban agriculture at the time of the survey.

Open-ended qualitative interviews were conducted in late 2010 with 31 farmers from Makina and Mashimoni villages within Kibera slums. Farmers were chosen for these interviews using purposive sampling, based on the recommendations of other farmers in the area, with the goal of interviewing people with a wide range of experience in terms of length of time gardening, number of sacks, age, and educational attainment. These interviews were conducted in Kiswahili by the primary author and a field assistant, were transcribed, translated into English, and analyzed for key themes using thematic analysis (Waitt 2005). During the interviews farmers were asked about a variety of issues including their farming practices and how they felt that gardening was impacting their ability to feed their families, and the variety of foods they were eating.

Information from the qualitative interviews was used to design a survey instrument that we used in a survey of 306 households (153 farmers, 153 non-farmers) in Kibera in early 2011. Households were selected using stratified random sampling of nine villages within the Kibera slums. Although there are ten villages in Kibera, one village (Lindi) was excluded for safety reasons. Local field assistants compiled lists of 40 farmers and 40 non-farmers from each village within Kibera, and 17 farmers and non-farmers were randomly selected for interviews from each village list. The interviews were conducted in Kiswahili by a team of four research assistants, plus local assistants who accompanied the research assistants to the households.

### *5.5.3 Survey Instrument and Qualitative Interviews*

In the qualitative interviews and the survey, households were asked various questions related to measures of social capital, including participating in informal or formally registered groups (e.g. religious groups, savings groups, or farming groups), their relationships with their neighbors, and exchanges of goods between rural and urban households. We measured their relationship with their neighbors by asking them to rate the quality of their relationship with their neighbors on a scale of 1 to 4, from 1=very good (speak every day) to 4=poor (do not get along).<sup>22</sup> We also asked farmers whether they thought their relationship with their neighbors had improved, stayed the same, or worsened since beginning sack gardening. Exchanges of goods between households were measured by asking whether or not, in the month prior to the interview, their household had exchanged items from a list of different goods and services with their rural relatives, urban relatives, or urban friends and neighbors. Goods and services included items such as cash, cash loans, child care, cooked foods, and harvested foods. We asked first about whether they had given these goods, and the frequency with which they were given, and then about whether they had received them.

The household survey used a variety of questions to assess household food security. The USAID FANTA program has created a set of survey tools designed to use food access as a measure of improved household food consumption (FAO 2003). The first component of these tools measures dietary diversity as a proxy for household food security. We measured dietary diversity using a 24-hour food recall, where foods consumed were categorized into one of 15 nutritionally unique food groups. Respondents were asked what they ate at each meal during the

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<sup>22</sup> Neighbor was self-defined by the respondent, but generally referred to people living in the same housing block or immediate vicinity.



previous 24 hours, including the ingredients used to prepare each meal. This information was used to quantify which food groups the respondent consumed. A total dietary diversity score was assigned to each respondent based on the total number of food groups consumed. We also compared the number of farmers and non-farmers who had consumed foods in each individual food group. In addition to measuring total dietary diversity, we measured the dietary diversity of vegetables consumed over the previous month. Respondents were asked whether or not they had consumed 17 different commonly eaten vegetables in the past month. They were also asked how frequently they consumed each vegetable, and how frequently during the month they were able to harvest this vegetable from their sack garden rather than purchasing it.

The survey also measured elements of coping strategies used by households during times of food insecurity by looking at months of inadequate food access over the previous year. Respondents were asked whether or not they had experienced a series of eight different situations where they lacked access to food, such as worrying about not being able to purchase food, skipping meals or reducing portion sizes (Gulyani and Talukdar 2010). Respondents were asked if they had ever experienced these scenarios, how frequently they experienced them, and if the children in the household experienced them.

Data from the household survey was analyzed using SPSS (Version 15). Using a series of independent t-tests and Pearson's correlations, we tested the significance of mean values (at a 95% confidence level) between farmers and non-farmers for indicators of dietary diversity, coping strategies, and social capital.

## 5.6 Findings

Establishing causality of relationships is very difficult in the social sciences, and even establishing directionality in statistically significant associations is difficult (Moser and Kalton 1971). For example, a finding that sack gardeners have stronger social capital than non-gardeners would leave unanswered the question of whether stronger social capital facilitated sack gardening or the reverse. In this section we present such associations between measures of a household's social capital and its participation in sack gardening, and between both social capital and sack gardening and well-being as in the model depicted in Figure 5.2. We draw on evidence from qualitative interviews to help interpret some of the findings.

We begin by describing our sample including demographic characteristics of sack gardeners. We present evidence suggesting that participation in sack gardening is associated with higher social capital, and then augment that evidence from the survey and from qualitative interviews that sack gardening contributes to improved social capital. We then present evidence that social capital is associated with improved well being including food security, and that participation in sack gardening is associated with greater household food security.

In our sample ( $n=306$ ), 90 percent of the respondents were female and 10 percent were male. This reflects that the majority of sack farmers are female, which is consistent with findings on urban agriculture elsewhere in instances when this form of agriculture is primarily a subsistence activity. When urban agriculture is more of a commercial venture, then it is more likely to engage men (Freeman 1991, Mudimu 1996, WinklerPrins and Souza 2005). Farmers were an average of 5 years older than non-farmers, with the mean age of farmers being 34.5 years and non-farmers being 29.5 years. There was no significant difference in the age of the males and females. The farmers we interviewed have lived in Kibera for a significantly longer

period of time (14.8 years) than non-farmers (11.6 years). However, there were more immigrants from rural areas among farmers (86.3%) than among non-farmers (81%). In addition, the average family size for farming households (5.15 people) is significantly larger ( $p < 0.001$ ) for than for non-farming households, with farming households (4.17 people). With larger families, households may be more drawn to an activity such as urban agriculture as a source of food to feed more people in their households. Smaller households with younger parents may be less likely to begin farming because they feel they are able to support their families with cash incomes alone. The mean level of education for all respondents was upper primary school.

For some farmers, sack gardening is a social activity in addition to being a strategy to improve food security. Fifty-three percent of farmers share space for their sack gardens with other farmers and 19% of farmers are members of a formal or informal gardening group. Farmers also report sharing in other activities, with 42% of farmers helping each other carry soil for the sacks, 52% helping to construct the sacks, and 75% consulting each other about farming issues.

### *5.6.1 Sack gardening and social capital*

#### *5.6.1.1 General association between sack gardening and social capital*

Farmers reported having significantly ( $p = 0.003$ ) better relationships with their neighbors than non-farmers. In Kibera, where it is normal for multiple families to share a single housing block, having a good relationship with neighbors is important for household safety and survival, and is thus a good measure of a person's social capital.

Another important aspect of social capital is the variety of exchanges that take place among households. Studies in developing countries have examined exchange networks between urban and rural families, with the assumption that urban families remit cash payments to rural areas, while rural areas contribute harvested goods to urban families (Baker and Aina 1995, Vall and Shalizi 2006, Linares 1996, WinklerPrins 2002, WinklerPrins and Souza 2005). However, as the population of urban areas grows, the exchange of goods between urban relatives, friends and neighbors is important as well. Farmers and non-farmers who were part of our study received goods or services from rural and urban relatives with equal frequency. However, farmers received goods from urban friends or neighbors marginally significantly more frequently ( $p = 0.086$ ) than non-farmers. Although all households tended to receive the same types of goods from rural areas and from their rural and urban relatives, there were significant differences in terms of the types of goods and services that households received from urban friends and neighbors. Farmers receive harvested goods (vegetables), and information from their neighbors significantly more frequently than non-farmers. Both groups received cash, child-minding, cooked foods, or loans with equal frequency.

An interesting finding concerns differences between farmers who undertake sack gardening jointly with their friends or neighbors as opposed to those who do so individually. Farmers who share space for sack gardening nearly always work together with other farmers to carry soil, construct their sacks, and share seedlings for the sacks. These farmers also report getting along better with their neighbors ( $p = 0.006$ ) than farmers who farm individual. Farmers who share space for their sack gardens are also significantly more frequently part of an informal gardening group ( $p = 0.007$ ) or another type of formal group ( $p < 0.0005$ ). Additionally, farmers who farmed individually exchanged goods and services with their rural and urban relatives or

urban friends no more frequently overall than non-farmers. These findings suggest that the act of working together as sack gardeners is what is most closely associated with measures of social capital as opposed to sack gardening per se.

We were unable to obtain data on how much private space for sack gardening each respondent had access to, but we did find farmers who share space more frequently have a smaller number of sacks than those who farm individually ( $\text{corr} = -0.141, p < 0.07$ ). This may signify that farmers who share space do so because they lack space of their own, but this correlation is significant only at the 10% level. Similarly, we found a weak negative association between household income<sup>23</sup> and some aspects of working together in sack gardening. A household's reported income was negatively and statistically significantly associated with consulting with others ( $p < 0.0005$ ), constructing sacks, ( $p = 0.028$ ), sharing seeds ( $p = 0.36$ ), and carrying soil ( $p = 0.06$ ), but curiously it was not correlated with sharing space.

#### 5.6.1.2 Evidence that sack gardening contributes to social capital

The evidence in the previous subsection only demonstrates a positive correlation between sack gardening and social capital. Evidence also suggests that sack gardening contributes to improved social capital. Farmers reported having significantly ( $p = 0.003$ ) better relationships with their neighbors than did non-farmers. While the previous section demonstrated that farmers who were part of a group had strong relationships with their neighbors, even individual farmers had a significantly better relationship with their neighbors than non-farmers ( $p=0.001$ ), which may result from sharing vegetables from their garden with their neighbors. In addition, 32% of

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<sup>23</sup> Because most of the respondents are casual laborers and do not have a fixed monthly salary, they were asked about their approximate monthly household income, and their responses were coded based on categories of fixed income ranges.

farmers reported that they now interact with their neighbors more frequently than they did before they began sack gardening.

During the qualitative interviews, many farmers reported that sack gardening had strengthened friendships or cooperation amongst people in Kibera. Some farmers felt gardening was beneficial because they were now able to share their vegetables with their friends, while others worked together with others by giving them extra seedlings, helping each other carry soil or build sacks, or by pooling money to buy fertilizer and pesticides. Sack gardening has helped to create a sense of community because it has given people reasons to talk with their neighbors. Thirty-two percent of farmers reported that they now interact with their neighbors more frequently than they did before they began sack gardening. They buy water from each other, consult with each other about problems, and create employment for each other. Sack farming has been a way to bring the women of certain neighborhoods together. As one farmer explained, *“Sack gardening brings women together... if it weren't for my kale, I wouldn't have a reason to talk to them... I would only talk to my customers. Now we buy water from others, creating employment and a sense of community here in Kibera.”*

Compared to those who farm alone, people who share space for sack gardening report more frequently that their relationships with neighbors have improved since they began sack gardening, though the correlations are only significant at the 5% level ( $p = .046$ )<sup>24</sup>.

#### 5.6.1.3 Effects of social capital on livelihoods and food security

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<sup>24</sup> Non-farmers were asked only about their current relationship with their neighbors, so it wasn't possible to compare individual farmers with non-farmers in this situation.

Studies elsewhere suggest that social capital contributes to economic development and household food security (e.g. Krishna 2001). Given that our data suggest that sack farmers have higher levels of social capital than non-farmers, we then explored the relationship between social capital and food security for farmers and non-farmers, looking at the exchanges of goods between households and their friends and relatives, as well as a respondent's relationship with their neighbors. Not surprisingly, both farmers and non-farmers more frequently reported receiving goods or services from their urban friends or neighbors if they reported having a good relationship with their neighbors. Farmers who reported that their relationship with neighbors had improved since beginning sack gardening reported receiving information ( $p=0.026$ ), labor for agriculture ( $p<0.000$ ), and cash loans from their neighbors ( $p=0.061$ ) significantly more frequently than other farmers. Receipt of cash loans is particularly important because it demonstrates an increase in trust between the farmer and their neighbors, thus improving their social safety net as a result of sack gardening.

The exchange of goods between households, particularly between urban friends and neighbors is related to improved household food security. Farmers and non-farmers who reported having a better relationship with their neighbors more frequently gave goods or services. Farmers with good relationships more frequently gave cash ( $p=0.048$ ), cooked foods ( $p<0.000$ ), and loans ( $p<0.000$ ) than other farmers, while non-farmers with good relationships more frequently gave cash loans ( $p<0.000$ ) or cooked foods ( $p<0.000$ ) than other non-farmers. Among farmers who reported an improved relationship with their neighbors since beginning gardening, they also reported significantly more frequently giving their friends and neighbors child care ( $p=0.015$ ) or labor for agriculture ( $p=0.027$ ). This indicates a greater sense of trust and cooperation between these households and their neighbors. Those who received a wider

variety of goods from their urban neighbors significantly less frequently reported being unable to eat what they wanted ( $p=0.053$ ), to eat a limited variety of foods ( $p=0.037$ ), to eat reduced portion sizes ( $p=0.065$ ), and to eat a reduced number of meals ( $p=0.052$ ).

To summarize the overall findings of this section, households with more social capital were more food secure than those who had less social capital. This suggests that neighbors provide a basic support system that prevents households from going without at least some food in times of need. People who participate in sack gardening were shown to have greater social capital than those who did not, possibly because of the opportunities that gardening creates for socializing with and sharing with other people. In this sense, gardening contributes more to food security than just the food harvested from the garden. It helps to create a social network that shares foods so that people do not find themselves in situations where they need to rely on coping strategies such as reducing portion sizes or skipping meals.

In terms of food security, there was a significant correlation between people who have a positive relationship with their neighbors and whether or not they were worried they would run out of food (Table 5.4). Respondents who had good relationships with their neighbors were less likely to be worried about running out of food, and they were also less likely to reduce the number of meals they eat. Farmers whose relationship with their neighbors had improved since beginning sack gardening less frequently reported being unable to eat the foods they want ( $p=0.035$ ), to eat reduced portion sizes at meals ( $p=0.041$ ), or to find themselves with no food in the house ( $p=0.002$ ). In addition, farmers who reported sharing harvested goods with their urban neighbors were less likely to eat a limited variety of foods. However, this relationship was not true for respondents who received harvested goods from their neighbors.



### 5.6.2 Direct effects of sack gardening on household food security

We examine effects of sack gardening on food security in terms of overall dietary diversity, diversity of vegetable consumption, and ability to avoid using painful coping mechanisms to manage food scarcity.

#### 5.6.2.1 Overall Dietary Diversity

We measured overall dietary diversity and diversity of vegetable consumption among farmers and non-farmers in the Kibera slums using the USAID FANTA Index. We found no significant difference in overall dietary diversity between the farming and non-farming households, all of whom consumed an average of 6.4 unique food groups in the 24 hours prior to the survey. Amongst the respondents of this survey, there was no significant correlation between dietary diversity and household wealth, the amount of money people spent on food, or the percentage of their income spent on food. There are several reasons why any potential increases in food security that may result from gardening would not show up in an overall dietary diversity index. First, food harvested from sack gardens would be classified only in the category of 'dark leafy green vegetables', which is a category of food that is eaten by most households in Kibera on a regular basis. Second, farmers who reported selling their crop to purchase other food items purchased larger quantities of commonly eaten foods, such as maize flour to make *ugali*, the staple starch, rather than purchasing food from a different food group, such as meat or fish.

In terms of individual food categories, there were few differences between farmers and non-farmers in terms of their consumption. The two exceptions were that farmers significantly more frequently reported consuming green leafy vegetables than non-farmers ( $p=0.033$ ) and

marginally significantly more frequently reported consuming fruits ( $p=0.090$ ). People who naturally consume more fruits and vegetables may be more inclined to plant gardens, or people who plant gardens may have easier access to these vegetables and thus be more inclined to eat them. Non-farmers consumed significantly more seafood ( $p=0.023$ ) than farmers, which suggests they may have been consuming *omena* (small dried fish) in place of kale or Swiss chard with *ugali*, a maize meal porridge.

#### 5.6.2.2 Vegetable Diversity

Leafy green vegetables are central to the diet of households in Kibera. A typical meal consists of *ugali*, a maize porridge, served with some type of leafy green vegetable (fried or boiled) and a simple meat stew if it is affordable. Many households consume vegetables at every meal, but most consume them at least once per day. Historically, Kenyans have eaten a wide range of vegetables including indigenous vegetables such as cowpea leaves, amaranth, and African nightshade (Table 5.1). Over the past several decades, especially in urban areas, these indigenous vegetables have been replaced by kale, Swiss chard, and cabbage, which are higher yielding and easier to harvest and thus much cheaper to purchase in the market. Indigenous vegetables, which were foraged from the wild, were also associated with poor, rural farming practices and were ignored by urban consumers. However, this trend is slowly beginning to reverse following campaigns that advocate the consumption of indigenous vegetables by enhancing consumers' nutritional knowledge and creating more favorable attitudes (Herforth 2010). The nutritional properties of these indigenous vegetables are very different than the newer varieties of kale, Swiss chard and cabbage. For example, amaranth is rich in lysine, an essential amino acid, and can be an important source of this amino acid for people who lack

access to meat or other sources of protein (Schippers 2000). People who eat a greater diversity of leafy green vegetables are likely consuming a more nutritionally balanced diet than people who eat fewer kinds of vegetables.

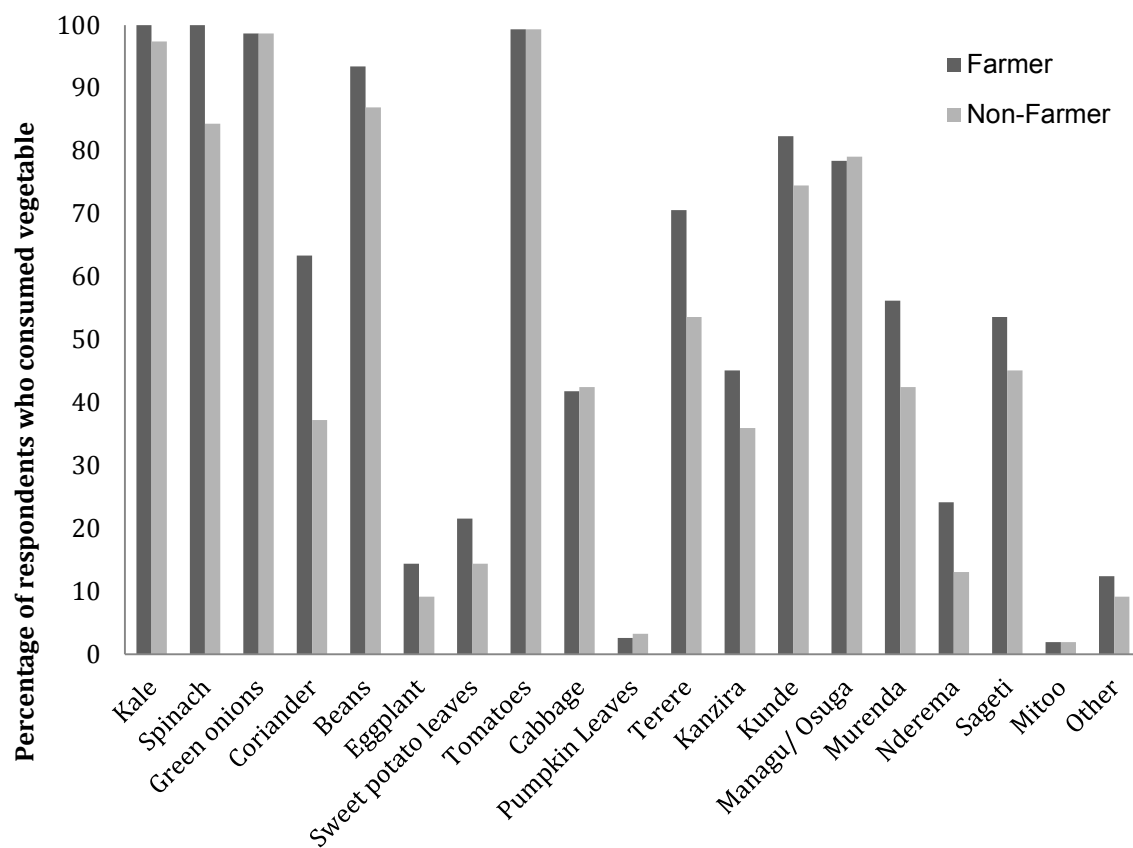
In addition to measuring the overall diversity of foods consumed by farmers and non-farmers, our survey asked respondents about consumption of a list of vegetables that we had identified during qualitative interviews as ones that are commonly consumed, and sometimes grown in sack gardens. These vegetables are listed in Table 5.1. Overall, farmers reported consuming a significantly greater diversity of vegetables than non-farmers ( $p < 0.001$ ) (Figure 5.4). In particular, farmers were significantly more likely than non-farmers to consume certain vegetables such as kale, Swiss chard, coriander, beans, *terere*, *kunde*, *managu*, and *nderema*. There were no vegetables that non-farmers were more likely to consume than farmers. Farmers and non-farmers who consumed any of these vegetables tended to consume them with the same frequency, with the exception of Swiss chard and coriander, which farmers consumed more frequently than non-farmers. Given that these two crops are commonly grown in sack gardens, farmers may be consuming them more frequently because they are readily available.

**Table 5.1** Commonly consumed vegetables in the Kibera slums. Sack farmers grow all of these crops but kale, Swiss chard, green onions and coriander are the most frequently grown. Crops are listed in order of importance, based on the percentage of households who consumed the vegetable in the month prior to the survey.

Common Local Name	Common English Name	Latin Name
<i>Sukuma wiki</i>	Kale	<i>Brassica oleracea</i> var.
<i>Spinach</i>	Swiss chard (spinach)	<i>Beta vulgaris</i> var.
	Green onions	<i>Allium</i> spp.
	Tomatoes	<i>Lycopersiconesculentum</i> var.
	Beans	<i>Phaseolus vulgaris</i> L.
<i>Kunde</i>	Cowpea (leaves)	<i>Vignaunguiculata</i>
<i>Managu/Osuga</i>	African Nightshade	<i>Solanumscabrum</i>
<i>Terere</i>	Amaranth	<i>Amaranth</i> spp.
<i>Dhania</i>	Coriander	<i>Coriandrum</i> sativum L.
<i>Murenda</i>		<i>Corchorus</i> spp.
<i>Saga/Sageti</i>	Spiderplant	<i>Cleome gynandra</i> L.
<i>Kanzira</i>	Ethiopian kale/mustard	<i>Brassica carinata</i>
	Cabbage	<a href="#"><i>Brassica oleracea</i></a> var.
<i>Nderema</i>	Indian Spinach	<i>Basella alba</i>
	Sweet potato (leaves)	<i>Ipomoea batatas</i>
	Eggplant	<i>Solanummelongena</i>
	Pumpkin (leaves)	<i>Cucurbita</i> spp.
<i>Mitoo</i>		<i>Crotalaria</i> spp.

While sack gardening does not appear to have had an impact on the overall dietary diversity of households in Kibera, it has positively influenced the diversity of vegetables that a household consumed. Part of the reason for that is that farming households are able to use money saved from selling vegetables or by not needing to purchase vegetables to buy other kinds of foods. During the survey, when asked how consumption of food from sack gardens affects their household, 87% of farmers stated that it saved money for the purchase of other types of foods, and 88% felt that their gardens provided them with extra food. As one farmer explained, *“One benefit of sack gardening is that when I harvest vegetables, I don’t have to buy them. I save the money I would have spent, and I can even buy fish.”* Gardening provides farmers with extra money, either from selling their crops or not having to buy them, and they use this money to buy staple foods (e.g. sugar, maize flour, cooking fat) and other kinds of vegetables. In qualitative interviews, farmers also suggested that gardening allowed them to buy the more expensive indigenous vegetables that they prefer from the market. Different indigenous vegetables are associated with different ethnic groups in Kenya, so people often have a strong cultural preference for particular indigenous vegetables (Herforth 2010). Because these vegetables are often more expensive than kale or Swiss chard, non-farming households may have been consuming fewer indigenous vegetables because they were less able to afford them than farmers.

**Figure 5.4** Diversity of vegetables consumed during one month prior to household interview. Farmers consumed a significantly greater diversity of vegetables than non-farmers.



### 5.6.2.3 Avoidance of coping mechanisms

The urban poor often lack access to food because they are unable to afford the kinds of foods they would prefer, or cannot purchase it in sufficient quantities. Thus, they develop various coping strategies, sets of actions that include limiting the variety or quantity of food they consume (Maxwell 1995), but also extraordinary measures such as migration, disposal of assets, consumption of highly unattractive items, and unlawful means of procuring food (Corbett 1988).

The urban poor who engage in urban agriculture often use it as a means to provide more food and reduce the need for other coping strategies. Therefore, we examined the impact of sack gardening in Kibera on household food security by looking at how frequently farmers experienced various coping mechanisms in the previous 12 months, as well as how households perceived their own food security. During the household survey, respondents were asked a series of questions to capture how food secure they felt their households were over the previous 12-month period. These questions asked about a range of scenarios that varied in terms of the severity of food insecurity, from simply worrying they might run out of food, to reduced portion sizes, to skipping meals, to going an entire day and night without food.

Overall, farmers and non-farmers both reported high levels of food insecurity over the previous 12 months. Over 95% of households reported worrying at some point in the last 12 months that their household would run out of food before they would acquire money to buy more. A majority of households reported using coping mechanisms such as eating foods they do not like, limiting the variety of foods they eat, reducing their portion sizes or the number of meals they eat. Additionally, more than half the households interviewed reported having no food in their house at some point over the last year, and nearly 20% reported going a whole day and night without food.

There was no significant difference between the number of farming and non-farming households that reported these individual events happening over the previous 12 months, with the exception of reducing the number of meals (Table 5.2). Significantly fewer farmers than non-farmers reported having to reduce the number of meals they consumed ( $p=0.059$ ). In addition, there was a marginally significant difference ( $p=0.070$ ) in the total number of coping mechanisms that households used during the previous year, with farmers using fewer of them than non-farmers (Table 5.3). Farmers reported using an average of 5.6 coping mechanisms over the previous 12 months, while non-farmers used an average of 6.1. This indicates that farmers were marginally more food secure than non-farmers (Table 5.4).

After indicating whether or not they had used these different coping scenarios over the past year, respondents were then asked to rank how frequently they occurred, ranging from never to always or nearly always in all months. Amongst households that experienced these different food insecurity scenarios, there was no statistical difference between farmers and non-farmers in terms of how frequently they occurred. In addition, there was no difference between farmers and non-farmers in terms of whether or not children in the household were affected.



**Table 5.2** The percentage of farmers and non-farmers who report using different coping mechanisms in times of food shortages during the 12 months prior to the survey. Significantly fewer farmers than non-farmers reported having to eat less (reduce their portion sizes).

	<b>Farmer</b>	<b>Non-Farmer</b>
In the past 12 months, did you ever worry that your household would run out of food before you would be able to get more money to buy or could acquire more food?	95	97
Were you or any household member not able to eat the kinds of foods you want because of lack of money? (e.g. no meat)	91	94
Did you or any household member have to eat a limited variety of food due to lack of money? (e.g. only ugali)	81	85
Did you or any household member have to eat less (portion size) in a meal than you wanted because there was not enough?	69*	76*
Did you or any household member have to reduce the number of meals eaten per day because there was not enough food (e.g. skip lunch)?	66	76
Was there ever no food to eat in your household because of lack of money to get food?	50	56
Did you or any household member go to sleep at night hungry because there was not enough food to eat?	42	46
Did you or any household member go a whole day and night without eating anything because there was not enough food?	20	25

**Table 5.3** Means and standard errors for all p-values reported in the text. For all tests, n = 306 (153 farmers, 153 non-farmers).

Variable	Mean ± S.E.		t	Sig.
	Farmer	Non-Farmer		
Demographics				
Family size	5.15 ±	4.17 ±	4.26	<0.001
Dietary Diversity				
Consumption of vegetables, fruits or seafood was part of the overall FANTA dietary diversity index, and was scored as 0 or 1 (not eaten, eaten) in the previous 24-hour period. Total veg diversity looked at number of vegetables consumed out of a list of 16 vegetables over the past 1 month.				
Consume leafy green vegetables	0.90 ± 0.024	0.82 ± 0.031	2.148	0.033
Consume fruits	0.16 ± 0.030	0.10 ± 0.024	1.699	0.090
Consume seafood	0.12 ± 0.027	0.22 ± 0.034	-2.278	0.023
Overall diversity of vegetables consumed	10.58 ± 0.190	9.16 ± 0.196	5.191	<0.001
Coping Strategies				
Coping strategies measure whether or not the respondent used the coping strategy in the 12 months prior to the interview.				
Reduce number of meals	0.66 ±0.038	0.76 ±0.035	-1.893	0.059
Reduce portion sizes for children	0.41 ± 0.041	0.48 ± 0.043	-1.628	0.105
Total number of coping strategies used	5.667 ± 0.212	6.189 ±0.196	-1.812	0.071
Social Capital				
Social capital was measured on a scale of 1-4, with 1 being a good relationship with their neighbors and 4 being a poor relationship. Exchanges of goods and services asked whether or not (0 or 1) houses had given or received goods in the previous one month.				
Relationship with neighbors	1.62 ± 0.039	1.78 ± 0.037	-3.024	0.003
Receive goods from urban friends or neighbors	0.88 ±0.026	0.81 ± 0.032	1.723	0.086
Give goods or services to urban friends or family members	0.92 ± 0.023	0.83 ±0.030	2.239	0.06

**Table 5.4** Correlation coefficients between measures of social capital and the use of various coping mechanisms, with significance (p-values). Significance at the 0.05 level is denoted in bold.

Coping Strategy	Measure of Social Capital		
	Good relationship with neighbors	Improved relationship with neighbors since farming	Received goods or services from neighbor
Worried will run out of food	0.121 <b>0.035</b>	0.100 0.222	0.095 0.163
Unable to eat desired foods	0.082 0.153	0.171 <b>0.035</b>	0.131 <b>0.053</b>
Eat a limited variety of food	0.046 0.421	0.084 0.303	0.141 <b>0.037</b>
Reduce portion sizes	0.062 0.283	0.166 <b>0.041</b>	0.125 0.065
Reduce number of meals	0.159 <b>0.005</b>	0.082 0.315	0.132 <b>0.052</b>
No food in the house	0.016 0.779	0.248 <b>0.002</b>	0.080 0.237
Sleep hungry at night	0.034 0.558	0.096 0.239	0.028 0.680
Go entire day and night without eating	0.053 0.356	0.082 0.313	-0.079 0.246

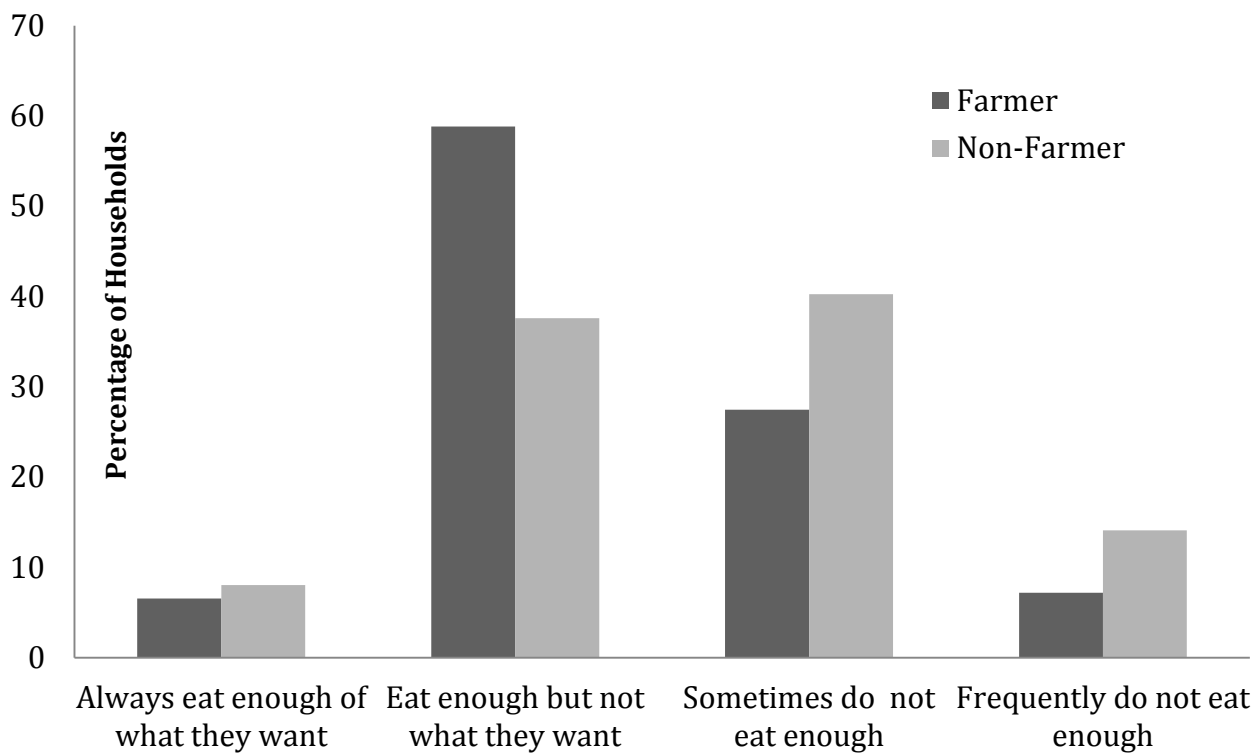
Different variables, such as household wealth or level of education, are frequently assumed to impact household food security. Not surprisingly, lower household incomes were correlated with all respondents' inability to eat the types of foods they wanted, eating a limited variety of foods, eating reduced portion sizes, reducing the number of meals consumed, having no food in the house, sleeping hungry at night, and going an entire day and night without food. For both farmers and non-farmers, the lower their monthly income, the less their ability to secure food for their households.

While most Kibera households are food insecure, sack gardening appears to have had a positive impact on household food security. By providing the household with extra food, or income from the sale of the crops, households are somewhat less reliant on other coping mechanisms such as reducing the quantity of food consumed at each meal. However, the extent to which sack gardens can contribute to overall household food security is constrained by the number of sacks that each household has. Because space is so limited within the slum, households in our study had limited space for sacks, planting an average of 5.3 sacks. These sacks supplement consumption or provide vegetables to sell, but not necessarily enough to alter behavioral patterns to a more significant extent.

Although the impact of sack gardening on household coping strategies is marginal, one important benefit of sack gardening is that it has provided farmers with a perceived sense of security in times of need. Over and over during qualitative interviews, farmers stated that a positive benefit of sack gardening for them was that they knew there was always a source of food to turn to if they ran out of other food in their house. As one farmer explained, when asked about the benefits of sack gardening, *"The first thing is that it helps a lot. I never go to sleep hungry, and even my children will never sleep hungry."*

As part of the household survey, respondents were asked to rate how food secure their household was during the month prior to the interview, on a scale of one to four. Farmers felt that their households were more food secure compared to non-farmers ( $p=0.005$ ). While over 90% of households reported experiencing some food insecurity in the month prior to the interview, farmers more frequently reported getting enough food to eat, just not necessarily the kinds they would like, while non-farmers more frequently reported that they did not get enough to eat (Figure 5.5).

**Figure 5.5** Self-reported food security over the one month prior to the interview. Farmers felt significantly more food secure than non-farmers.



## 5.7 Conclusion

Sack gardening is relatively new in the Kibera slums and was introduced to the area as a way to improve food security in a place where urban poverty is endemic. Although commonly accepted that it has improved food security, to date no empirical study has demonstrated that sack gardening has in fact done so, nor how. We were able to demonstrate that sack gardening has contributed to improved household food security directly. We also found that while there was not a significant change in overall dietary diversity, there was an increase in the variety of vegetables consumed, with farmers consuming more leafy green vegetables and fruit than non-farmers. In addition, farmers eat a wider variety of leafy green vegetables, including many indigenous vegetables, which have broader nutritional benefits and are culturally preferred to the kale, Swiss chard and cabbage, which are consumed by most households in Kibera. More importantly, farmers feel more food secure than non-farmers do. They more frequently reported being able to eat enough, and less likely to skip meals.

Sack gardening has also resulted in an increase in social capital, particularly for those households that undertake sack gardening together with others. This helps food security indirectly. Theories suggest that communities with greater senses of trust and reciprocity have greater social capital. Our findings support this, demonstrating that by helping to improve social capital, sack gardening has helped farmers to strengthen the social safety nets that help to provide them with assistance in times of need.

Although this study was conducted in a single informal settlement in Nairobi, it is one of the world's largest and most diverse slums, and we expect that this form of sack gardening would contribute to household food security in a similar manner in other densely populated slums elsewhere in the world, although the extent to which households benefit from sack gardening

may vary with the cost of inputs such as seeds, water and fertilizer. Worldwide, countries are undergoing rapid urbanization with the majority of population growth in urban areas taking place amongst the urban poor. The urban poor, particularly those living in informal settlements such as Kibera, often do not benefit from urban agriculture because they lack access to plots needed for farming (Tevera 1999). A recent baseline survey of urban agriculture in 11 cities across southern Africa found that very few poor residents practiced urban agriculture, partly because they lacked land to farm (Crush, Hovorka and Tevera 2011). Policies that promote types of low-space agriculture, such as sack gardening, that are more accessible to the urban poor have the potential to improve household food security as well as provide these households with alternate livelihood strategies.

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## **Chapter 6- Real or Perceived: The Environmental Health Risks of Urban Sack Gardening in Kibera Slums of Nairobi, Kenya**

*[Note: This chapter is a manuscript that is under review by the journal Ecohealth.]*

### **6.0 Abstract**

Cities around the world are undergoing rapid urbanization, often resulting in the growth of informal settlements or slums. In general, these informal settlements lack basic services, including sanitation, and are associated with joblessness, low-income levels, and insecurity. Families living in such settlements may turn to a variety of strategies to improve their livelihoods and household food security, including urban agriculture. However, given the lack of formal sanitation services in most of these informal settlements, residents are frequently exposed to a number of environmental risks, including biological and chemical contaminants. In the Kibera slums of Nairobi, Kenya, households practice a form of urban agriculture called sack gardening, or vertical gardening, where plants such as kale and swiss chard are planted into large sacks filled with soil. Given the nature of farming in slum environments, farmers and consumers of this produce in Kibera are potentially exposed to a variety of environmental contaminants due to the lack of formal sanitation systems. Our research demonstrates that perceived and actual environmental risks, in terms of contamination of food crops from sack gardening, are not the same. Farmers perceived exposure to biological contaminants to be the greatest risk to their food crops, but we found that heavy metal contamination was a more significant risk. By demonstrating this disconnect between risk perception and actual risk, we wish to inform debates about how to appropriately promote urban agriculture in informal settlements, and more generally about the trade-offs created by farming in urban spaces.

## 6.1 Introduction

Cities around the world are undergoing rapid urbanization, often resulting in the growth of informal settlements or slums within these cities. In general, these informal settlements lack basic services, and are associated with joblessness, low-income levels, and insecurity. Families living in such settlements may turn to a variety of strategies to improve their livelihoods and household food security, including urban agriculture (Baumgartner and Belevi 2001, Binns and Lynch 1998, Freeman 1991, Mwangi 1995). However, given the lack of formal sanitation services in most of these informal settlements, people who farm are frequently exposed to a number of environmental risks, including biological and chemical contaminants (Lee-Smith 2010, Mireri et al. 2007, Karanja et al. 2010b). This creates trade-offs between the potential benefits of urban agriculture as a means to increase household income and food security and the potential threats to human health, and here we report on one such case.

In the Kibera slums of Nairobi, Kenya, households practice a form of urban agriculture called sack gardening, or vertical gardening, where plants such as kale and spinach are planted into large sacks filled with soil. Kibera is one of the largest and most densely populated informal settlements in sub-Saharan Africa (Erulkar and Matheka 2007), and there is little open space for people to farm. Sack gardening allows households to take advantage of small open spaces to grow food by planting twenty to forty plants into the sides and top of a 50 kg sack of soil (Figure 6.1). Previous research has demonstrated that sack gardening has a positive impact on household food security in Kibera, and also serves to strengthen social capital amongst the farmers (Gallaher et al, nd).

**Figure 6.1** A young farmer with her sack gardens in the Kibera slums. She has planted kale into both the top and sides of the sacks to maximize space for growing this crop. Photo by C. Gallaher, 2010.



However, given the nature of farming in slum environments, farmers and consumers of vegetables grown in Kibera are potentially exposed to a variety of environmental contaminants due to the lack of formal sanitation systems. This is an issue both because of the potential health risks associated with the environmental contaminants, and because farmers may perceive these risks to be different than actual threats, resulting in a lack of action taken to mitigate the risks.

Farmers in Kibera are potentially exposed to a range of environmental contaminants through the soil they use to fill their sacks and the water used to irrigate their plants. Soil collected near the railroad, from old dumpsites or other industrial areas may be polluted with heavy metals, amongst a variety of other contaminants. Irrigation water, obtained from wells, city pipes, or water vendors, may contain heavy metals as well as biological contaminants. Long-term exposure to heavy metals has been linked to a number of diseases, including cancer, cardiovascular disease, and long-term neurological effects, with the main threats to human health from heavy metals being associated with exposure to arsenic, cadmium, mercury and lead (Jarup 2003, Khan et al. 2008, Muchuweti et al. 2006). Kale, the most commonly grown crop in the sack gardens, is extremely efficient in concentrating heavy metals in the leaves, the edible portion, of the plant (Itanna 2004a, Alloway and Jackson 1991), which makes potential exposure to heavy metals a real concern for farmers in Kibera. Another potential risk associated with farming in Kibera is the exposure to biological contaminants, particularly those of fecal origin, such as *Salmonella*, *Shigella*, *Escherichia coli* and *Klebsiella*. These most frequently contaminate food crops via contaminated irrigation water (Olayemi 1997, Karanja et al. 2010b). Exposure to these can lead to diarrheal diseases, including cholera and typhoid, which can cause death, particularly amongst children and the elderly (Rarneke et al. 1991).



People's perceptions of environmental risk are often quite different than actual measures of that risk. Previous research on risk perception in other locales has demonstrated that how individuals perceive risks is related to a variety of factors, including gender, level of education, household size and income, as well as a person's emotional involvement with regards to an environmental issue (Flynn, Slovic and Mertz 1994, Dosman, Adamowicz and Hrudey 2001, Okello et al. 2011). More importantly, people's tolerance for risk is strongly correlated with the perceived benefits of the risky behavior; the greater the benefit, the less concern about the risk (Wandel 1994). Initial interviews with farmers in Kibera revealed that some farmers had concerns about the safety of the food from their sack gardens, but their perceptions of the source of these environmental risks was very different than their actual risks we identified in this study.

The purpose of this study was to evaluate if participation in sack gardening exposes people to environmental risks, and the extent to which farmers understand these risks. Our research demonstrates that perceived and actual environmental risks, in terms of contamination of food crops from sack gardening, are not the same. Farmers perceived exposure to biological contaminants to be the greatest risk to their food crops, but we found that heavy metal contamination was a more significant risk to human health. By demonstrating this disconnect between risk perception and actual risk, we wish to inform debates about how to appropriately promote urban agriculture in informal settlements, and more generally about the trade-offs created by farming in polluted urban spaces.

## 6.2 Methods

### *6.2.1 Study Area*

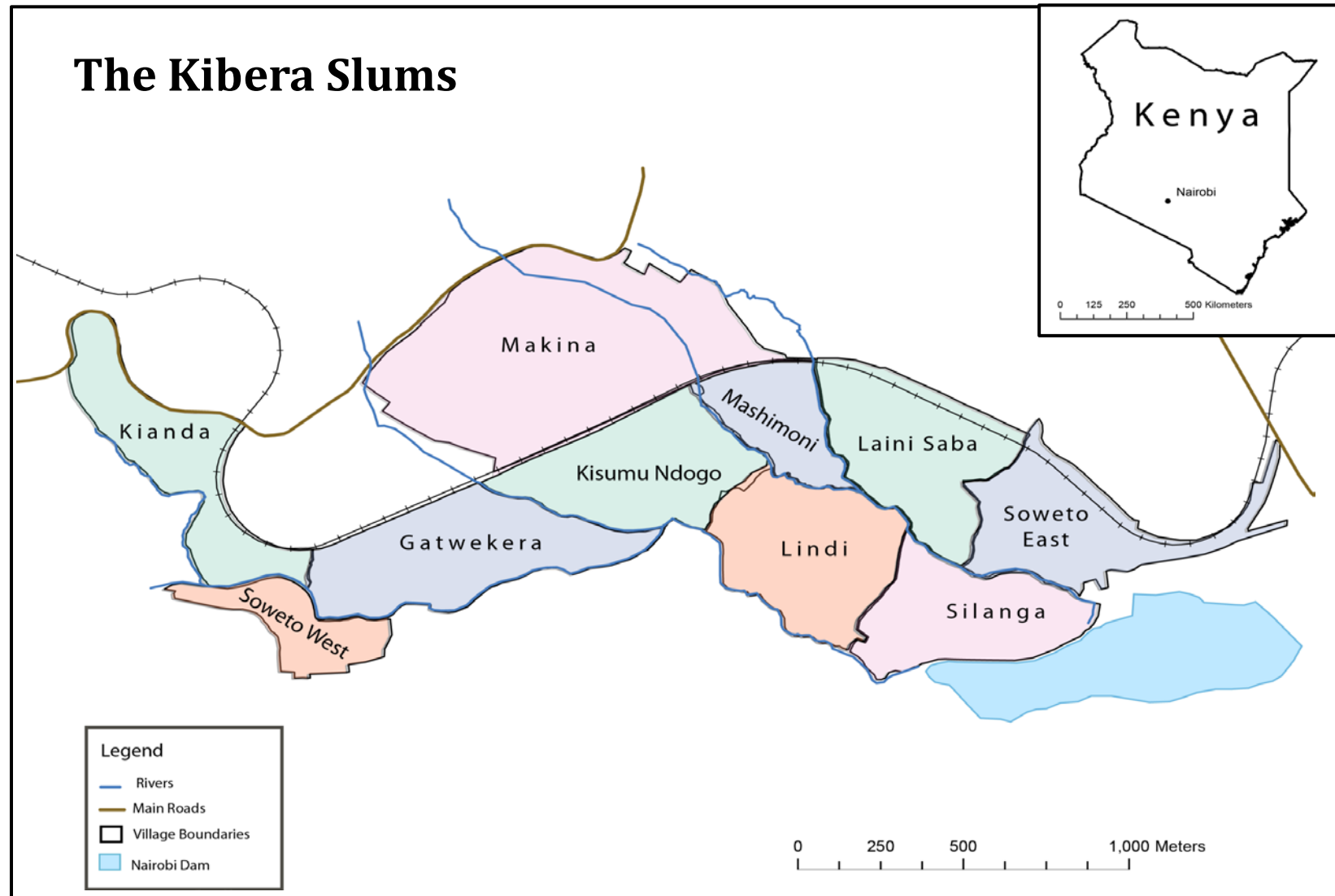
This research was conducted in the Kibera slums of Nairobi, Kenya. Kibera is located within the legal city boundaries of Nairobi, approximately 7 km southwest of the city center. It is one of the most densely populated informal settlements in the world, and East Africa's largest slum, with approximately half a million residents occupying about 2.5 square kilometers. Kibera is divided into 10 to 13 villages, depending on how boundaries are drawn, many of which are divided along ethnic lines (UN Habitat 2009). For the purposes of this research, we recognized the following 10 villages in Kibera: Makina, Mashimoni, Laini Saba, Soweto East, Lindi, Silanga, Soweto West, Kianda, Gatwekera, and Kisumu Ndogo (Figure 6.2). Residents of Kibera have participated in sack gardening for several years, with many beginning to garden after the post-election violence of early 2008 during which time there was an acute shortage of food in the slums. Soon after the riots a French non-profit organization called Solidarités dispersed free seedlings and technical assistance to start sack gardening. More than 5000 households in the Kibera slums are now involved in some form of sack gardening as a result of these efforts (Personal communication with Solidarités 2010; Karanja and Njenga 2011).

Like most informal settlements in Nairobi, Kibera lacks formal sanitation services, including reliable access to toilets and solid waste management services. Solid waste disposal is a major challenge for residents of Kibera, with less than 1% of households being served by a public garbage collection system in the slum. The lack of well defined solid waste disposal systems influences waste disposal patterns in the slums to a large extent. Most households dispose of their waste by dumping it in their own neighborhoods, or burning or burying it in their own compound. Others simply sweep the trash into the drainage ditches that cross Kibera, and

the trash continues to get swept or pushed downstream towards the river (Umande Trust et al. 2007).

Waste water disposal channels in the slum are no better, and often double as footpaths, areas for children to play, as well as major ventilation channels for the slums. These multiple uses, coupled with their open nature, inadequate sizes and poor maintenance and operation, results in extensive environmental pollution, health risks and danger to the inhabitants. Most residents dispose of waste water, or grey water, by dumping it into open drainage ditches outside their houses. These drains are also used as dumping points for both fecal waste from latrines and grey wash water from bathrooms. The outcome of these waste disposal patterns is open drains which are often filled with uncollected trash. This creates stagnant pools of water that form breeding grounds for mosquitoes, and attract large numbers of flies outside people's houses (Bickel et al. 2000). In addition, the drainage ditches are subject to overflowing when it rains, a significant problem during the rainy seasons. The overall lack of formal sanitation services means that residents of Kibera live and farm in surroundings with high potential environmental risks.

**Figure 6.2 Study Area.** The Kibera slums are located in Nairobi Province, approximately 7 kilometers from the city center. Kibera is informally divided into 10 villages and occupies approximately 2.5 square kilometers.



### 6.2.2 *Field Work*

Research for this study was conducted in late 2010 and early 2011 over a period of seven months. We used a mixed methods approach, which combined qualitative and quantitative interviews, and analysis of soil, plant and water samples to collect data about farmer perceptions of environmental risks, and exposure to heavy metal and biological contamination through sack gardening.

In the first phase of our project, we conducted 31 qualitative interviews with farmers from Makina and Mashimoni villages in Kibera.<sup>25</sup> The purpose of these interviews was to collect basic information on the experiences farmers had with sack gardening, including their perceptions of potential environmental risks. The qualitative interviews used open ended questions to assess what environmental risks farmers thought might affect their vegetables, and what actions they took to eliminate these risks.

Based on this information gathered from the qualitative interviews, we conducted a household survey of 153 farmers and 153 non-farmers in nine villages in Kibera in order to collect more detailed information about a variety of issues, including farmer's perceptions of environmental risk. The household survey compared perception of environmental risks between farming and non-farming households, including questions about the source of the pollution, efforts to mitigate risks, and concerns about food safety. As part of the household survey, farmers were asked whether they were concerned about contamination of the soil in their sacks and water used for irrigation. To measure risk perception, both farmers and non-farmers were also asked whether or not they believed food from the sacks could be contaminated by a variety of potential pollutants, including the soil, irrigation water, trash near the sacks, dust, flies, or

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<sup>25</sup> Human subjects in this research were protected under Michigan State University's IRB protocol # 10-568; r036781.

people urinating or defecating near the sacks. Both farmers and non-farmers were also asked whether or not they were concerned about eating vegetables from sack gardens, kiosks, or farmers, or if they had no concerns. Finally, respondents were asked whether or not they personally knew someone who had gotten sick<sup>26</sup> after eating vegetables from sack gardens, kiosks, or outside farms.

### *6.2.3 Plant, Soil and Water Analyses*

After completing the household survey, we selected a subset of farmers ( $n = 50$ ) from whom we collected soil, plant and water samples. Farmers were selected using stratified random sampling, with households stratified by the source of where they collected their soil (open field, railroad, river bank, dumpsite, and other) and then randomly selected in proportion to the actual number of farmers in the overall survey who had collected soil from these sources. Soil was sampled from each of the farmer's sacks, mixed and then a sub-sample of 500 g was collected for heavy metal analysis. Two samples of kale leaves (200 g and 300 g each) were also purchased from the farmer for heavy metal and total coliform bacteria analysis. Two water samples (500 mL each) from the source of irrigation water used for watering vegetables in the sacks was collected for analyses of heavy metals and fecal coliform bacteria. Samples were collected by a team of research assistants, placed in an ice chest, and taken to the laboratory for analysis the same day. Since most farmers reported purchasing piped city water for irrigation, only 11 total water samples were collected from different households.

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<sup>26</sup> Our survey did not define the term 'sick', but many respondents described it as having a stomach ache or getting diarrhea following the consumption of vegetables from a particular location.

Soil, plant and water samples were analyzed for a composite of heavy metals, including arsenic (As), cadmium (Cd), and lead (Pb), by the Crop Nutrition Laboratory in Nairobi. Plant and water samples were also analyzed for total coliform bacteria by Analabs Limited in Nairobi. Total coliform in water was determined using the most probable number (MPN) method, while total coliform for plant samples was determined based on a count of colony forming units (CFUs) at 30°C (Gronewold and Wolpert 2008).

#### *6.2.4 Analysis of Data*

Qualitative interviews were recorded, transcribed, translated and analyzed using thematic analysis (Waitt 2005), using the software package NVivo, in order to determine major themes raised by the participants related to their perceptions of environmental risk. Data from the household survey were analyzed using the statistical software package SPSS (Version 15). We used a series of independent t-tests and Pearson's correlations to test the significance of mean values between farmers and non-farmer for differences in their perceptions of environmental risk. One-way ANOVAS, t-tests, and Pearson's correlations, were used to determine differences in mean levels of heavy metal contaminants and total coliform bacteria counts between villages, and correlations between these levels of contamination and the sources of the farmers' soil and water.

## 6.3 Results

### *6.3.1 Perceptions of Environmental Risk*

About 38% of farmers expressed some concern about the quality of their soil. Most of these farmers were concerned that the soil used in their sack gardens was polluted in some way, while a smaller number were worried that the soil in their sacks was infertile. Of farmers concerned about soil quality, the most commonly cited sources of soil pollution were visible sources of contamination such as plastic bags and glass. A smaller number of these farmers named other sources of visible pollution, such as clothing, trash and other solid waste. Only one farmer had any concerns over chemicals in the soil. Overall, water quality was not a major concern for farmers, with only two percent of farmers expressing any unease about water pollution.

Farmers were worried that various pollutants could contaminate food grown in their sack gardens. More than two thirds of farmers were concerned about the impact of dust and flies on the quality of their vegetables, while fewer than twenty percent of farmers were concerned that the soil used in their gardens, trash, human waste or irrigation water would contaminate the food they grew in their gardens.

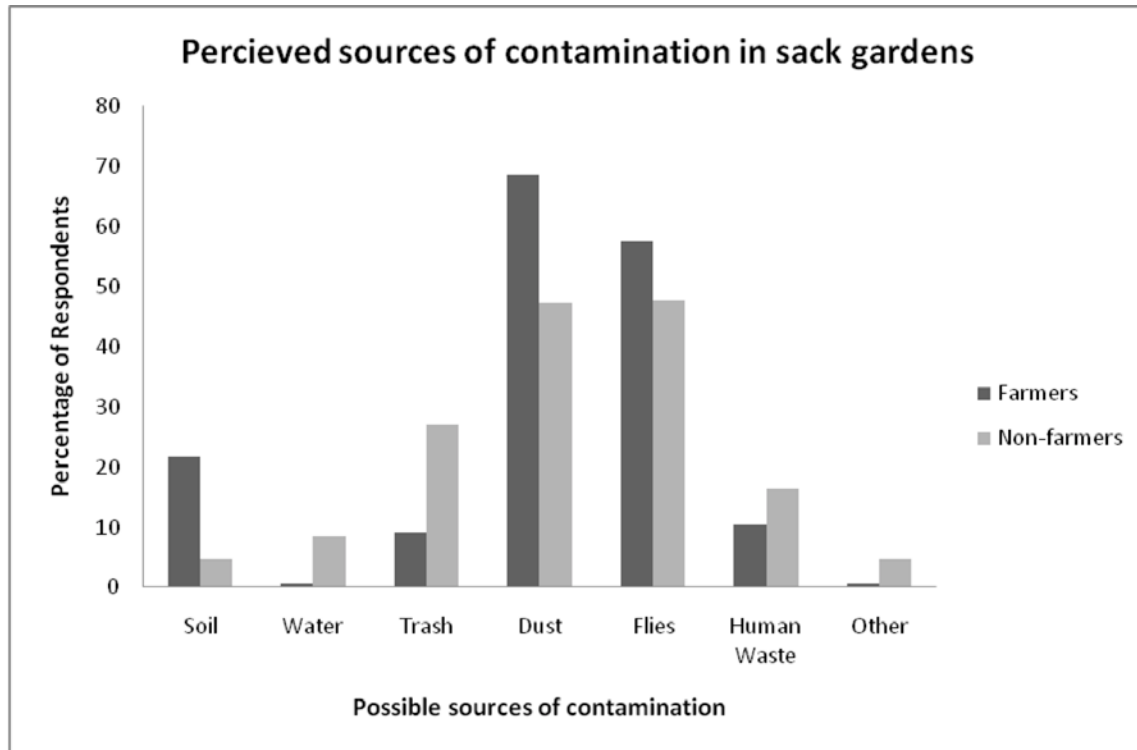
When asked whether or not different sources of pollutants could affect food from their neighbors' sack gardens, non-farmers also expressed concern that vegetables grown by their neighbors could be contaminated. However, their concerns were slightly different from those of farmers (Figure 6.3). Farmers were significantly ( $p < 0.000$ ) more concerned than non-farmers that the soil used in the sacks may contaminate the vegetables they grew, while non-farmers were significantly ( $p = 0.001$ ) more concerned than farmers about irrigation water contaminating the vegetables from the sacks. Non-farmers were also significantly ( $p = 0.001$ ) more concerned about the impact of trash on vegetables from the sack gardens, while farmers were significantly



more concerned that dust and flies would contaminate their crops. Both farmers and non-farmers were equally concerned that human waste would contaminate vegetables.

With respect to the safety of vegetables from sack gardens, farmers had almost no concerns while about ten percent of non-farmers were concerned about eating vegetables from sack gardens. Farmers were significantly more concerned about eating vegetables sold at local kiosks than were non-farmers. There was no significant difference between farmers and non-farmers in their concern about eating vegetables from farms. Those who did express concern about farms often referred specifically to vegetables from farms in a nearby area called Lang'ata where the farmers use wastewater to irrigate their crops. Overall, non-farmers were significantly ( $p = 0.044$ ) less concerned about eating vegetables from any outside source than were farmers. Farmers were significantly more likely ( $p = 0.007$ ) than non-farmers to know someone who had gotten sick after eating vegetables from kiosks or farms, and significantly more likely overall to know someone who has gotten sick from eating vegetables.

**Figure 6.3** Perceived sources of contamination of food from sack gardens. Farmers were more concerned than non-farmers about the impacts of soil pollution, while non-farmers were more concerned than farmers about trash or human waste near the sacks. Both farmers and non-farmers were concerned about dust and flies contaminating good grown in sack gardens.



### *6.3.2 Heavy Metal Contamination*

There was a significant difference in the levels of arsenic, lead and cadmium found in kale harvested from the different villages in Kibera, according to our analyses. Mean levels of arsenic (As) in kale varied substantially by village, from 0.01 parts per million (ppm) to 0.57 ppm (Table 6.1). Kale sampled from farmers sack gardens in Gatwekera, Makina, Mashimoni, and Soweto West exceeded the FAO's recommended limit for human consumption of 0.1 ppm (FAO and WHO, 2005). In particular, kale from Makina and Mashimoni villages exceeded the recommended limit by 300 and 500%, respectively. There is a significant correlation ( $p = 0.005$ ) between the level of arsenic found in kale leaves and whether or not farmers used dumpsite waste as a source of fertilizer for their plants. Farmers who used dumpsite waste had significantly higher levels of arsenic in their kale, with levels being approximately four times the levels of those who did not use dumpsite waste as a form of fertilizer. Arsenic is commonly used in pesticides, but there was no significant difference in the level of arsenic found in leaves from those farmers who use chemical pesticides, and those who do not, in our study. Therefore, the soil is a more likely source of this arsenic.

There was a significant difference in the level of lead found in the kale harvested in the various villages. According to the safety limits set by the FAO and WHO (2010), lead levels in kale exceeded the WHO maximum limits of 0.3 ppm in Soweto East, Makina, and Mashimoni villages, and were near the recommended limit in Silanga. Lead is often found in polluted soil, as a result of leaded gasoline that was used until the 1990's, or in irrigation water from lead in the pipes. While lead levels in kale were not strongly correlated with the source of the soil in the sacks, there was a significant correlation ( $p < 0.000$ ) with the source of the irrigation water.

Concentrations of lead in kale were highest in kale samples from those people who irrigated their sacks with water from pipes in their compound or water purchased from a water vendor.

There were no significant differences in the mean levels of cadmium (Cd) found in kale harvested from different villages in Kibera, with a mean level of 0.025 ppm and concentrations ranging from 0.00623 ppm to 0.0946 ppm  $\pm$  0.0201 ppm. Cadmium levels were highest in kale grown with soil collected from Kianda, Silanga, and Kisumu Ndogo villages. The majority of kale samples collected had levels of cadmium within the recommended maximum limit of 0.05ppm (FAO and WHO 2010). While cadmium levels in kale sampled were within the recommended safe limit (FAO and WHO 2010), they were still relatively high. Given that kale is large part of the Kenya diet, the concentration of cadmium may still pose some threat.

**Table 6.1** Levels of heavy metal contamination of soil, plant and water samples by village in the Kibera slums of Nairobi, Kenya. Heavy metals were measured in parts per million (milligrams per kilogram) and total coliform bacteria were measured as total counts of colony forming units per gram (cfu/g). In several villages of Kibera, samples of kale exceed the maximum safe levels of arsenic 0.1ppm and lead 0.3ppm in kale (shown in bold), according to standards set by the Food and Agriculture Organization (FAO and WHO 2010). Kale samples fell within the maximum safe level of cadmium, 0.05ppm.

		Soil (mg/kg)			Kale (mg/kg)			Water (mg/kg)			Kale (cfu/g)	Water (cfu/g)
Village	Sample Size (Soil/Kale, Water)	Arsenic (As)	Cadmium (Cd)	Lead (Pb)	Arsenic (As)	Cadmium (Cd)	Lead (Pb)	Arsenic (As)	Cadmium (Cd)	Lead (Pb)	Total Coliform Bacteria count	Total Coliform Bacteria count
Gatwekera	3, 1	6.970 ± 2.628	0.7167 ± 0.0937	33.27 ± 5.01	<b>0.1175</b> ± <b>0.1024</b>	0.01370 ± 0.00607	0.06169 ± 0.03378	> 0.01	> 0.01	> 0.01	7100 ± 12038	1600
Laini Saba	3, 1	4.909 ± 0.289	0.6816 ± 0.1701	35.20 ± 4.79	0.0100 ± 0.000	0.01281 ± 0.00255	0.13083 ± 0.00930				7413 ± 1232	--
Kianda	7, 1	4.997 ± 1.005	0.06601 ± 0.1276	31.28 ± 7.97	0.0206 ± 0.0184	0.03996 ± 0.2900	0.02196 ± 0.02392	> 0.01	> 0.01	> 0.01	131586 ± 157562	1800
Kisumu Ndogo	5, 2	30.976 ± 56.396	0.8268 ± 0.1769	91.80 ± 80.14	0.0286 ± 0.0265	0.02946 ± 0.01666	0.21028 ± 0.28022	> 0.01	> 0.01	> 0.01	3660 ± 4796	1800 ± 0
Makina	6, 1	5.081 ± 1.169	1.1429 ± 0.2646	185.64 ± 207.33	<b>0.3275</b> ± <b>0.3387</b>	0.02594 ± 0.02539	<b>0.54327</b> ± <b>0.34394</b>	> 0.01	> 0.01	> 0.01	8250 ± 17562	1800
Mashimoni	4, 0	6.974 ± 1.134	1.0029 ± 0.1286	95.18 ± 47.58	<b>0.5728</b> ± <b>0.1367</b>	0.02330 ± 0.01358	<b>0.58807</b> ± <b>0.25730</b>	--	--	--	75325 ± 149784	--
Silanga	5, 1	5.202 ± 1.114	1.1531 ± 0.4208	95.56 ± 46.70	0.0712 ± 0.1055	0.03829 ± 0.2191	0.027382 ± 0.22347	> 0.01	> 0.01	> 0.01	15840 ± 30400	0
Soweto East	10, 2	5.187 ± 0.605	0.9612 ± 0.5053	81.32 ± 61.26	0.0538 ± 0.0926	0.01453 ± 0.31655	<b>0.31655</b> ± <b>0.24902</b>	> 0.01	> 0.01	> 0.01	1920 ± 2568	900 ± 1273
Soweto West	7, 2	8.686 ± 1.078	0.9354 ± 0.4855	41.14 ± 16.03	<b>0.1474</b> ± <b>0.1719</b>	0.02294 ± 0.01582	0.03467 ± 0.02320	> 0.01	> 0.01	> 0.01	171471 ± 160303	901 ± 1271

### *6.3.3 Biological Contamination*

Samples of kale from farmers' sacks were tested for total coliform bacteria as an indicator of other possible biological contaminants, such as typhoid or cholera. The mean level of colony forming units (CFUs) present on the kale leaves was  $5.3 \times 10^4 \pm 1.1 \times 10^5$  cfu/g. While this does indicate a presence of biological contaminants, it is actually much lower than the mean level of total coliform bacteria found on kale purchased in other parts of Nairobi, including peri-urban farms ( $2.6 \times 10^5 \pm 5.0 \times 10^5$  cfu/g), wet markets ( $4.6 \times 10^6 \pm 9.1 \times 10^6$  cfu/g), supermarkets ( $2.6 \times 10^6 \pm 2.7 \times 10^6$ ) and high end specialty stores ( $4.7 \times 10^5 \pm 8.9 \times 10^5$ ) (Kutto et al. 2011). Thus, in comparison to kale that residents of Kibera may purchase, the kale they grow in their sacks poses less of a health risk in terms of biological contamination. The irrigation water sampled had minimal levels of total coliform bacterial contamination.

## **6.4 Discussion**

### *6.4.1 Perceptions of Environmental Risk*

Overall, farmers recognized various possible health risks associated with farming in Kibera. Their primary concerns focused on visible contaminants that they believed could lead to immediate illness, such as diarrhea or typhoid. During the household survey, farmers indicated some concern over the quality of the soil used in their sack gardens. Their concern was likely because they collected soil for their sacks from contaminated sites and many farmers reported removing trash, plastic bags or glass out of the soil prior to filling their sacks with it. Because the majority of farmers irrigated their sacks with the same water they purchased for other

household uses, including drinking and cooking, they did not associate any level of risk with their irrigation water.

During the qualitative interviews, farmers frequently discussed risks they associated with farming. In particular, farmers described dust blowing onto the vegetables, trash in the nearby waterways and flies landing on the vegetables as sources of contamination that could lead to a variety of problems including stomach aches, diarrhea, vomiting, cholera, typhoid or parasites. These concerns were consistent with the findings of the household survey, which suggested that farmers and non-farmers were most concerned that food from their sacks would be contaminated by dust and flies. However, farmers generally felt that the benefit of increased household food security was worth the risk of becoming ill. As one farmer from Kibera explained, *“As you know, when you harvest the vegetables you must wash them so you can cook them... you may still suspect they are dirty and can make you sick, but you just assume that there is no problem...you just ignore it and then you can eat without any problems.”* The type of trade-off that this farmer described is consistent with the risk perception literature, which suggests that the greater the perceived benefit from an activity, the greater the risk a person is willing to take (Wandel 1994).

While both farmers and non-farmers were concerned with the safety of food grown in sack gardens, they perceived the sources of the pollution to be different. Farmers were more concerned than non-farmers about pollution from the soil, dust and flies, while non-farmers were more concerned than farmers about pollution from irrigation water, trash and human waste. These differences are likely due to farmer’s familiarity with the process of growing food, and their sense of control over these issues. During the qualitative interviews, farmers frequently mentioned trash as a concern, but described efforts they took to mitigate their risk, including sweeping the trash away from the sacks, constructing fences around their gardens to prevent

people from urinating on them, and only using fresh water to irrigate their gardens. Non-farmers unfamiliar with mitigation efforts undertaken by the farmers were concerned with the potential health risks associated with having trash or human waste near the sack gardens.

Overall, farmers tended to be more skeptical of the quality of food available to them, including from sack gardens, local kiosk, markets or nearby farms. This is not surprising given that farmers were also significantly more likely to report knowing someone who had gotten sick eating vegetables from kiosk, markets or farms. However, it is unclear from our data whether concerns over food quality were a motivating factor to growing food for their consumption or whether farmers now pay more attention to the safety of food they eat as a result of being actively involved in the production process.

#### *6.4.2 Heavy Metals and Biological Contaminants*

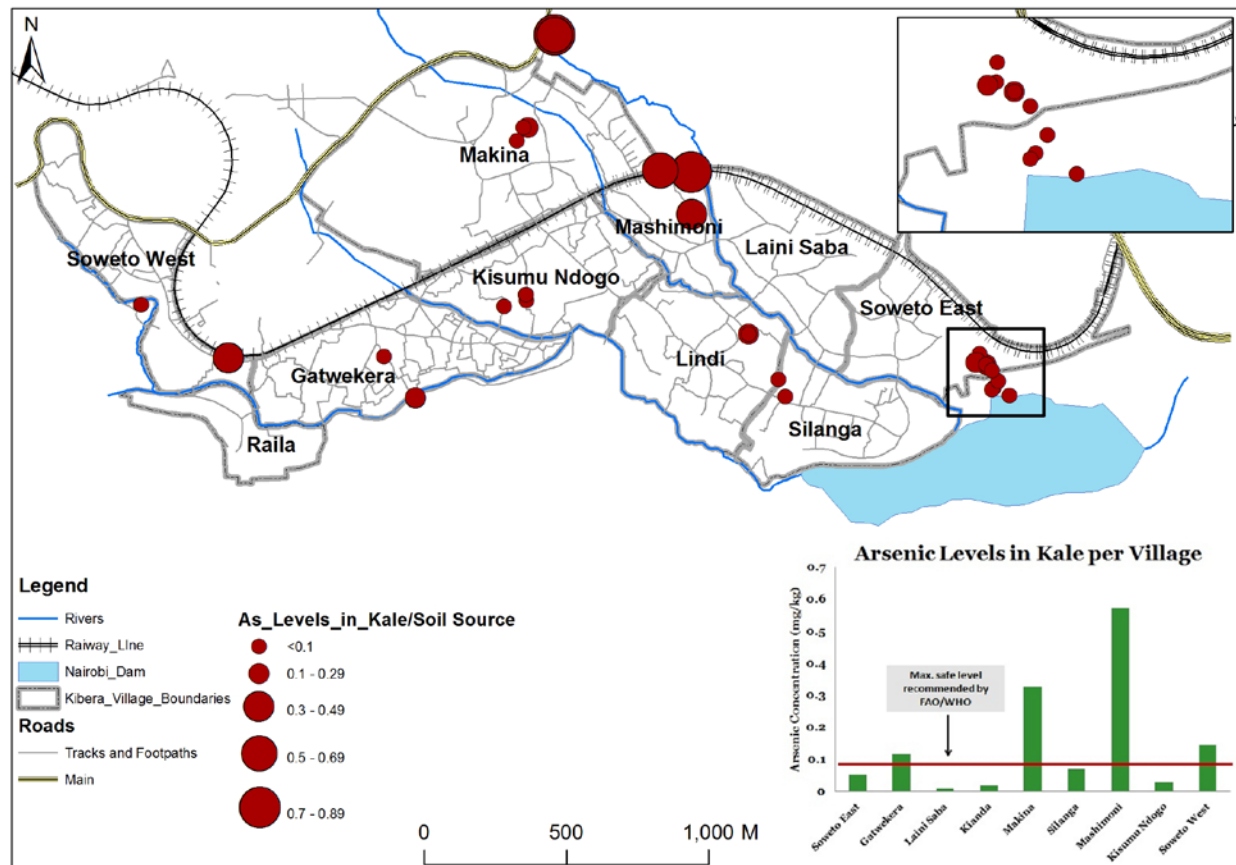
One of the major challenges that farmers face with constructing sack gardens in Kibera is lack of available soil as there are so few open plots of land in the slum. Our results suggest that soil from dumpsites is highly contaminated with a range of heavy metals, specifically lead, cadmium and arsenic, and farmers should not collect soil from these locations to plant sack gardens. The level of metals in the kale samples was spatially correlated with particular sites of soil collection (Figures 6.4, 6.5 and 6.6). Our findings are consistent with other studies of heavy metal pollution in urban agriculture, which found that concentrations of metals tend to be highest next to transportation systems, including roadways or railways, as a result of vehicle emissions and industrial contaminants (Li, Poon and Liu 2001, Kelly, Thornton and Simpson 1996). The most contaminated sources of soil were next to the major railroad that goes through Kibera, next to the Nairobi River dam, and from a large open field near a major road north of the slum where



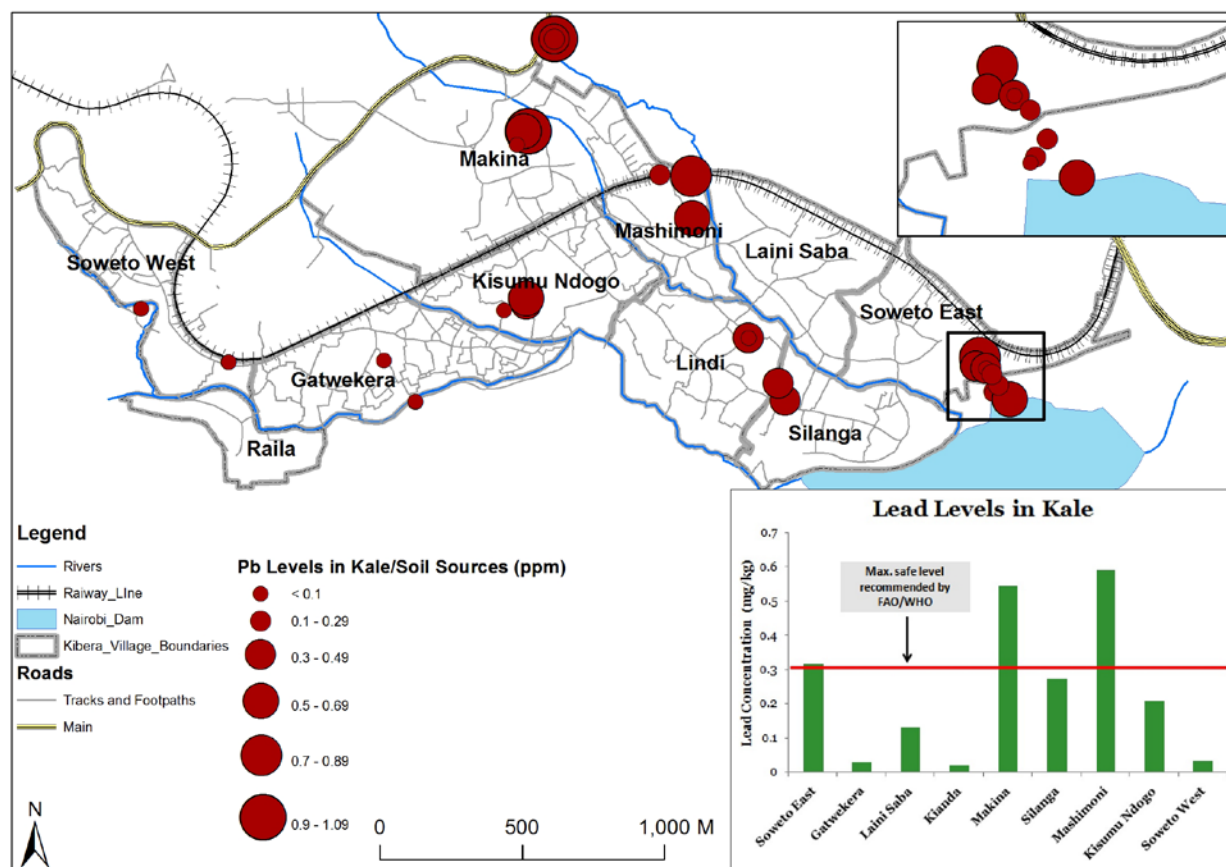
the Nairobi City Council had recently delivered soil from a construction project to level the sports field.

Given the lack of formal sanitation systems in Kibera, we expected to find high levels of total coliform bacteria on the samples of kale collected from farmers' sack gardens. Total coliform bacteria are indicative of a range of biological contaminants, including salmonella and *E. coli* bacteria. Sacks are often located in close proximity to drainage ditches and latrines, and flies are a common problem for farmers. Both farmers and local NGO working with farmers in the slum were aware of the potential risks posed by eating vegetables with biological contaminants. Farmers used a variety of techniques to mitigate their risks, including constructing fences between sacks and the drainage ditches and washing vegetables prior to cooking them. However, as our results indicate (Table 6.1), there were fewer total coliform bacteria present on kale sampled from the sack gardens than on samples collected earlier in the year from open markets, supermarkets, and specialty shops in other parts of Nairobi. The authors in the market study concluded that vegetable transportation and handling in markets were the main sources of biological contamination of vegetables (Kutto et al. 2011). The lower amounts of biological contaminants on kale from sack gardens is most likely because the kale harvested from sack gardens has not exchanged hands as it travels up the supply chain. Kale grown in sack gardens is handled only minimally by the farmer and irrigated with purchased or well water, and is thus relatively clean by comparison. Additionally, it is important to note that since households cook their leafy vegetables prior to consumption, the actual threat from biological contaminants is very minimal as most pathogens are killed during cooking, unlike heavy metal contaminants which cannot be removed through the cooking process.

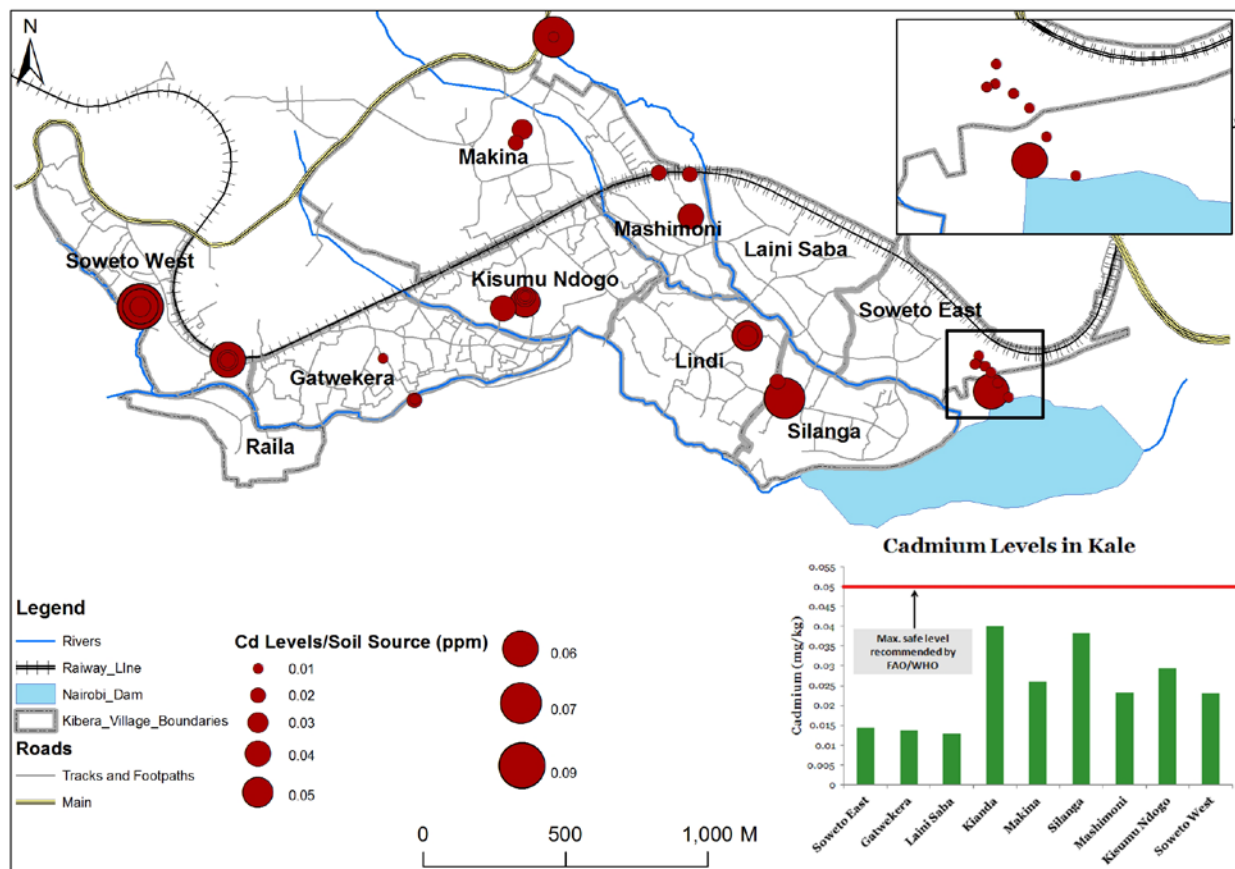
**Figure 6.4** Arsenic levels in kale samples based on where the soil for the sacks was collected.



**Figure 6.5** Lead levels in kale according to where soil for the sack gardens was collected.



**Figure 6.6** Cadmium levels in kale according to where the soil for the sack gardens was collected.



## 6.5 Summary and Conclusions

While sack gardening has resulted in modest increases in household food security (Gallaher et al, n.d.), this study demonstrates the need to also examine potential exposure to environmental risks such as heavy metals and biological contamination. This study demonstrated differences in what farmers and non-farmers perceived to be risks associated with their health from sack gardening and actual risks in terms of measured contamination of the food crops. Farmers perceptions of environmental risks focused primarily on visible contaminants, such as trash in the soil, or dust and flies on the leaves of their kale plants, which they were concerned could result in short-term illnesses, such as stomach aches or diarrhea. We demonstrated that compared to kale purchased from other sources, the kale from their sack gardens had lower counts of bacterial pathogens. However vegetables from sack gardens had heavy metal contamination above the recommended levels for human consumption. This was spatially correlated with particular points of soil collection. This disconnect between farmers' perceptions of environmental risk and actual risk raises questions about how to appropriately promote urban agriculture within urban areas as well as the trade-offs inherent with farming in densely populated urban areas.

As urban agriculture gains popularity amongst urban dwellers worldwide, policy makers and development organizations promoting it need to work with farmers to clearly identify potential contaminants. In Kibera, for example, local NGO's sensitized farmers to health risks from bacterial contaminants, but a far greater health concern is their exposure to heavy metal contamination that can cause major health problems in the long term, including cancer.

In the absence of being able to test all agricultural soils for heavy metal contaminants, policies should be pursued which make it possible for farmers to farm unpolluted soil. In the Kibera slums, sack farmers should be encouraged to collect their soil away from the railroad. Since soil is difficult to obtain in Kibera, one solution might be for the Nairobi City Council or other local NGOs working with the sack farmers to make arrangements to dump relatively cleaner soil from the many construction projects going on in Nairobi at a location near the slum and make this soil available to slum residents. This would provide farmers with a potentially cleaner source of soil, and would make farming and the associated benefits of improved household food security, available to a wider number of residents of Kibera.

The lack of current legal guidelines for urban agriculture has made it difficult to regulate and provide resources to farmers, particularly those in informal settlements like Kibera. New draft legislation regarding urban agriculture in Kenya has been proposed by Kenya's Ministry of Agriculture and other stakeholders. Should urban agriculture be legally recognized through this new law, this will allow policy makers and extension agents to work more directly with farmers to deal with issues, such as exposure to environmental contamination via urban agriculture in informal settlements. Efforts towards safe production of vegetables in urban areas should be included in urban agriculture national policies and city by-laws.

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## **Chapter 7- The Role of Gender in Sack Gardening in the Kibera slums of Nairobi, Kenya**

### **7.1 Introduction**

Globally, women and men often hold specific roles in terms of household livelihood strategies. While they generally work together to support their households, men and women typically have different responsibilities and thus allocate their time differently. However, the way in which their labor is divided varies widely across cultures (Niehof and Price 2001). In Sub-Saharan Africa, men have historically been tasked with supporting the household monetarily, often through the production of cash crops. In contrast, women have generally been responsible for providing or managing household necessities, including food, water and clothing. Their domestic roles require women to interact with their communities and the surrounding natural resources at multiple scales (Verma 2001).

Women in Sub-Saharan Africa draw on the land and natural resources to meet their domestic responsibilities, yet access to the land and resources is usually gendered, with women's access to resources, particularly land, frequently controlled by men (Rocheleau, Thomas-Slayter and Wangari 1996). In terms of rural agricultural production, land tenure is often controlled by men with women being granted access to plots of land for to grow crops for home consumption. However, women's access to land is not guaranteed. Examples from both The Gambia (Schroeder 1997) and Mali (Wooten 2003) have documented the cases of women using their designated dry-season plots to successfully generate large amounts of income from market gardening. In both cases, village men then renegotiated customary land tenure laws such that

women could no longer claim rights to the land, and men could use their plots of land for market gardening to generate income.

In another example from Western Kenya, where tea is a major cash crop, women provide labor for growing the tea, while cash payments for the tea crop are made to the men who own the land. When men use the cash income for the greater good of the household, women have generally provided adequate labor to maintain the crop. But, amongst households wherein the women have felt the men squandered the cash income, women have generally resisted working on the tea plantation in order to spend time farming other food crops (Francis 2000). While the specifics of these types of negotiations vary amongst rural communities in Sub-Saharan Africa, the gendered dynamics that require men and women to negotiate use of land and labor for agriculture are similar.

In general the role of gender in agriculture is different in urban settings than in rural settings as different structures, institutions and circumstances change gender dynamics in cities. Because cultural values are blended in cities, traditional definitions of gender roles that draw on rural experiences may not be appropriate in urban areas (Hovorka, Zeeuw and Njenga 2009). Women in urban areas draw on a diverse set of social networks and livelihood strategies, including urban agriculture, to provide food for their families. The gendered nature of urban agriculture has been widely discussed in the literature, most often from a livelihoods perspective. Numerous studies from Sub-Saharan Africa have shown that women constitute a majority amongst urban farmers (Maxwell 1995, Memon and Lee-Smith 1993, Rakodi 1988). Most of these women farmers come from low-income households, and use urban agriculture to subsidize their income or food supply (Foeken and Owuor 2008). Urban agriculture is particularly important in light of the various food crises, such as the food crisis of 2008, that continue to

affect the urban poor who may spend 60-80% of their household income on food (Hovorka et al. 2009). For a minority of women, urban agriculture is also viewed as a business strategy, allowing them to generate additional income for household needs (Freeman 1991, Hovorka et al. 2009). Fewer women than men in Sub-Saharan Africa have access to formal employment, often because of less formal education than men, relegating them to the informal sector when they search for work. Urban agriculture is accessible to women reliant on the informal sector as a livelihood strategy because it requires little cash investment, it can be practiced close to home, and it combines well with other household duties (Hovorka et al. 2009). Additionally, urban agriculture is often an important livelihood strategy for women because it is typically viewed as unimportant or invisible, allowing women to generate income or save cash without it being noticed by the male head of the household (Foeken and Mwangi 1998).

Given the potential contributions of urban agriculture to household food security, it is important to consider the gendered nature of intrahousehold resource allocations, as various studies have shown that resources, including food, are not evenly allocated within households (Quisumbing 2003). In many African cultures women are responsible for paying for household items, such as food, cooking utensils, etc. while men are responsible for providing housing, paying school fees, or other larger expenses. In rural areas, women often grow subsistence crops while men grow cash crops, so women may draw upon their agricultural plots to provide food to their families. In urban areas, many of these cultural norms persist, so women turn to urban agriculture to meet their household needs (Quisumbing et al. 1995). In terms of food security, food is sometimes allocated unevenly depending on gender or age within households, although this is more commonly the case in SE Asia than in sub-Saharan Africa. Nonetheless, studies have shown that improvements made in the livelihoods of women generally result in

improvements in food security and nutrition for children in the household (Quisumbing et al. 1995).

Participation in urban agriculture can contribute to women's livelihoods beyond the additional food or income. A study by Slater (2001) of women urban gardeners in South Africa demonstrated that women may attach additional meaning to the act of gardening, using it as a coping strategy for traumatic events such as rape, or as a means of exerting control over household food consumption, by growing crops traditionally consumed only by women. Women attach particular meaning to these spaces (Slater 2001) and the produce grown from these gardens may help to enhance their social networks through the exchange of gifts (WinklerPrins and de Souza 2005). Because urban agriculture often takes place on lands for which people lack tenure, conflicts often arise between urban officials or land managers and the people farming the land. Research by Mudimu (1996) in Zimbabwe showed that women often bear the brunt of conflict or harassment by city officials. In addition, women's gardens are often at greater risk of theft and vandalism. Many of these studies illustrate the importance of gender in studies of urban agriculture, but do not place their research in broader political or economic contexts.

In Kibera the majority of sack farmers are women, which is consistent with other studies of urban agriculture in East Africa that have also demonstrated the important role of women in urban agriculture. While my research did not explicitly examine the role of gender in sack gardening, certain insights can be gathered from the data I collected to better understand the role of gender in sack gardening. In the sections that follow, I examine men and women's motivations for urban farming, the relationship between household structure and participation in

sack gardening, the role of gender in the division of agricultural labor, and finally the relationship between gender and the construction of social capital.

## 7.2 Gender and motivations to participate in sack gardening

Sack gardening in Kibera is an activity primarily undertaken by women. While my research did not explicitly investigate why this is the case, I was interested more generally in farmers' motivations for farming. During the qualitative interviews, we interviewed 29 women farmers and 2 men farmers. These farmers gave a wide variety of reasons for why they were involved in sack gardening. The first reason, which was given by nearly all the farmers, was that they were motivated to plant their sack gardens as a means of getting food to eat. For some farmers, this was because during the dry season, vegetables are rare in the markets and this was a more secure, and cheaper, way of getting them; others felt that vegetables were healthy for their bodies. One farmer wanted to grow her own vegetables so that her family could eat vegetables more frequently. As discussed elsewhere in this dissertation, many farmers were motivated by the prospect of self-reliance, meaning that even if they did not have money to buy foods, they could still pick them from their gardens.

Over a third of farmers interviewed were at least somewhat motivated to plant sack gardens by the possibility of being able to sell the vegetables from their sacks. Some farmers, especially those who already ran vegetables kiosks, saw this as a business opportunity because they could more reliably get vegetables for their stands, especially during the dry season when vegetables are scarce. Other farmers described being able to sell their vegetables as a coping strategy, which would allow them to get a small amount of money in a time of need to buy extra food or

other household goods. For the two male farmers we interviewed, selling their vegetables seemed to be their primary motivation, while for the women farmers, selling their vegetables usually came second to being able to feed their household.

Another important reason given during the qualitative interviews by many women farmers for participating in sack gardening was that it made them more self-reliant. One farmer explicitly mentioned that she was interested in sack gardening because she enjoys farming, but many other farmers expressed this sentiment in the way they talked about farming and as they were showing us their sacks. There is pleasure in sack gardening, and it gives many people something to do.

While the qualitative interviews provided good insight into the overall motivations for farming, they did not explicitly clarify why sack gardening is a women-dominated activity. During the household survey, we interviewed a total of 153 farmers, including 14 men and 139 women. As part of this survey, we asked about what farmers did with their crops as a follow-up to the data obtained during the qualitative interviews. We found no significant difference between men and women farmers in terms of whether or not they ate their crops, sold their crops, or shared them with friends or neighbors. Thus, there does not appear to be a gendered pattern to what is done with food from the sack gardens by women and men who farm. We also asked non-farmers about why they chose not to farm, including whether they lacked the time, knowledge of farming, access to supplies, or just lack of interest. Again, we found no significant correlation between gender and the reason given for not farming.

While there is clearly a gendered dimension to sack gardening, my data does not strongly support a clear explanation for why sack gardening is predominately carried out by women. Literature on urban agriculture in East Africa suggests that women tend to practice urban



agriculture at a smaller, subsistence scale in order to supplement their household's food requirements, while men tend to practice urban agriculture at a larger scale, more suitable for a business (Foeken, Sofer and Mlozi 2004, Freeman 1991, Hovorka 2006). This relates to the gendered division of household labor, wherein women are primarily responsible for providing for household expenses, including food, while men are primarily responsible for paying for larger expenses such as rent, school fees, and medical bills. The motivations for farming given by women during the interviews are consistent with this narrative, as most women used the vegetables from sack gardening first for their own domestic consumption and used any profits from selling the vegetables to purchase other household goods.

### 7.3 Female-headed households and sack gardening

Numerous studies have suggested that female-headed households are often poorer than other households (Kossoudji and Mueller 1983, Fukuda-Parr 1999), and thus might be more likely to turn to subsistence activities like urban agriculture to support themselves. However, in the case of sack gardening in Kibera, my data suggest that women from female-headed households participate in sack gardening at a rate proportional to the general population. Approximately 26% (n=41) of farming households were female-headed, while 24% (n= 36) of non-farming households were female headed. This means that female-headed households were no more motivated to begin farming than any other household in Kibera.

To further examine this relationship, I looked at whether the type of household (female-headed or male-headed) was correlated with why non-farmers chose not to farm. During the household survey, non-farmers were asked about the reasons for why they chose not to farm,

including lack of time, knowledge about farming, access to supplies or just lack of interest. I found no significant correlation between the type of household and the reason given for not farming. This again suggests that amongst non-farmers, female-headed houses were no more or less motivated to take up farming than other types of households.

#### 7.4 Gender and the division of labor for agriculture

Studies of rural agricultural production have demonstrated that the division of labor for various agricultural activities is often gendered (Mills 2003), with women in Sub-Saharan Africa participating more than men in agricultural production. While studies of urban agriculture have suggested that women farmers tend to participate more in subsistence farming, while men tend to undertake urban agriculture for production of cash crops (Hovorka et al. 2009), I was interested in the division of labor in agriculture for women and men participating in the same type of agricultural activity: sack gardening. During our household survey, we asked both men and women farmers about who was responsible for various agricultural tasks related to sack gardening in order to better understand the extent to which sack gardening was a shared activity within a household. Overall, if a woman reported being the primary household member in charge of a sack garden, she also reported participating in nearly all aspects of farming, including constructing the sacks, planting, weeding, watering and harvesting. Women farmers relied minimally on help from adult men in their household, but were more likely to receive assistance from children in the household. Seventeen percent (17%) of women farmers reported receiving help from their children with watering the sack gardens.

In contrast, male farmers who participated in sack gardening tended to share the labor requirements more than women farmers. When asked about activities such as building the sacks, planting, weeding and water the sacks, only 79% of the male farmers reported actually participating. These men also relied heavily on help from women in their household, with more than 50% of the male farmers reporting that a women household member helped them with these tasks. Of particular note, even if sack gardens were owned by a man, women were frequently (64%) involved in the harvesting of the vegetables. This likely relates to the role that women play in cooking the vegetables.

**Table 7.1 Division of labor in caring for sack gardens between male and female farmers.**

	Men Farmers (N= 14)			Women Farmers (N= 139)		
	Themselves (%)	Help from adult women (%)	Help from Children (%)	Themselves (%)	Help from Adult Men (%)	Help from Children (%)
Building sacks	79	50	14	96	3	9
Planting	79	50	14	98	2	9
Weeding	79	57	7	97	4	12
Watering	79	64	7	97	4	17
Harvesting	57	64	0	97	4	12

My findings suggest that even when men claim to be the primary caretaker of a sack garden, women in the household are frequently often involved in the maintenance of these gardens. There are several plausible explanations for this finding. First, because women are generally responsible for food preparation, they may also help with tasks such as harvesting the vegetables when the vegetables will be used for household consumption. One of the primary motivations women gave for sack gardening was to provide food for their families in times of

need. Even if the sack gardens belong to her husband, women in the household may feel some sense of obligation knowing that this food could be used in times of need. Second, because sack gardens are generally located near the house, they fall within the geographic sphere of a woman's other domestic activities. Women may thus be more inclined to help with maintaining the sacks.

### 7.5 Gender and the construction of social capital

As discussed elsewhere in the dissertation, social capital is a measure of the networks of trust and connectedness within a community. In my research, I measured social capital by looking at participation in groups, exchanges of goods and services between friends and relatives, and the quality of people's relationship with their neighbors. In chapters 4 and 5, I demonstrated a positive relationship between participation in farming and various measures of social capital. Given that the majority of sack farmers were women, in this chapter I ask whether there is a relationship between gender and social capital.

As part of the interviews, farmers were asked about their participation in gardening groups. Five farmers (15%) reported belonging to a formal sack gardening group. In these groups, women meet to talk about issues pertaining to sack gardening. In two of these groups, women contribute money to merry-go-rounds and can borrow the money with interest. Two said they use the money for their sack gardens, while one said that her farming is too small-scale to make it feasible to repay the loan. In one of the groups, women contributed money to share the cost of fertilizers and pesticides. Finally, one woman belonged to a group in which women planted and harvested their sacks together. The farmer left the group due to mismanagement of funds. More

than a third of women I spoke with during the qualitative interviews had participated in an informal gardening group. These groups seemed to be organized based on proximity to other farmers, and met only occasionally to discuss problems or to receive training on things like how to prepare local pesticides. Many women reported that their groups shared the cost of purchasing manure or pesticides for the sack gardens. About a third of farmers were not part of any group, either ones that dealt directly with gardening or other types, such as merry-go-rounds. Typically farmers gave two reasons for not participating in these groups. Either they had never heard of a group near their neighborhood to join, or they felt they lacked the money to join, particularly merry-go-round groups, where they would be required to make contributions. However, more than half of the farmers who were not currently part of a group expressed an interest in joining a group, particularly one that deals with farming. They would have liked to get advice from others about how to improve their farming. Others were interested in starting a more formal group farming project, if more land were available, so they could plant a wider variety and larger quantity of vegetables together.

During the household survey, we asked both men and women farmers about their participation in group activities, either related to farming or other types of activities such as microcredit organizations. We found no significant difference in the frequency with which men or women farmers participated in any type of group, formal or informal. While groups are important to the formation of social capital, they do not appear to contribute to a ‘gendered’ construction of social capital.

A second way in which our study measured social capital was to ask about a farmers’ relationship with their neighbors, and to ask whether their relationship with their neighbor’s had changed since beginning sack gardening. There was no significant correlation in our data

between the gender of the farmer and these two measures of social capital. Again, while my data does demonstrate a significant relationship between sack gardening and social capital, this relationship is not different between men and women farmers.

A final way in which we examined social capital in the household survey was to look at the exchange of goods between farmers and their rural relatives, urban relatives and urban neighbors. Our data showed no significant difference in the frequency with which men and women farmers gave goods to their rural and urban relatives, or their urban neighbors. However, women farmers who were part of the household survey received goods from their urban relatives significantly less frequently than male relatives. This may reflect a lower position amongst women within their family structure, but it is unlikely this is related to sack gardening as an activity. We found no significant correlation between gender and whether or not farmers shared the crops grown in their sack gardens. Overall, my research does not demonstrate a gendered component to social capital. Rather, my overall data suggests that social capital is more strongly related to an individual's actions, including whether or not they choose to participate in a group, than and their relationships with friends, relatives and their neighbors.

## 7.6 Conclusions

Sack gardening in Kibera has a clear gender dimension given that the majority of farmers are women, but my data are not sufficient to adequately explain why this is the case. I was unable to find any differences between men and women farmers in terms of motivations for participating in sack gardening or the creation of social capital through participation in social groups. I also was unable to support the hypothesis that women-headed households may have

been more likely to participate in sack gardening as a means of providing for their household through subsistence agriculture. I did find that men farmers tended to receive help from women farmers in terms of caring for their sack gardens, while women rarely received help from other men in their household.

Overall, more research is needed to better understand the role of gender in urban agriculture in Kibera. In addition to the data collections presented in this dissertation, I conducted focus group sessions with women and men farmers and non-farmers from Kibera to discuss motivations for farming and more general concerns about the environment in Kibera. It is possible that these focus groups sessions will yield more insights into the gendered dynamics of sack gardening, and future analysis may well bear this out.

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## **Chapter 8- Summary and Conclusions**

### **8.1 Introduction**

This dissertation has examined the impact of sack gardening on the lives of people in the Kibera slums of Nairobi, Kenya. The research investigated three related components of sack gardening within Kibera: 1) the way in which sack gardening has been integrated into household livelihood strategies, 2) the impact that sack gardening has had on household food security, and 3) the extent to which sack gardening has exposed farmers to environmental risk, and the way in which they perceive and understand these risks. These research questions were framed within the context of a sustainable livelihoods framework, literature on urban food security, and the use of urban political ecology to examine environmental risk. While research on urban agriculture in East Africa has previously addressed components of these research questions, few studies have integrated questions about household food security and environmental health. In particular, previous studies have tended to focus strongly on either social measures of wellbeing or urban ecology, but have not integrated the two components. My research attempts to integrate social and ecological measures of household wellbeing in order to better understand the impact of this form of urban agriculture in the context of the ecological and socioeconomic realities of the Kibera slums, and in the broader context of urban sustainability.

In this concluding chapter, I summarize the key findings from each of the previous chapters and discuss the implications of these findings in the context of the theoretical frameworks used for the study. While this research is based on a small-scale study of urban agriculture in one location in Kenya, I relate the findings of my research to broader issues within

the research on urban agriculture in other parts of the world. I then provide recommendations for future research that build upon the findings from this research project.

## 8.2 Summary of Main Findings

This research on sack gardening was conducted in the Kibera slums of Nairobi. Using a mixed-methods approach, I combined qualitative interviews, quantitative household surveys, focus group discussions, and soil, plant and water samples to answer the following research questions:

1. *How does participation in sack gardening serve to improve the livelihoods of gardeners in the Kibera slums of Nairobi?*
2. *Are households in Kibera who participate in sack gardening more food secure than households that do not garden?*
3. *To what extent does participation in sack gardening expose people to environmental risks, and how do farmers understand these environmental risks?*

Comparisons were made between households actively involved in sack gardening (farming households) and households who were not involved in any form of urban agriculture (non-farming households) in order to elicit differences in household livelihood strategies, food security, and exposure to environmental risks.

*RQ 1: How does participation in sack gardening serve to improve the livelihoods of gardeners in the Kibera slums of Nairobi?*

The aim of the first data chapter (Chapter 4) was to investigate the ways in which households in Kibera have integrated sack gardening into their urban livelihood strategies, in order to understand whether low-space forms of urban agriculture can be viable livelihood

strategies in densely populated urban environments where residents lack access to land for more traditional forms of urban agriculture. Household livelihood strategies were examined using a sustainable livelihoods framework, asking how households used natural, physical, financial, human and social capital to engage in sack gardening.

This portion of the study demonstrated that sack gardening is a viable livelihood strategy in the Kibera slums that can be integrated with other household livelihood strategies.

Households draw on their capital assets in a variety of ways as they practice urban agriculture. Farmers drew on both physical and natural capital to enable them to set-up and maintain their sack gardens. Physical capital, such as sacks and seeds, was relatively easy for farmers to obtain. However, insecure access to natural capital, including land, soil, stones and water, was one of the major limiting factors in determining how many sacks a farmer had, or whether they were able to begin farming. Farming households with greater human capital, mainly those with previous agricultural experience, were more likely to participate in sack gardening. Sack gardening also helped to build human capital by teaching farmers a new skill that they were able to share with others. In terms of financial capital, sack gardening did not have a significant impact on overall household wealth. However, it did contribute to household savings and was a source of additional income for approximately a third of the farming households. Finally, sack gardening positively contributed to farmers' social capital by creating stronger social networks between those involved in gardening groups, creating a greater sense of community, and by strengthening friendships between farmers and also between farmers and their non-farming neighbors. These findings have broader implications for urban agriculture in Kenya, and other developing countries, because they demonstrate that slum dwellers are able to successfully integrate sack

gardening into their urban livelihood strategies, but that particular consideration must be given to access to natural capital if farming is to succeed.

*RQ 2: Are households in Kibera who participate in sack gardening more food secure than households that do not garden?*

The aim of Chapter 5 was to examine whether households in Kibera who practice sack gardening are more food secure than those who do not. Sack gardening was originally promoted on a wide-scale within Kibera by the NGO Solidarités as a means of improving household food security following the post-election violence of late 2007. Sack gardening in Kibera has received a lot of media attention over the past few years, and while it has been commonly accepted that sack gardening improves household food security, no study had empirically demonstrated this to be true. This research measured dietary diversity as an indicator of food security. We found that sack gardening has contributed to improved household food security directly. While there was no significant difference in overall dietary diversity between farming and non-farming households, farming households did consume a greater variety of vegetables than non-farmers, including many indigenous vegetables, which have broader nutritional benefits and are culturally preferred to the kale, swiss chard and cabbage which are consumed by most households in Kibera. More importantly, farmers reported feeling more food secure than non-farmers. Finally, sack gardening also resulted in an increase in social capital, which helps food security indirectly. Theories about social capital suggest that communities with greater senses of trust and reciprocity have greater social capital. Our findings confirmed this, demonstrating that by helping to improve social capital, sack gardening has helped farmers to strengthen the social

safety nets which help to provide them with assistance in times of need. Therefore, policies which promote low-space agriculture, such as sack gardening, that are more accessible to the urban poor have the potential to improve household food security as well as provide these households with alternate livelihood strategies.

*RQ 3: To what extent does participation in sack gardening expose people to environmental risks, and how do farmers understand these environmental risks?*

The aim of Chapter 6 was to investigate whether participation in sack gardening exposes people to environmental risks, and the extent to which farmers understand these environmental risks. Many studies of urban agriculture focus on the benefits of farming in terms of improvements in household food security, but ignore the potential health hazards of farming in a polluted urban environment (Baumgartner and Belevi 2001, Binns and Lynch 1998, Egziabher et al. 1994, Maxwell et al. 1998). Additionally, studies that have examined environmental contamination often fail to link measured risk to how people perceive this risk, when ignoring risk perception often means that people will be unable or unwilling to recognize and act upon information regarding measured environmental risks (Amend and Mwaisango 1998, Karanja et al. 2010b, Mireri et al. 2007).

To understand environmental risk in Kibera, we analyzed soil, plant and water samples for heavy metal contamination and levels of total coliform bacteria as measures of chemical and biological risk. We also investigated what farmers and non-farmers perceived to be major environmental risks within Kibera. This research demonstrated that farmers' perceptions of environmental risks focused primarily on visible contaminants, such as trash in the soil, or dust and flies on the leaves of their kale plants, which they were concerned could result in short-term

illnesses, such as stomach aches or diarrhea. Compared to kale purchased from other sources, the kale from their sack gardens had lower counts of bacterial pathogens, meaning that their concerns were not validated.

On the other hand, vegetables from sack gardens had heavy metal concentrations above the recommended levels for human consumption. This was spatially correlated with particular points of soil collection. This disconnect between farmers' perceptions of environmental risk and actual risk raises questions about how to appropriately promote urban agriculture within urban areas as well as the trade-offs inherent with farming in densely populated urban areas. As urban agriculture gains popularity amongst urban dwellers worldwide, policy makers and development organizations promoting it need to work with farmers to clearly identify potential contaminants and possible solutions that minimize health risks.

### 8.3 Recommendations for future research

Historically, research on urban agriculture in East Africa has been descriptive in nature, intended to explain who is practicing urban agriculture and how it is being practiced (Freeman 1991, Egziabher et al. 1994, Memon and Lee-Smith 1993, Foeken 2006). Some studies have looked at the impacts of urban agriculture on household food security, particularly as a coping strategy (Maxwell et al. 1998, Maxwell 1995, Maxwell 1996a, Mwangi 1995). More recent research has also investigated the health impacts of urban agriculture in East Africa, especially in terms of exposure to biological pathogens (Karanja et al. 2010a, Mireri et al. 2007). However, there has been limited research in East Africa that has strongly integrated social and ecological measures of the impacts of urban agriculture. While my dissertation research and the resulting



manuscripts are a first step towards this type of integrated research, there are still many directions this type of research on urban agriculture could be taken.

In terms of continuing research on sack gardens, one area that I would like to explore in the future is to more strongly integrate urban political ecology with traditional ecology and environmental science to be used as an explanatory tool for why the urban environment is so polluted. While my dissertation research on sack gardening was able to demonstrate that sack farmers are exposed to high levels of environmental contamination, I did not fully investigate the power dynamics that have denied residents of Kibera access to formal sanitation services, as well as ignoring efforts by residents to respond to and improve their urban environments, and I hope to do so in the future.

Sack gardening has increased tremendously in popularity in recent years and sack gardening projects have now been implemented in informal settlements, schools, and residential areas in many countries around the world. Because people's livelihood strategies are dictated strongly by local socioeconomic and ecological circumstances, I would also be interested in comparing the impacts of sack gardening in different geographic locations in terms of livelihoods, food security and environmental risk.

In the broader context of research on urban agriculture, much of the research done on urban farming has approached the research from the perspective of either the physical farming system (e.g. soil quality issues) or the farmer (e.g. food security and livelihood issues). However, if urban agriculture is being promoted as a component of urban sustainability, then a larger-scale approach that examines urban farming as part of a food supply chain would be useful. This type of approach potentially has wide applications in terms of research questions. For example, the kale we tested in Kibera for total coliform bacteria was actually much less

contaminated than kale purchased from grocery stores or open-air markets. As vegetables are handled up the supply chain, new potential sources of environmental contamination are introduced. In terms of improving household food security, one of the major issues for households is access to food. While directly participating in urban agriculture increases a household's access to food, food access can also be increased by having others around you grow food. These types of supply-chain issues (social and environmental) are topics that I would like to explore in greater detail with my collaborators at the University of Nairobi.

#### 8.4 Theoretical implications of this dissertation

As I summarized in the main findings, this research has contributed to discussions in the literature related to sustainable livelihoods framework, urban food security, and measurements of environmental risk and risk perception. The sustainable livelihoods framework was originally proposed by development practitioners as a means of understanding livelihood strategies in the context of social and environmental sustainability (Chambers and Conway 1992). The early literature on sustainable livelihoods focused primarily on rural livelihood strategies (Scoones 1998), although this framework has since been adapted to examine urban livelihood strategies as well (e.g. Villavicencio 2009). By applying the sustainable livelihoods framework to Kibera, my research was able to illustrate how urban agriculture has been successfully integrated into urban livelihood strategies in the slum.

Theoretical discussions of the linkages between urban food security and urban agriculture in East Africa have often focused on urban agriculture as a coping strategy for the poor, with the food that is grown directly supplementing household consumption. There has been little formal discussion in literature on the linkages between household food security and social capital, yet

my research has clearly demonstrated that sack gardening contributed to greater social capital among farmers, and that in turn, those with social capital were more food secure for reasons beyond just directly supplementing their household food supply. Because these farmers had stronger social ties to their friends and neighbors, they were also more likely to share food or borrow money. Growing social capital through urban agriculture has been given lots of attention in more developed countries, particularly in the context of community gardens. My research suggests that these sorts of connections are equally important to consider in the context of urban agriculture as a tool to improve household food security in the context of developing countries as well.

Another area of my research focused on exposure to environmental risks and people's understandings of these risks. There have been numerous studies done documenting environmental risks related to urban agriculture in East Africa, particularly focusing on exposure to biological pathogens. However, while extensive literature exists on how people perceive risks in developed countries, remarkably little research has taken place examining how people in developing countries perceive environmental risks. Additionally, very few studies directly link actual measures of environmental risk with people's perceptions of these risks. Ignoring this linkage means that even if people are presented with clear information about what environmental risks they are exposed to, they may not act on this information if they do not perceive these risks as serious threats. My research has attempted to contribute to this gap in the literature by demonstrating that households in Kibera had very different perceptions of environmental risks than those we actually measured. These theoretical linkages are especially important in the context of applied research that should be useful to policy makers.

Finally, my research on sack gardening was situated more broadly in the field of human-environment geography. As a sub-discipline, human-environment geography has a long history of examining the ways in which humans shape and are shaped by the natural environment. While geography is a diverse field of study, there is often a division between those whose research is more aligned with a natural science approach (e.g. physical geography) and those whose research uses a social science approach, focusing more on relationships and power dynamics as explanatory tools for how humans interact with the environment. Human-environment geography has the potential to bridge these different cores because of the wide range of research interests represented within the field, yet many studies remain strongly human or strongly physical in nature. As Turner (1997) has argued, fragmenting geography into smaller and smaller subfields weakens the discipline when there is great potential for human-environment geography to benefit from the theoretical and methodological strengths of both physical and human geography. My research questions were shaped by a sustainable livelihoods approach and urban political ecology as theories that had the potential to answer questions about how people engage with their urban environments, and how their livelihoods are shaped by uneven local, regional, and national power relationships that have created unequal access to waste and sanitation services, and thus potential exposure to environmental contamination. As I have illustrated in this dissertation, my research is one example of how social and physical perspectives and methods in geography can be integrated to examine the topics such as urban agriculture in a large city in the developing world.

## 8.5 Methodological considerations

This dissertation research used a mixed methods approach to investigate the trade-offs between sack gardening as a strategy to improve livelihoods and household food security and potential exposure to environmental contamination. Integrating qualitative and quantitative data collection methods provided general information about *process* with the ability to provide statistically significant evidence to support this information. However, there were several logistical obstacles to actually working and carrying out my research in Kibera.

The first major obstacle faced was obtaining access to households for qualitative interviews, household survey and focus group discussions. Part of the challenge stemmed from insecurity in Kibera, which made it unsafe for me and my research assistants (all university students) to travel alone in Kibera. We were reliant on local contacts in Kibera to gain access to households for interviews. I was extremely fortunate to have made contact with a farmer, Catherine Wangui, who was well respected in her neighborhood and easily gained the trust of other households, making it easy for us to get permission to interview the households. However, because Kibera is large in size, Catherine was forced to seek contacts in other villages within the slums to help coordinate the visits to households for the household survey, and these extra assistants varied in quality and reliability. Although we have no definitive evidence, we strongly suspect that when we were mugged during the household survey in Lindi village, the muggers had been tipped off by our local field assistant, who subsequently disappeared. Beyond safety issues, access to households was also challenging as houses do not have addresses and many residents did not own mobile phones. Thus, households that had been identified as part of our sampling frame were often hard to relocate, forcing us to choose another house on the list.

Another major challenge we faced as outside researchers doing research in Kenya related to the expectations of the farmers. Although we discussed the nature of our interview as a research project during the informed consent process as the start of each interview, farmers we interviewed had difficulty understanding the difference between us as researchers, and aid workers associated with local NGOs. As such, at the end of many of our interviews, farmers would ask us if we could provide them with any assistance, either financially or in the form of seeds or fertilizer for their sacks. All of my research assistants were coached on how to answer these types of questions, so that we could appropriately explain that as researchers we were trying to document and obtain information that could be used to inform policy or help NGOs, but that we could not provide assistance to them directly. However, these conversations reflect the issue of raised expectations between outside researcher and marginalized research subjects. Handling these issues compassionately and with respect for the research subjects is imperative if communities are to allow researchers to maintain long-term ties. These raised expectations were one of the major motivating factors behind the feedback workshops we held at the end of the project.

## 8.6 Policy implications

As discussed in the conclusions of the three data chapters, urban agriculture is not a legal activity in Kenya or in many African cities (Foeken 2006). Yet, as this dissertation research has demonstrated, urban agriculture has the potential to have positive impacts on household food security and urban livelihood strategies. If development organizations are to promote urban agriculture as a sustainable urban livelihood strategy, then this practice needs to be legally

recognized. Until this is done, urban farmers will continue to be marginalized. There are numerous accounts of urban farmers in Kenya being harassed by the police, who either burn their crops or harvest the food and keep it for themselves, and urban farmers have no legal recourse for these events (Foeken 2006, Foeken and Owuor 2008). Additionally, until urban agriculture is formally recognized as a legitimate urban livelihood strategy, farmers may continue to be exposed to environmental risks with little attention paid by government agricultural or health agencies. Farmers we interviewed as part of our household survey were interested in having access to government extension officers to seek advice on issues such as pest management. Yet, these types of services will remain inaccessible until urban agriculture as a whole is recognized as legitimate.

Positive steps have been made towards the formal recognition of urban agriculture in Kenya. In 2010, a draft policy on urban agriculture was written that was to be passed by the Ministry of Agriculture. This draft policy would have legalized urban agriculture, and therefore urban farmers would have had access to government extension officers, and government aid for farmers (Government of Kenya 2010). However, with the passing of the new Kenyan constitution in August 2010, the Kenyan government was reorganized in an effort to become more decentralized and the draft policy was put on hold. Hopefully this issue will be reconsidered in the near future.

## 8.7 Broader impacts

This dissertation has attempted to demonstrate the potential positive impacts of sack gardening as a form of urban agriculture in Kenya. As an international researcher, it was

extremely important to me that the research be collaborative in nature and that results from the research be put back into the hands of local researchers, policy makers, and farmers in order to provide support for proposed policy changes that will more formally recognize urban agriculture as a legitimate activity. As discussed in Chapter 3, I returned to Kenya after completing my field research to hold two feedback workshops, with policy makers and with farmers. Approximately 20 people from government offices, NGO's and local research institutions attended the policy feedback workshop, as well as 5 farmers from Kibera. While I did present the findings of my research, it was perhaps more exciting to hear the vibrant discussions that took place between the different attendees. Government officials and NGO staff seemed genuinely surprised to learn that such a small-scale farming activity had a noticeable impact on household food security, but were interested in exploring opportunities to scale up this type of agriculture elsewhere. Farmers from Kibera were able to speak directly to high-ranking officials from Nairobi City Council and the Ministry of Agriculture to describe the benefits they had received from sack gardening and to explain the main challenges they face as farmers. This was an empowering opportunity for these farmers, who are normally very marginalized as residents of Kibera, and you could see how proud they were to be asked their expert opinions on sack gardening.

The second feedback workshop was held in Kibera with farmers and non-farmers who had been part of the research study. The purpose of this workshop was to return the results of the research to the local residents. Because Kibera is one of the largest slums in Sub-Saharan Africa, it has become an extremely popular place for a wide range of research projects and development interventions. Residents have grown accustomed to seeing journalists in the slum, or to seeing many NGOs and research projects come and go. Because these residents suffer from 'research fatigue', I felt it was imperative that we share the results of our study with them and allow them



to ask questions more generally about the research process. The feedback workshop was attended by nearly 100 farmers and non-farmers, and they seemed genuinely appreciative that we had come to share the results of our study with them. While international researchers will often make an effort to share the results of their study with local policy makers, either through publications or research talks, I think that ethically it is equally important that study participants be part of the research process from start to finish. Doing so not only generates support for continued research in that community, but it also empowers local residents to ask questions and feel like they have a right to be heard.

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## Appendices

## Appendices

### Appendix A. In-depth qualitative interview guide for households who participate in sack gardening<sup>27</sup>

1. Socio-demographic information:  
Name:  
Age:  
Gender:  
Occupation:  
Level of education:  
Location of house:
2. How long have you participated in sack gardening?
3. How did you first learn about sack gardening?
4. What made you decide to try sack gardening?
5. Can you describe the process of sack gardening? (Where do you get the materials and how do you care for the plants?)
6. What kinds of plants do you grow in your sacks, and why did you choose these plants?
7. Where do you obtain the seeds or cuttings for these plants?
  - If purchased, have they heard of Solidarites and the free seedlings?
  - If yes, then why didn't they get seedlings from them?
  - If they could get any type of seedlings for free, what would they plant?
8. What do you do with the food that is grown in your gardens?
9. What kind of previous experience did you have with (urban) agriculture?
10. Did you receive any training (formal or informal) to learn how to plant a sack garden? If so, what kind?
11. Are you part of any sort of sack gardening group (e.g. women's group)? If so, what kind of support do you provide to each other?
12. What (if any) benefits have you experienced from sack gardening?

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<sup>27</sup> All interviews were administered in Kiswahili.

- What is done with the money saved from not purchasing vegetables?
  - Do you buy other types of food with money saved?
13. What kinds of challenges have you faced with your sack gardens?
- Have they experienced any conflict with family, friends, or neighbors?
  - Has there been any conflict over what is done with the money they saved?
14. Ask about environmental contamination in Kibera and whether they do anything to prevent spread of diseases or contamination to their food.

Appendix B. Table 9.1 Codes used to analyze data from qualitative interviews

Theme	Code	Definition	Rule for Applying Code	Example when the rule applies
<b>Length of time sack gardening</b>	TIME	The length of time a farmer has been gardening.	Apply to anything that describes when a farmer began gardening or how long they have been gardening.	“Q: Okay. When did you start this sack gardening? A: I started in July” (1:1)
<b>How they first heard about sack gardening</b>	HEAR	How did the farmer first hear about sack gardening.	Apply anytime a farmer describes first hearing about sack gardening, including from formal organizations, friends, family or just seeing it somewhere.	“I was seeing it and I was very interested because I like farming... so I asked my cousin... she was planting.” (31:1)
<b>Motivations for sack gardening</b>	MOTIV-EAT	First interested in sack gardening as a way of getting food to eat.	Apply anytime a farmer describes wanting to try sack gardening because they plan to eat the food that they grow in their gardens.	“...because i realized that vegetables had become rare for many days and it could help me by picking from there and cooking.” (1:2)
	MOTIV-SELL	First interested in sack gardening as a way of getting vegetables to sell.	Apply anytime a farmer describes wanting to try sack gardening because they plan to sell the food that they grow in their gardens.	“I realized I could plant and be getting vegetables from there, and selling them...” (4:2)
	MOTIV-VOUCHER	First interested in sack gardening because of the vouchers offered by Solidarités.	Apply anytime a farmer describes wanting to try sack gardening because they were expecting to receive a food voucher from Solidarités after they began gardening.	“Honestly, I heard them (her friends) say they would be given something small.... A voucher for food.” (5:2)
	MOTIV-OTHER	The farmer was first interested in sack gardening for a reason other than eating or selling the vegetables.	Apply anytime a farmer describes wanting to try sack gardening for a reason other than wanting to eat or sell the food they grow.	“I was very interested because I like farming...” (31:2)



<b>Process of sack gardening</b>	SOIL	Describes the collection of and care for soil in the farmer's sacks.	Apply to anything that describes how a farmer got soil for their sacks or how frequently they change the soil in their sacks.	"I got the soil from the DC's place..." (4:3)
	SACKS	Describes how a farmer got the sacks to start their garden.	Apply to anything that describes how a farmer got hold of their sacks, including purchasing them.	"D: Did you buy the sacks" C: I had the sacks here already..." (5:3)
	STONES	Describes the collection of stones for a farmer's sacks.	Apply to anything that describes how a farmer collected or purchased stones for their sacks.	"I carried the soil and the stones myself (from the D.C.'s office)..." (6:3)
	BUILD	Describes the process of actually building the sack to hold the seedlings.	Apply anytime a farmer is describing how they assembled their sack prior to planting.	"When I brought it, I filled the sacks as I arranged the stones in the middle, with the soil on the sides. Then I watered and planted." (7:3)
	SEEDLINGS	Describes how farmers get the seedlings for their sacks.	Apply anytime a farmer discusses how they got their seedlings, including purchasing or receiving them for free.	"The seedlings we were given (by Solidarites)..." (6:5)
	FERT	The farmer adds fertilizer (organic or commercial) to their sacks.	Apply anytime a farmer mentions applying fertilizer or manure to their sacks, or where they got the fertilizer and manure.	
	PESTICIDE	The farmer uses pesticides (local or commercial) on their plants.	Apply anytime a farmer mentions applying pesticides of any kind to their sacks, or anytime they discuss how they get or make pesticides.	"I try to apply ash, water with garlic or pepper... I grind them and then spray..." (5:8)
	WATER	Where the farmer collects water to water their plants.	Apply anytime a farmer describes how they get water to put on their sacks, including purchasing water or collecting it.	"I get it [the water] from the tap... I buy it outside, but it is nearby." (7:4)
<b>What types of plants are grown</b>	IND VEG	A farmer describes planting indigenous vegetables.	Apply anytime a farmer says they have in the past or currently plant indigenous vegetables in their sack gardens.	"[I had] others like kunde, kienyeji, and manaagu but those ones are finished, we ate them..." (6:6)
	KALE	A farmer plants or has planted kale in their sack garden.		"I have spinach, onions, dhanian and sukuma." (6:6)

	SPINACH	A farmer plants or has planted spinach in their sack garden.		"I have spinach, onions, dhanian and sukuma." (6:6)
	DHANIA	A farmer plants or has planted coriander in their sack gardens.		"I have spinach, onions, dhanian and sukuma." (6:6)
	ONIONS	A farmer plants or has planted green onions in their sack gardens.		"I have spinach, onions, dhanian and sukuma." (6:6)
	CHOICE PLANTS	The reason a farmer has chosen to plant certain plants in their garden.		"D: Why didn't you plant indigenous vegetables? C: There were no seeds for those ones at Solidarités. D: If the seeds were available, what would you have planted? C: African Nightshade, cowpeas, amaranth..." (5:7)
<b>How they care for the plants</b>	FREQ H2O	The timing and frequency with which a farmer applies water to their sacks.	Apply anytime a farmer describes watering their plants, including how often and what time of day this is done.	"I usually use about 3 cans [of water]... if I pour 2 cans in the morning, I will pour one jug per sack in the evening." (8:5)
	AMT H2O	Describes the amount of water applied to the sacks each day.	Apply anytime a farmer describes how much water they apply to their sacks and how much money is spent on this water.	"I usually use about 3 cans [of water]... if I pour 2 cans in the morning, I will pour one jug per sack in the evening." (8:5)
	FREQ HARVEST	Describes the frequency that the farmer harvests their sacks.	Apply anytime a farmer describes harvesting plants from their gardens, including how often they do this.	"You cannot pick every day. If you pick today, tomorrow you leave it to grow, and then pick another day..." (3:6)
	AMT HARVEST	Describes the quantity of vegetables harvested from a farmer's sacks.	Apply anytime a farmer describes how much they harvest from their sacks, especially in comparison to what they would have spent to purchase the vegetables.	" M: I pick [vegetables] once per week... D: and how much does it cost you to buy vegetables the other 6 days per week? M: Twenty shillings." (8:9)

<b>What is done with the food that is grown</b>	EAT	Farmers eat some or all of the vegetables they grow.	Apply anytime a farmer mentions eating food that has been grown in their gardens, even if it is rarely.	"I only harvest for consumption. I have not started harvesting for sale." (4:6)
	SELL	Farmers sell some or all of the vegetables they grow.	Apply anytime a farmer mentions selling food that has been grown in their gardens, even if it is rarely.	"The rest [of the vegetables] I sell to buy water or indigenous vegetables to substitute this [for our meals]..." (6:8)
	SHARE	Farmers share some or all of the vegetables they grow.	Apply anytime a farmer mentions sharing food from their garden, such as with a neighbor or family member.	"D: You usually pick for your friends?... C: it's mostly my friends who consume (my plants) and not even me." (5:5)
<b>Previous experience with agriculture</b>	NO EXP	Farmers have no experience with UA prior to starting sack gardening.	Apply code if a farmer says they have no previous experience with agriculture, and if the first time they have farmed is with sack gardens.	"I didn't have any previous experience.... I was born at home (Western) but... I started being a house help when I was very young, so I didn't stay at home for young." (5:6)
	URBAN EXP	Farmers have previously practiced urban ag before beginning sack gardening.	Apply if a farmer describes having farmed in an urban setting prior to sack gardening.	
	RURAL EXP	Farmers have experience with farming in rural areas.	Apply if a farmer describes having learned to farm in a rural area.	"R: I was born in the rural areas in Kisii ...[we used to plant] sugar cane, maize, sweet potatoes, potatoes, and bananas." (6:9)
	FRIENDS-FAMILY	Farmer describes having been taught to farm by friends or family.	Apply if a farmer was taught about some aspect of agriculture, either rural or urban, by friends or family members.	"You know, I've been brought up by parents who have been planting vegetables..." (3:8)
<b>Training for sack gardening</b>	SOLIDAR	Farmer received training from Solidarités.		"For now we have not received much training. We were only trained about how to plant... from Solidarités." (7:9)

	OTHER ORG	Farmer received training from some other organization.		
	FRIEND-FAM	Farmer received training from either friends or family members.	Apply anytime a farmer describes having learned about sack gardening (not other forms of agriculture) from either friends or family members.	"My friends initially taught me the benefit of this project..." (6:9)
	SELF	Farmer did not receive any formal training, just tried on their own.		"Q: Nobody taught you or ..... you did not visit a place and find people farming? A: No, I just planted. That is I used my brains, thought of it and planted." (3:2)
<b>Participation in a sack gardening group</b>	GROUP-FORMAL			
	GROUP-INFORMAL			" It is just like a group because we help each other. All the women in the project, from here to over there. Vegetables are very important... they make life easier." (9:3)
	NO GROUP			"I don't know if there is one, but if there is, I could have joined them..." (7:10)
<b>Benefits to sack gardening</b>	FOOD			"My benefit is that when I plant and they are plenty, I harvest and we eat." (3:9)
	INCOME	The farmer gains additional income as a result of selling their vegetables.		" I no longer buy vegetables. I sell them for money to buy water and many other things... I buy flour, soap, cooking oil, fare for children to go to school, bread, milk..."

				(6:10)
	SAVINGS	The farmer saves money as a result of not having to purchase food.	Apply if a farmer specifically describes saving the money they otherwise would have spent on food when they harvest vegetables from their sack gardens.	" [Sack gardening] is a good concept... for starters, it gives you money to buy other things since you will be saving what you used to spend on vegetables." (6:13)
	FRIENDSHIP	The farmer describes an example of how sack gardening has lead to greater cooperation or friendship.	The farmer describes an example of how sack gardening has lead to greater cooperation or friendship. This could be a result of helping each other build sacks, sharing money for pesticides, sharing the food grown, etc.	"C: Do you ever pick some of your vegetables for neighbors who don't have any? F: Yes C: Do you sell to them or is it just out of friendship? F: Just friendship." (4:9)
	KNOWLEDGE			"It has also given me a lot of knowledge about how one can plant vegetables in a sack and they grow just the same way that they would in a regular garden." (10:8)
<b>Challenges with sack gardening</b>	INSECTS			"...if you stay for a week without spraying, they (the plants) are eaten up by insects." (4:11)
	ANIMALS			"There is someone who keeps rabbits at the place I have planted and they often eat my vegetables." (4:10)
	CHILDREN			"We look out for each other's gardens... so that children playing around there don't damage the crops..." (9:7)
	THIEVES	The farmer describes theft as a problem with sack gardening.		"I have planted some onions although they are occasionally stolen. When an onion gets big, you will find that someone has uprooted it

				and stolen it.” (10:4)
	WATER			“Yeah, sometimes I lack the money to buy water... in a week, I may fail to irrigate twice...” (7:11)
	POLLUTION			“Sometimes if you eat the dirty vegetables, your stomach may really hurt.” (10:9)
	TENURE	The farmers feel the space where they grow is insecure because they do not own it.		“And again, you know, this is now our place. It’s just a place we are staying and can move anytime.” (3:10)
<b>Environmental Risk</b>	PREVENT RISK	The farmer is aware of environmental risk and actively does something to prevent it.		“The flies are a problem since the garden is near garbage, but we received training on how to prevent any harm. After harvesting, you clean the vegetables with warm water, and then you cook them well to kill all the germs.” (7:12)
	AWARE RISK	The farmer is aware of the risk, but does nothing special to prevent it.		
	NO RISK	A farmer is not concerned about the environmental risk.		
	RISK-WATER	The farmer is aware of the risk of using dirty water to irrigate their plants.		“Household water contains soap... when it has soap, you cannot pour it on the vegetables. Vegetables which are food must have clean water.” (3:13)

<b>Farmer Innovation</b>	INNOVATE	Anything that a farmer has experimented with or tried that was not taught to them.	Apply any time a farmer describes experimenting or trying something new that was not taught to them by friends, family, outside organizations, etc.	<p>“D: Have you ever seen someone plant cabbage in a sack, or its just an idea you have?</p> <p>F: This is just my idea.” (4:9)</p>
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Appendix C. Example of how summary statements were created based on all data coded **for a particular theme from an individual interview. This example refers to the theme of motivations for farming.**

[<Internals\Interview transcripts \(english\)\Interview 1 T>](#) - § 1 reference coded [3.42% Coverage]

Reference 1 - 3.42% Coverage

M: and when you saw and thought it was a good thing to start doing, what made you decide to start farming? You saw from your neighbor and decided to.....

E: try also

M: Why ? what made you decide to start?

E: because i realised that vegetables had become rare for many days and it could help me by picking from there and cooking

M: Mhhh

E: and i could also pick onions from there and use for frying my vegetables

M: Mhh ..... so you started so that you could eat?

E: Ehhhh

M: Mhhh ....and ..... did you think of say for selling or your first thoughts were .....

E: i first thought of my own food then i could sell

M:Okay

**Summary statement I1: This farmer was motivated to begin sack gardening because vegetables had become rare in the markets and she realized she could grow her own to eat.**

[<Internals\Interview transcripts \(english\)\Interview 10 T>](#) - § 1 reference coded [0.96% Coverage]

Reference 1 - 0.96% Coverage

D : And what about eating the vegetables ? Or was eating later ?

W : I can also eat them because you know that vegetables are good for the human body.

D: Okay

W: Yes.....so it also is a source of food.

**Summary statement I10: This farmer was motivated to start farming because she wanted to eat the vegetables, which she says are good for the human body.**



Appendix D. Example of how individual summary statements were aggregated into grand summary statements for each theme. **This example refers to *motivations for farming*.**

### **Summary Statements: Motivations for Farming**

#### Eat

I1: This farmer was motivated to begin sack gardening because vegetables had become rare in the markets and she realized she could grow her own to eat.

I2: This farmer began sack gardening in order to get vegetables to eat.

I7: The farmer was motivated to plant in order to get food to eat.

I8: This farmer was motivated to plant in order to get food for her and her children to eat. She saw her friends doing it and wanted to act.

I10: This farmer was motivated to start farming because she wanted to eat the vegetables, which she says are good for the human body.

I11: This farmer was initially motivated to farm because after the post-election violence, she had trouble finding vegetables to cook. By growing them herself, she knew she could get them to eat. She feels that growing vegetables is a healthy thing because you can pick your own vegetables and use the money saved to buy other types of food (i.e. more variety).

I12: This farmer began farming so that she would have food to eat if she did not get a job that day, and had no money to buy food.

I13: This farmer began planting because it provides her with food to eat, and something to hope for.

I15: This farmer was motivated to begin because she is able to supply her food needs (i.e. to eat).

I16: This farmer started sack gardening because she felt it was an easy way to get food to eat.

I17: This farmer was motivated to plant a sack garden because she would have food to eat, and would feel more secure knowing she wouldn't sleep hungry at night.

I20: This farmer began sack farming with other women as an income generating activity, but says that being able to eat them has been more beneficial.

I21: This farmer was motivated to begin planting so that she could easily get vegetables during the dry season, when they are scarce in the markets. She can also use the money saved to buy other types of foods.

I23: This woman was motivated to plant after seeing other women who had planted and no longer had to buy vegetables to eat. She wanted to have vegetables available so that even if she didn't have money, there would still be food to eat.

I24: The farmer decided to plant in order to get food to eat.

I25: This farmer decided to plant in order to have food to eat.

I26: This farmer was motivated to plant in order to have vegetables to eat if she had no money to buy other food.

I27: The farmer was motivated to plant in order to have vegetables to eat (so that she doesn't have to buy them).

I29: The farmer decided to plant in order to have vegetables to eat more frequently.

I30: The farmer felt motivated to plant because she was impressed with being able to get her own vegetables to eat.

**GSS: Most of the farmers we interviewed were motivated to plant their sack gardens as a means of getting food to eat. For some farmers, this was because during the dry season, vegetables are rare in the markets and this was a more secure, and cheaper, way of getting them. For others, they felt that vegetables were healthy for their bodies. One farmer wanted to grow her own vegetables so they could eat vegetables more frequently. Many farmers were motivated by the prospect of self-reliance, meaning that even if they didn't have money to buy foods, they could still pick them from their gardens.**

#### Food Voucher

I5: This farmer began planting her sack gardens because she heard that Solidarites sometimes gives food vouchers to farmers who participate in their programs.

I7: This farmer planted her vegetables in hopes of being able to receive a food voucher from Solidarites.

I11: This farmer began sack farming with Solidarites in late 2007 and early 2008. She received a food voucher before beginning to plant and was expecting to receive another food voucher in return for planting. Although she feels it has been worth planting anyway, she was motivated to plant by the voucher system and disappointed she has not received another one.

I13: This farmer received a food voucher in early 2008 before planting but says that it was not her main motivation for planting.

I17: This farmer heard that other farmers had received food vouchers, so she began planting and has maintained her vegetables nicely in hopes of eventually receiving one.

I21: This farmer had been planting for two years when she was finally registered by Solidarites and given a food voucher for enough food to last 6 months. She does not know why she was chosen when there are many other farmers in her area who have never received one, but she thought perhaps they randomly choose farmers to motivate them to keep farming.

I27: This farmer received a food voucher in early 2008 and felt encouraged to plant a sack garden. Now that she has not received anything, and her sacks have not been doing well, she feels demoralized and is considering stopping to farm.

I28: This farmer is confused because she did not receive a voucher initially when she planted, but she did receive one along the way. Although she says they aren't the main motivation for planting, she has been waiting to receive another one.

**GSS: In the past, Solidarites has given farmers vouchers that can be redeemed at grocery stores for items like flour, sugar, beans and cooking fat. Several farmers mentioned these vouchers during our interviews. Three farmers admitted that their main motivation for planting was that they hoped to receive a food voucher from Solidarites, but have not yet. A few other farmers were encouraged to begin planting because they had received a voucher. And others still admitted that while the vouchers were not their main motivation, part of the reason they planted was they hoped to eventually receive the vouchers.**

#### Saves Space

I10: This farmer was motivated to plant vegetables in sacks because it saves so much space compared to planting on the ground.

I16: The farmer was motivated to plant in sacks because she loves farming but lacked the space on the ground to do it, so she saw that sacks saved space.

**GSS: Two farmers described being motivated to plant gardens in sacks because planting in a sack saves so much space compared to planting on the ground.**

#### Sell

I1: The farmer was motivated to begin planting by the possibility of selling her vegetables.

I4: This farmer was primarily motivated to plant because she realized she could sell the vegetables from her sack.

I10: This farmer runs a fruit and vegetable stand, so she was excited by the possibility of growing vegetables to sell and her stall so she wouldn't have to buy them all from the market. In particular, she thought it would help during the dry season when it is especially difficult to get enough vegetables at the market.

I14: The farmer was motivated to plant because if she was lacking money for food or household items, she could sell her vegetables to get money.

I16: The farmer was motivated to plant because she would be able to occasionally sell her vegetables.

I18: This farmer primarily planted vegetables in sacks in order to be able to sell them.

I20: Originally, this farmer was motivated to plant in order to sell the money to get vegetables because her husband had just left her and she needed money. Now, she only occasionally sells.

I21: This farmer was motivated to plant because when vegetables become scarce during the dry season, she will easily be able to sell and get money for other household items or food.

I22: This farmer decided to plant because he wanted to be able to sell the vegetables at his vegetable stand.

I24: This farmer was motivated to plant because she was impressed by other women who had planted and were selling their vegetables.

I25: This farmer was motivated to plant because in a pinch, if she lacked money for household goods, she could always sell her vegetables and get some money.

I26: This farmer was partially motivated to plant because if she lacks money for essential goods, she can sell a few vegetables to get some money.

I30: This farmer was motivated by the possibility of selling her vegetables.

**GSS: Over a third of farmers interviewed were at least somewhat motivated to plant sack gardens by the possibility of being able to sell the vegetables from their sacks. Some farmers, especially those who already ran vegetables kiosks, saw this as a business opportunity because they could more reliably get vegetables for their stands, especially during the dry season when vegetables are scarce. Other farmers described being able to sell their vegetables as a coping strategy, which would allow them to get a small amount of money in a time of need to buy extra food or other household goods.**

#### Share with Friends

I26: This farmer was motivated to plant vegetables in a sack because she would be able to assist her friends by giving them vegetables.

**GSS: One farmer was motivated to plant vegetables in a sack because she would be able to assist her friends by giving them vegetables.**

Appendix E. Grand summary statements for all themes from the qualitative interviews.

## **Motivations for Sack Farming**

### Eat

Most of the farmers we interviewed were motivated to plant their sack gardens as a means of getting food to eat. For some farmers, this was because during the dry season, vegetables are rare in the markets and this was a more secure, and cheaper, way of getting them. For others, they felt that vegetables were healthy for their bodies. One farmer wanted to grow her own vegetables so they could eat vegetables more frequently. Many farmers were motivated by the prospect of self-reliance, meaning that even if they didn't have money to buy foods, they could still pick them from their gardens.

### Enjoy Farming

One farmer explicitly mentioned that she was interested in sack because she enjoys farming, but many other farmers expressed this sentiment in the way they talked about farming and as they were showing us their sacks.

### Food Vouchers

In the past, Solidarites has given farmers vouchers that can be redeemed at grocery stores for items like flour, sugar, beans and cooking fat. Several farmers mentioned these vouchers during our interviews. Three farmers admitted that their main motivation for planting was that they hoped to receive a food voucher from Solidarites, but have not yet. A few other farmers were encouraged to begin planting because they had received a voucher. And others still admitted that while the vouchers were not their main motivation, part of the reason they planted was they hoped to eventually receive the vouchers.

### Saves Space

Two farmers described being motivated to plant gardens in sacks because planting in a sack saves so much space compared to planting on the ground.

### Sell

Over a third of farmers interviewed were at least somewhat motivated to plant sack gardens by the possibility of being able to sell the vegetables from their sacks. Some farmers, especially those who already ran vegetables kiosks, saw this as a business opportunity because they could more reliably get vegetables for their stands, especially during the dry season when vegetables are scarce. Other farmers described being able to sell their vegetables as a coping strategy, which would allow them to get a small amount of money in a time of need to buy extra food or other household goods.

### Share with Friends

One farmer was motivated to plant vegetables in a sack because she would be able to assist her friends by giving them vegetables.

## **Process of Sack Gardening**

### Building the Sack

The majority of farmers arranged their sacks according to the method taught by Solidarites. Sacks are built by first filling the sack  $\frac{1}{4}$  full of soil. After that, the farmer removes the bottom from a tin, places the tin in the middle of the soil, and fills the tin with stones. Soil is poured around the tin and the tin is slid out and placed on top of the soil again, repeating until the entire sack is filled with a column of stones and soil around them. Then, farmers pour water on the sack and wait for the water to soak into the soil. At this point, some farmers had to wait to have their sacks inspected by Solidarités, while others were able to get seedlings right away. Anywhere from 28 to 56 seedlings were planted into holes in the side of the sack, and on top of the sacks. A few farmers used an older method from Solidarités, which involves alternating layers of soil and stones. And a few other farmers had tried sack gardening by simply filling sacks with soil. Sacks usually ranged in size from 50 to 90kgs.

### Fertilizer

Two thirds of the farmers interviewed have applied manure of some kind to their sack gardens, including cow, goat, chicken, and rabbit manure. Many of the farmers mixed manure with the soil initially as they were constructing their sacks. Several farmers have been brought some type of manure by Solidarites to apply to their sacks, and a few farmers have received manure for free from friends, neighbors, and even from Mizuka (another sack gardening project). Other farmers have purchased manure, usually for 30 to 50 ksh for a 2kg tin. A few farmers said that manure is hard to get, so they have either used soil from areas they considered to be naturally fertile (e.g. dumping grounds) or they allow the plants to compost in the sacks before planting again. None of the farmers interviewed had ever applied chemical fertilizers.

### Getting Water

Most farmers buy water to irrigate their sack gardens from outside taps or tanks. They generally pay 3 ksh for 20L, and must carry the water to their houses on their head or on their backs. The water they buy is the same water that is used for other household uses. Some farmers are given money by other family members to specifically to buy water, some farmers take it out of their overall food budget, and others get money from their businesses to pay for it. A small number of farmers interviewed get their water from a shallow well within the household compound. This groundwater is slightly brackish, but they use it for doing laundry and also for watering their plants.

### Pesticides

About a third of farmers (10) report having used a chemical pesticide to treat their plants for disease or insect pests at some point in time, while slightly more than a third (13) report having tried an organic pesticide on their plants. Women who have used chemical pesticides have generally contributed money to a group and split the cost of purchasing the pesticides as they are fairly expensive. Organic pesticides vary substantially but many women report using a traditional method of applying ash to the leaves of their plants. Others have used a type introduced by Solidarites which is a mixture of garlic, hot peppers, bar soap and water. The farmers grind these ingredients together, let it sit in water overnight, and then spray or sprinkle

this mixture on their plants. In talking to farmers, variations of this mixture also appear to be used. Some farmers add waterguard (a chemical disinfectant like bleach) to the mixture, and others report adding ash to the mixture. Some farmers report trying either the ash or hot pepper mixture and being frustrated because the pests return, while others feel it works well. There is also a disparity in the advice given regarding pesticides because some farmers reported that Solidarites came and sprayed their plants with chemical pesticides, others were taught how to prepare the chili pepper mixture, and a few were only advised to apply ash to the leaves. Finally, a small number of farmer report not being able to apply any pesticides because they are too expensive to prepare.

### Planting

Farmers must replace the plants in their sack in order to keep the sack gardens going. Some replace the entire sack every few months, while others just replace plants on an as-needed basis, which allows the entire sack to last more than a year. When planting into the sack, farmers have been taught to measure the distance between the seedlings so that they do not die from crowding. Finally, one farmer shared that Solidarites told her she must separate kale and spinach seedlings into separate sacks because they will not do well together (which is not likely true).

### Sacks

About half of the farmers reported purchasing sacks to build their sack gardens, while the other half either already had sacks or they were given sacks for free by a friend, family member or by Solidarités. The sacks vary in price, depending on size and quality, but range from 10 to 30 shillings per sack. Many farmers reported having to change their sacks after a few months or a year because the sacks degrade over time and rip open. However, a few farmers have not changed their sacks since they began sack gardening three years ago.

### Seedlings

More than two thirds (22) of the farmers report being given kale and spinach seedlings, or green onion and coriander seed packets, for free by Solidarites at some point during their sack gardening experience. Most of the farmers went to one of the nurseries run by Soldiarites, at the DC's office, in Mashimoni or Kikoshep, to collect the seeds. Other farmers were brought seedlings or seed packets at their homes by community mobilizers. Several farmers (12) have also bought seedlings from various markets, including Toi, Markiti, Kabernet gardens and Kawangware. Sometimes this is because they were not aware of the free seedlings available from Solidarites, sometimes there were no seedlings available at Solidarites' nurseries, or sometimes they wanted a particular type vegetable, such as an indigenous vegetable like kunde. One farmer bought green onion, coriander and cowpea seed packets from an agrovot. Another farmer reported bringing back sage seeds from her home upcountry, and she also collected (stole) nderema seedlings from someone's house in Westlands. Finally, a couple of farmers were given seedlings by friends.

### Soil

Nearly all farmers agreed that getting soil for their sacks was challenging because of the lack of open spaces within Kibera. Farmers collected soil from a variety of locations including an open field near the Solidarites office, a field near the ODM office, houses and latrines that were under construction, farm fields outside of Kibera, the railroad, and old dump sites. Many farmers

collected soil from near the District Commissioner's (DC) office, next to the Solidarites office. The soil there was dumped by the Nairobi City Council to level soccer field, but farmers were collecting the soil for their sacks. Several farmers acknowledged that they were collecting their soil illegally, particularly from the DC's office and the railway, and said they went to collect late in the evening or early in the morning. People caught collecting soil from the railway risk being jailed. At least half of the farmers were able to obtain their soil for free, while the others paid anywhere from 50 to 150 shillings per sack to get the soil, depending on whether the cost included having someone carry the soil. A few farmers said that they paid a worker from Solidarites to carry soil to their houses and help them erect the sacks, but most farmers carried the soil themselves on their heads, their backs or in a wheelbarrow. A few groups of farmers had worked together to help each other dig and carry the soil to their houses. Some farmers said they had problems when digging the soil because they had to separate out the stones, broken glass and trash out of the soil as they were filling their sacks.

### Stones

Farmers obtained stones in a variety of ways in order to construct their sack gardens. Many farmers simply collected stones from the roads around their houses. Some were able to collect stones from the DC's office where they also collected the soil. Others said there were no stones near their houses so they were forced to collect stones from along the railroad, which is an offense punishable by jail if caught. One woman paid for stones because there were no stones near her house, and she did not want to get caught stealing stones from the railroad. However, the stones she was given were of poor quality and had cement on them, which she felt was bad for her plants.

### Weeding

A few farmers discussed weeding their sack gardens, although the frequency and amount of time spent on it varied substantially from over an hour each day to once every two months. Women used a variety of tools to do the weeding including their hands, a stick and a panga (a large knife), which one farmer uses to chop off large weeds from the bottom of her sack.

## **Types of Plants Grown**

### Choice of Plants

Several factors affected the types of plants that farmers chose to plant in their sacks. The majority of farmers reported planting kale, spinach, onions or dhanias because these seedlings were freely available at the Solidarités office, and they were also confident that these grew well in sacks. Many farmers expressed an interest in planting other types of indigenous vegetables, such as African nightshade, amaranth, managu, nderema and terere, had the seedlings been available for free, but were hesitant to purchase them if they could get kale and spinach for free. However, other farmers felt that indigenous vegetables require too much space or are not able to grow well in sacks. In addition, many indigenous vegetables cannot be harvested continuously in the same way that kale and spinach can. A few farmers chose to plant other types of vegetables, like tomatoes, beans and cowpeas because they were able to get the seeds nearby.



### Plants Grown

Nearly all the farmers planted kale, spinach, onions and coriander, most likely because these seedlings are given to farmers for free by Solidarites. Six farmers (20%) have grown or do grow indigenous vegetables in their sacks, and 12 farmers (approx. one third) have planted something other than kale, spinach, coriander and onions.

### List of all plants grown in sacks

Kale

Spinach (Swiss Chard)

Onions

Coriander

### Other

Beans

Cabbage

Cowpeas (as greens)

Eggplant

Sweet potato (as greens)

Tomato

Unknown volunteer plant

### Indigenous Vegetables

Amaranth

Kanzira/kazira

Kienyeji

Kunde

Managu

Murenda

Nderema

Sage

Terere

## **What is done with the Vegetables Grown**

### Eat

Most of the farmers interviewed ate part or all of the vegetables they harvested from their sack gardens. Farmers with more sacks reported rarely buying vegetables for their homes anymore, while others only harvest once per week or a few times per month.

### Sell

Many of the farmers sell vegetables from their sacks. Some sell them informally to their neighbors, harvesting amounts according to what their neighbors can pay. Others sell them more formally at vegetable stands in the market. A couple farmers treat sack farming as a business venture, and have carefully calculated the money they invest in water and pesticides versus the

money they earn from selling the vegetables, while others have not really done the calculations. Vegetables are sold either as a bunch or per leaf, depending on how abundant vegetables are in the market.

#### Share

Many of the sack farmers share some of the vegetables they harvest with their friends or neighbors, often at least once or twice per month. Sometimes they share their vegetables as a way of encouraging their neighbors to plant their own sack gardens, while others share with their neighbors so that they won't have to sleep hungry. Several farmers said they were willing to share the vegetables with anyone once, but after that they would encourage that person to plant their own sack garden. In an area where many people garden, one farmer said that she used to share with her neighbors but now she only sells her vegetables because so many people have now planted.

#### Feed to Animals

One farmer keeps chickens, so if he has extra kale or kale stems, he will feed them to his chickens.

### **Previous Experience with Agriculture**

#### Formal Learning

A small number of farmers drew upon agricultural lessons they learned in school in order to understand some aspect of sack gardening.

#### No Prior Experience

A small number of farmers (4) said they had no previous experience with agriculture prior to beginning sack farming. Two were Somali and had never been exposed to agriculture because their families have been pastoralists. The other two spent the majority of their childhoods in Nairobi, so they never learned to farm.

#### Rural Experience

More than half of the urban farmers we interviewed were migrants to Kibera and reported having learned to farm back home. The majority of these farmers know how to farm a wide variety of crops, including grains (maize, sorghum, millet), vegetables and indigenous vegetables. Many of these farmers have drawn upon their rural agricultural experience to help them care for their sack gardens in Kibera.

#### Urban Experience

About a third of the sack farmers we interviewed have previously practiced some form of urban agriculture. Several just grew vegetables (kale, spinach, indigenous vegetables) on the ground near their house. A few women farmed more intensively on larger plots in areas like Langata or Kenyatta, where they grew a variety of crops including kale, spinach, sweet potatoes, pumpkins, sugarcane, arrowroots and cowpeas. However these farmers were forced to quit farming in these areas as the farm fields were developed into houses.

## **Training for Sack Gardening**

### Friends and Family

Overall, informal training by friends and family members seems to have instrumental in teaching many of the farmers I interviewed how to plant and care for their sack gardens. Many farmers report being encouraged and even trained about how to plant sack gardens by their friends and neighbors before receiving any training from other organizations like Solidarités, if at all. Other farmers learned how to prepare local pesticides, such as putting ash on the leaves, or mixing soap, hot peppers and garlic together with water. Some farmers learned certain techniques, like composting plant leaves, from other relatives like their grandmothers. A few farmers overheard women in the market talking about sack gardening and approached them to learn how it was done.

### Other Organizations

Although Solidarités has played a major role in training farmers, a few farmers learned about sack farming first through other organizations such as church groups and women's groups. The farmers were taught about sack gardening by these other organizations well before Solidarités began working in Kibera. One farmer also reported learning about different types of pesticides by an employee of a pesticide company who will spray the farmers' plants for a fee.

### Self

Many farmers reported training themselves on some aspect of sack gardening, including how to build the sacks, how to apply manure, preventing the spread of infection between plants, the best watering schedules, and how to use traditional pesticides. Many farmers reported experimenting with different techniques until they found the best one, but a few said they drew upon knowledge they had learned in school or on materials they had read.

### Solidarités

Solidarités has had a major presence in terms of training farmers in Kibera about how to practice sack gardening. Their trainings included how to build the sacks, how to plant, how to deal with insects and diseases and how to weed. They did not cover topics like nutrition, how to use the vegetables at home, or selling the produce. The quality of the training the farmers received seemed to be inconsistent. While some farmers were required to attend training seminars at the Solidarités office before receiving seedlings, others were taught how to plant at their house and the seedlings were brought to them. A few farmers had been sack gardening for a long time, but agreed to register with and go through the Solidarités trainings so that they could receive free seedlings. Many of the farmers living closer to the Solidarités office had received training on how to make traditional pesticides using soap, garlic, and hot peppers. However, in other areas, the community organizers had never taught them how to do this, or they had instructed them to put ash on the leaves. When asked whether they ever used waste water to irrigate their plants, the majority of farmers said that Solidarités had instructed them not to do this. Some farmers seemed overly concerned about disobeying what Solidarités had instructed them to do or not do. Many of the farmers living further away from the Solidarités office seemed disappointed by how infrequently they were visited by community mobilizers, with many having not received a visit in over three months. Finally, one farmer was interested in joining Solidarités, but was reticent

to approach the community mobilizer because of reports that he operated based on tribalism, meaning he was more willing to work with farmers of certain ethnicities than others.

### Teach Others

Several farmers reported training others, especially their neighbors and family members, about how to construct sack gardens or about how to take care of their plants. One farmer, the chairwoman of a women's group, attends the Solidarités trainings and then briefs other members of her group.

## **Groups**

### Formal Groups (other)

Two farmers were part of formal groups, such as merry-go-rounds, which had nothing to do with sack gardening.

### Informal Groups (other)

One farmer is a member of an informal group that is a merry-go-round. Women in the group contribute money to buy household items, or to send money home. This woman has used the money for her sack gardens, but that is not the focus of the group. The group is not registered, and does not have a name.

### Formal Gardening Groups

Five farmers (15%) reported belonging to a formal sack gardening group. In these groups, women meet to talk about issues pertaining to sack gardening. In two of these groups, women contribute money to merry-go-rounds and can borrow the money with interest. Two said they use the money for their sack gardens, while one said that her farming is too small-scale to make it feasible to repay the loan. In one of the groups, women contributed money to share the cost of fertilizers and pesticides. Finally, one woman belonged to a group in which women planted and harvested their sacks together. The farmer left the group due to mismanagement of funds.

### Informal Gardening Groups

More than a third of women interviewed participated in an informal gardening group. These groups seemed to be organized based on proximity to other farmers, and meet only occasionally to discuss problems or to receive training on things like how to prepare local pesticides. Many women reported that their groups share the cost of purchasing manure or pesticides for the sack gardens.

### No Group

About a third of farmers are not part of any group, either ones that deal directly with gardening or other types, such as merry-go-rounds. Typically farmers gave two reasons for not participating in these groups. Either they had never heard of a group near their neighborhood to join, or they felt they lacked the money to join, particularly merry-go-round groups, where they would be required to make contributions.

### Would like to Join a Group

More than half of the farmers who are not currently part of a group expressed an interest in joining a group, particularly one that deals with farming. They would like to get advice from others about how to improve their farming. Others are interested in starting a more formal group farming project, if more land were available, so they could plant a wider variety and larger quantity of vegetables together.

## **Benefits to Sack Gardening**

### Environment

A benefit of sack gardening, for some farmers, has been that it makes the environment of Kibera look better, or greener.

### Food

Many farmers feel they have benefited by being able to get food from their gardens. Sometimes vegetables are rare or expensive in the markets, so this is an easy way for them to get vegetables. Others expressed feeling more secure because they knew that if they didn't have money to purchase food, at least they could pick vegetables from their gardens to eat or to sell in order to purchase flour or cooking fat. Some acknowledged that sack gardening is not extremely profitable, but they appreciate knowing that they have food available when they don't have money so that they don't have to sleep hungry.

### Friendship and Cooperation

Many farmers felt that sack gardening had strengthened friendships or cooperation amongst people in Kibera. For some farmers, they felt gardening was beneficial because they are now able to share their vegetables with their friends. Others cooperated with friends or neighbors by giving them extra seedlings, helping each other to carry soil or build their sacks, or by pooling money to buy fertilizer and pesticides. A few farmers emphasized that while they had space to plant more sacks, they made sure to share the space with their neighbors so they could benefit as well. In addition, sack gardening has helped to create a sense of community because it has given people reasons to talk to their neighbors. They buy water from each other, consult with each other about problems, and create employment for each other. Sack farming has been a way to bring the women of certain neighborhoods together, and according to one farmer, has decreased tensions between different ethnicities in Kibera.

### Gaining Knowledge

Farmers feel they have benefited from sack gardening because they now have the knowledge of how to grow in urban areas. They feel more secure because even if they move to other areas of the city or of Kenya, they can take this knowledge with them and plant again. Other farmers said they felt more confident because they had never farmed before and they had now learned a new skill.

### Income

For some farmers, sack gardening has been beneficial because it has provided them with additional income. Some own vegetable kiosks and have been able to sell the vegetables they

grow and their shops. Others sell their vegetables more informally to friends or neighbors if asked. The money they earn is used to buy a variety of things, including water for their plants, other household items, or to help pay rent. However, many of the farmers had not clearly calculated how much money they invested in their sack gardens to purchase water or pesticides, versus how much money they earned from selling the vegetables. The margin of profitability seemed very small due to the high cost of water for many of the farmers we talked to.

### Pride

A few farmers expressed feeling proud or more confident as a result of sack gardening. They feel healthier, happier, and more confident because they are better able to provide for their families or share their vegetables with their friends. They feel that sack gardening has given women more confidence because of the challenges they undergo as part of farming. One farmer said she was proud because the vegetables she grows taste much better than those she buys at the market.

### Savings

Sack gardening has provided farmers with an opportunity to save money by setting aside the money they would normally spend buying vegetables in the market. Some women have been setting aside the money for an unspecified goal. Others save the money to buy household items, things like clothing, shoes, or pens for their children, or to pay their rent each month. Several farmers contribute their savings to merry-go-rounds, and they use the loans from the merry-go-rounds to invest in household goods. One farmer has been teaching her daughter to save as part of the project. One farmer uses the savings from her vegetables to buy stock for her fish selling business, thus multiplying the savings into substantial profits.

### Sharing Knowledge

Farmers have found sack gardening to be beneficial because they are now able to share the knowledge with their friends and family in Kibera or other parts of Kenya. A few farmers have already showed their relatives in rural areas how to plant sack gardens. One farmer has helped her young daughter plant a sack garden and is teaching her how to maintain it. Another farmer has seen young children in her neighborhood build little gardens on the ground. Although they have picked her kale leaves to “plant” in their gardens, she does not mind because it is encouraging them to be interested in agriculture.

## **Challenges to Sack Gardening**

### Animals

Seven farmers (23%) reported having their crops eaten or destroyed by animals at some point in time, including by chickens, ducks, dogs, cats, and rabbits. Several farmers had built fences out of old sacks and poles to keep the animals away from their sacks, but one farmer continued to have problems with her neighbor’s chickens getting inside the fenced in area.

### Children

Seven farmers reported having problems with children destroying their vegetables or sacks, usually by picking off the leaves or pulling the seedlings out of the side of the sack. In one case, children were pulling out the leaves so they could pretend to plant their own gardens.

### Disease

About a third of farmers reported having problems with their plants being infected by diseases. They said the leaves would turn yellow and dry up, or the leaves got black spots on them. Some treated their leaves with pesticides, while others uprooted the infected plants and replanted.

### Insects

More than half of the farmers reported having problems with insect damage to their crops. Although the majority could not identify or did not specify the type of insects, observations at their sack gardens suggest they were frequently attacked by aphids or flies.

### Insecure Tenure

Only a few farmers mentioned issues related to insecure land tenure during the interviews. Those that did mentioned having to move their sacks because they did not own the land they had built the sack gardens on. One farmer said she did not want to invest in farming on her plot because she may have to move at any time.

### Lack of Knowledge

Several farmers have faced challenges with sack gardening because they lack knowledge about particular aspects of it. In particular, farmers seem to have struggled with knowing how to construct their sacks. Many farmers said after they built their first sacks, they watered them and the sacks fell down. Other farmers have had trouble because they lack the knowledge about how to treat their plants for different pests or diseases.

### Lack of Pesticides

Nearly a third of farmers reported having difficulty obtaining pesticides because they lacked the money to purchase it. Some farmers did not know how to make the traditional pesticides using hot peppers, garlic and soap, and others felt that even buying those ingredients was too much of a financial burden.

### Lack of Water

More than half of the farmers reported having trouble getting water to water their sack gardens. For some, this was because of water shortages at the pipes or tanks and so they were not able to purchase enough water. For others, this was because they lacked the money to buy the water. Several farmers said that at least twice per week they were unable to buy water, and others said their plants have withered or died as a result of not being watered.

### Low Yield

A few farmers expressed frustration with the low yields from their sack gardens. They would like to be able to sell their vegetables, but because they do not get much, they only eat the vegetables from their sacks.

### Neighbors

Five farmers reported having conflicts with their neighbors as a result of their sack gardens. Problems include neighbors urinating on the sacks, pouring dirty water, stealing the vegetables, and destroying the sacks. One farmer said it is better to let her neighbors pick the vegetables than quarrel because Kibera is sensitive and small issues can explode.

### Obtaining Seeds or Seedlings

More than a third of farmers have experienced problems with obtaining seeds or seedlings in some form or another. In some cases, farmers have tried to get either seed packets for coriander and green onions from Solidarités, but have been unable to because they have run out. In other cases, farmers would like to plant other types of vegetables, especially indigenous vegetables, but have not because they do not know how to get hold of the seeds here in Nairobi.

### Obtaining Soil or Stones

Several farmers reported having trouble obtaining soil or stones, enough that it deterred them from planting more sacks or that they had to resort to stealing the soil and stones, or paying for the soil and stones for their sacks.

### Pollution

Several farmers experienced problems with cutting their hands on glass, or having to pull trash out of the soil they were using to construct their sacks. Other women have had problems with people urinating on their plants, or pouring dirty water on them. One woman has problems with finding piles of human excrement next to her sacks. Finally, one farmer said she would like to construct additional sacks but she feels her area is too dirty, because it is next to a latrine and a drainage way filled with trash. She believes that other households in her area have not built sacks because they are afraid that the plants grown in this area are too polluted to eat, not because they can't get the materials to build them.

### Space

Nearly half of the farmers interviewed said that finding enough space to put their sacks was a major challenge. Several women said that they would have planted a greater diversity of plants, particularly indigenous vegetables, if they had more room to build more sacks. In addition, a few women said they had taught their friends how to construct a sack garden, but their friends did not have enough space to actually build them.

### Theft

At least a third of farmers have experienced theft from their gardens, including having some or all of their plants harvested, and having basins or bags stolen with vegetables growing in them. Farmers have various ways of dealing with theft. Some just let it happen, while others have moved their sacks to different locations, fenced their gardens with sticks and old sacks, or pretend to spray their plants with pesticides each day to make them seem inedible.

### Time

Several farmers mentioned time constraints as a major challenge with sack gardening. In particular, they said they were unable to attend the training seminars being held by Solidarités as a result of their day jobs or caring for small children.



## **Environmental Risk**

### No Risk

Several farmers interviewed felt that their vegetables were not at risk from any form of contamination. Two farmers described using soil with trash in it, but were not concerned about the quality of the soil. Other farmers felt they kept the areas near their gardens clean, so there was nothing to worry about. One farmer uses well water to irrigate her plants. She says it is clean, because if it weren't, she would have found out by now. All of them do wash their vegetables before eating them.

### Aware of Risk (but do not actively prevent it)

Four farmers described being aware of different types of environmental risk, such as contamination by flies, but did not feel that their own vegetables were affected, or did not take measures to prevent it.

### Prevent Risk

The majority of farmers expressed some level of concern about environmental risk. The most commonly mentioned sources of environmental risk were dusts blowing onto the vegetables, trash in the nearby waterways and flies landing on the vegetables. They believed contamination from these could cause a variety of problems including stomach aches, diarrhea, vomiting, cholera, typhoid or parasites. Farmers used a variety of measures to prevent the risk of contamination of their plants including sweeping near their sacks, clearing the trash out of the drains that pass near their plants, building fences around the sacks, sprinkling water on the plants. Nearly everyone washes their vegetables before consuming them, although washing methods range from a simple rinse, washing with warm water, soaking them in water guard, or rinsing them multiple times. The majority of farmers felt that the measures they had taken were sufficient to eliminate all environmental risk.

### Waste Water

None of the farmers interviewed admitted to using waste water of any kind, either from a stream or from their household use, to water their plants. The majority claimed that water with any kind of soap in it would dry up or burn their plants, and they did not want to lose the efforts they had put into gardening. They were also concerned that other waste water would contaminate their plants and make them sick. The only farmer who didn't use clean (i.e. from a well or from a tap) water collects water in buckets when it rains. She says it isn't clean enough to drink, but she feels it is safe for her plants.

## **Food Consumption**

### Greater Quantity

Four farmers reported that they now eat vegetables in greater quantities than before they began sack gardening. They normally budget a certain amount of money per day or per week to purchase vegetables to cook. But on days that they harvest from their sacks, they eat more

vegetables than they would have been able to buy from the market. One farmer says on days that she harvests, they eat until they are happy.

#### More Variety

Six farmers (15%) report having more diverse diets as a result of growing their own vegetables. A few farmers use the money they save by not buying vegetables to buy other types of food such as eggs, fish, meat or yogurt. Others said that on days they do not harvest from their gardens, they buy other types of vegetables to get more variety.

#### Same as Before

One farmer says that her food consumption has not changed since she began gardening because the size of her family has not changed, so she does not need more food.

## Appendix F. Survey Instrument for Farming Households

Checked By: \_\_\_\_\_ Date Checked: \_\_\_\_\_

### **Section A: Socio-demographic Information**

Note: Interviewee must be the primary person who cares for the household's sack gardens.

Enumerator (Name) \_\_\_\_\_ ☐ Oral Consent given

Respondent Name \_\_\_\_\_

Telephone # of the respondent \_\_\_\_\_

A1. Household #: \_\_\_\_\_ A2. Interview type \_\_\_\_\_ 01 farmer 02 non-farmer

A3. Gender: M F A4. Age \_\_\_\_\_ A5. Date: \_\_\_\_/\_\_\_\_/2011  
(day) (month)

A6. Village within Kibera: \_\_\_\_\_  
01 Soweto East/West 03 Laini Saba 05 Makina 07 Siranga 09 Kisumu dogo  
02 Gatwekera 04 Kianda 06 Lindi 09 Mashimoni

A7a-c. Place birth (if not Kibera):

Province:

District:

Village:

A8. Number of years the respondent has lived in Kibera \_\_\_\_\_

A9. Are you the household head? \_\_\_\_\_  
00=No 01= Yes → go to A11

A10. Who is the HH head in relation to you? \_\_\_\_\_  
01 Husband 02 Wife 88 = N/A 03 = Other (specify)

A11. How many people live (i.e. regularly sleep and eat) in this household? \_\_\_\_\_

A12. Type of household \_\_\_\_\_  
01 Joint- husband and wife present on regular basis  
02 Female headed- husband lives elsewhere, does not regularly sleep in house  
03 Female headed- woman is single, separated, divorced or widowed  
04 Male headed- wife lives elsewhere, does not sleep regularly in house  
05 Male-headed- male is single, separated, divorced or widowed  
06 Other (identify)

A13. Marital Status \_\_\_\_\_  
01 Married monogamous 05 Separated  
02 Married polygamous 06. Divorced  
03 together but unmarried 07. Widowed/widower  
04 Single (never married) 08. Other: \_\_\_\_\_

77. Don't know  
88. N/A

99. No answer

<b>Family Member</b> (Only those <u>living</u> in the household)	<b>A14. Sex</b> 1. Male 2. Female	<b>A15. Age</b> *Children less than 1 year should be written as mo./12	<b>A16. Relation to Household head</b> 01. Husband 02. Wife 03. Son 04. Daughter 05. Grandchild 06. Male relative 07. Female relative 08. Orphan 09. No relation	<b>A17. Primary occupation over last one yr</b> 01. Cannot work due to illness/injury 02. Unemployed 03. Farmer 04. Salaried employee 05. Formal business owner 06. Informal business owner 07. Casual laborer 08. Caregiver 09. Student 10. Child (too young for work) 77. Others (specify)_____ 88. Don't Know 99. No Answer	<b>A18. No. of days a week devoted to occupation</b>	<b>A19. Secondary occupation over last one yr</b> 01. Farmer 02. Salaried employee 03. Formal business owner 04. Informal business owner 05. Casual laborer 06. Caregiver 07. Student 08. Others ( specify)_____ 77. N/A 88. Don't Know 99. No Answer	<b>A20. Number of days a week devoted to occupation</b>	<b>A21. Highest level of education</b> 01. No formal schooling 02. Nursery school 03. Lower primary (1-3) 04. Upper primary (4-8) 05. Ordinary secondary (1-4) 06. Advanced secondary (5-6) 07. Vocational Training 08. Tertiary education 09. College/university 10. Child (too young) 77. Other (specify)_____ 88. Don't Know 99. No Answer
A								
B								
C								
D								
E								
F								
G								
H								
I								
J								

## Section B: Physical and Natural Capital

B1. When did you first begin sack gardening? (month and year) \_\_\_\_\_

B2. How did you learn about sack gardening? \_\_\_\_\_

- 01 Family member
- 02 Friend
- 03 Neighbor
- 04 Solidarites
- 05 Mizuka
- 06 Other NGO \_\_\_\_\_
- 07 Other \_\_\_\_\_

B3. How many sacks did you initially start with in your garden? \_\_\_\_\_

B4. How many sacks do you now have? \_\_\_\_\_

B5. When did you plant your current sacks? \_\_\_\_\_ (mo/year)

What are the main crops you plant in your sack gardens, listed in order of priority?

	B6. Crop	B7. How often harvested (per month)	B8a. Amount at harvest during <u>WET</u> season (in leaves or bundles)		B8b. Amount at harvest during <u>DRY</u> season (in leaves or bundles)		B9. What is done with vegetables, in order of priority? 01 Eaten 02 Sold 03 Shared with friend/family	B10. How did you get the seedlings/seeds (list in order of priority)? 01 Solidarités 02 Purchased 03 Friend/family member (urban) 04 Friend/family member (rural) 05 Other _____
A								
B								
C								
D								
E								
F								
G								

### Crop Codes

- 01 Sukuma (kale)
- 02 Spinach
- 03 Onions
- 04 Dhania (coriander)
- 05 Beans

- 06 Eggplant (Biringanya)
- 07 Sweet potatoes (as leaves)
- 08 Tomatoes
- 09 Terere (Amaranth)
- 10 Kanzirai
- 11 Kunde (cowpeas)

- 12 Managu
- 13 Managu
- 14 Murenda
- 15 Nderema
- 16 Sageti
- 17 Other \_\_\_\_\_

B11. How did you obtain the sacks used for your gardens? \_\_\_\_\_

- 01 Already owned  
 02 Given for free  
 03 Purchased (specify cost per sack \_\_\_\_\_)  
 04 Other \_\_\_\_\_

	Have you used any of these fertilizers in sack gardens for your existing crop?	Use 00= No 01= Yes	How many times have you applied fertilizers to your current crop since planting?		How obtained (in order of priority)? 01 Purchased alone 02 Purchased in a group 03 Given by Solidarités 04 Given by family/friends 05 Open drain 06 Own source 07 Other _____		Cost of fertilizer or manure, if purchased (total since planting)	
			Planting	Post-Planting	Planting	Post-Planting	Amount purchased	Cost of purchase
B12a-g	Manure _____							
B13a-g	Compost							
B14a-g	Wastewater							
B15a-g	Chemical fertilizer							
B16a-g	Dumpsite waste							
B17a-g	Plant residues (leaves)							
B18a-g	Other (specify) _____							

	Have you used any pesticides in your sack gardens in the last 1 year:	Use 00 = No 01= Yes	Frequency of application 01 >2 times per week 02 1-2 x/week 03 2-3 x/mo. 04 1/mo. 05 every 2 mo. 06 > every 2 mo. 07 N/A	How obtained (in order of priority)? 01 Purchased alone 02 Purchased in a group 03 Given by Solidarités 04 Given by friend/family 05 Other _____	Cost of pesticide, if purchased (ksh/ application)	
					Amount purchased	Cost of purchase
B16a-e	Chemical pesticide					
B17a-e	Traditional (e.g. soap, garlic, hot pepper)					
B18a-e	Traditional (ash)					
B19a-e	Other (specify) _____					

	In the last <u>YEAR</u> , who in the HH is MAINLY responsible for the following crop related tasks?	Responsible 01 HH male adult 02 HH female adult 03 HH child/youth 04 Non HH person for pay 05 Non HH person for free 06 Solidarites 07 N/A
B20	Building the sacks	
B21	Planting	
B22	Weeding	
B23	Watering	
B24	Applying pesticides or fertilizers	
B25	Harvesting	
B26	Marketing/Sale of crops	



B27. If the crops are sold, what is done with the income from this produce, in order of priority?

- |                                  |                      |
|----------------------------------|----------------------|
| 01 Purchase other food items     | 06 Used to buy water |
| 02 Purchase other HH items       | 07 Other _____       |
| 03 Pay rent                      | 88 N/A               |
| 04 Put into savings              | 99 Don't know        |
| 05 Contributed to merry-go-round |                      |

B28. How frequently do you sell vegetables from your sack gardens (per month)? \_\_\_\_\_

B29a-b. On average, how much money do you earn selling your vegetables during a single sale?

Quantity sold \_\_\_\_\_ (leaves/bunches)      Amount earned \_\_\_\_\_

B30. Where do you sell the vegetables from your sack gardens (in order of priority)? \_\_\_\_\_

- 01 Informally to friends or neighbors
- 02 To vegetable vendors
- 03 At my own vegetables stalls
- 04 Other \_\_\_\_\_
- 88 N/A

	<b>B31. Where did you obtain the soil for your sacks?</b>	<b>B32. No. of Sacks</b>	<b>B33. Permission given to obtain soil?</b>  01 Ask, given 02 Asked, not given 03 Did not ask	<b>B34. Cost per sack (if bought)</b> 88= NA	<b>B35. GPS coordinates</b> Note: If distance is too great to collect coordinates, write verbal description of location and collect coordinates after survey is complete.
A	Solidarités office				
B	Open field (specify location)				
C	Building under construction				
D	Rail road				
E	Dump site				
F	Fields outside Kibera				
G	Other (specify)				

B36. During the <b>dry</b> season, where do you get the water to irrigate your sack garden, in order of priority?	B37. How many liters of water do you use per day for your sacks?	B38. If irrigation water is purchased, how much does it cost? *Indicate cost/volume	B39. GPS location of water source?  (Give waypoint and coordinates)

Codes for water sources:

01 Piped water in the house/compound  
02 Piped water in neighbor's compound  
03 Public tap

04 Open public well  
05 Closed public well  
06 Open well, compound  
07 Closed well, compound  
08 Rainwater  
09 River/stream

10 Borehold  
11 Water vendor  
12 Other \_\_\_\_\_  
77 Don't know  
99 No answer

B40. During the <b>wet</b> season, where do you get the water to irrigate your sack garden? (Use same coding for B36)	B41. How many liters of water do you use per day?	B42. If irrigation water is purchased, how much does it cost? *Indicate cost/volume	B43. GPS location of water source?  (Give waypoint and coordinates)

B44. GPS location of sack gardens : Waypoint No. \_\_\_\_\_ Location \_\_\_\_\_

B45. Appearance of sack gardens (note all that apply): \_\_\_\_\_

- 01 Under a clothesline
- 02 Near a drain
- 03 Fenced off
- 04 Near a toilet/latrine
- 05 Near a road

B46. Proximity of sack gardens to house (meters) \_\_\_\_\_

### **Section C: Financial Capital**

C1. How many rooms are in the house? \_\_\_\_\_

*Note: A room is a place with a permanent division, including fabric, such as a curtain that opens and closes between a bedroom and a kitchen.*

C2. What kind of seats does the respondent have in the house? \_\_\_\_\_

- 01 None
- 02 Stools or chairs
- 03 Skeleton seats (sofa)
- 04 Butterfly seats (sofa)
- 05 Other \_\_\_\_\_

C3. Does the house use electricity? \_\_\_\_\_

- 00 No
- 01 Yes

C4. If no electricity, what is their primary source of light? \_\_\_\_\_

- 01 none
- 02 kerosene carboy
- 03 candles
- 04 kerosene lantern
- 05 Other \_\_\_\_\_
- 06 N/A

C5-C16	Does the respondent own the following household items:	00 No, 01 Yes
C5	Charcoal stove (jiko)	
C6	Gas cooker	
C7	Plastic cups and plates	
C8	Porcelain cups and plates	
C9	Carpeting	
C10	Radio	
C11	Mobile phone	
C12	Television	
C13	DVD player	
C14	Computer	
C15	Refrigerator	
C16	Microwave	

C17. Do you own the plot and the house that you live in? \_\_\_\_\_

- 01 House owned, plot owned
- 02 House owned, plot leased
- 03 House leased, plot leased
- 04 Other: \_\_\_\_\_
- 77 Don't know
- 99 No Answer

C18. Who owns the land that your sack gardens have been placed on? \_\_\_\_\_

- 01 Owned by HH
- 02 Owned by farmer's landlord
- 03 Owned by other landlord
- 04 Public or unclaimed land
- 05 Other \_\_\_\_\_
- 77 Don't know
- 99 No Answer

	<b>SOURCE OF INCOME</b>	Practiced by Household?	Approximate proportion of total annual income 01 = less than 25% 02 = 25-49% 03 = 50-75% 04 = 75- 100% 88 = N/A
	Please tell me if your household gets monetary income from the following sources:	00= No 01 = Yes 77 = Don't know 99 = No answer	
<b>C19a-b</b>	Agriculture (sack gardening)		
<b>C20a-b</b>	Agriculture (other)		
<b>C21a-b</b>	Salaried employee		
<b>C22a-b</b>	Medium size business (with employees and permanent premises)		
<b>C23a-b</b>	Small business (e.g. kiosks, doing small repairs, etc)		
<b>C24a-b</b>	Casual laboring (e.g. finding day work, jua kali)		
<b>C25a-b</b>	Relatives/friends outside HH (remittances and payments)		
<b>C26a-b</b>	Other: _____		

C27. What was your household's MONTHLY income last month?

If exact amount known, enter here: \_\_\_\_\_

C28. If not, circle approximate income (in kshs): \_\_\_\_\_

- |                |                |
|----------------|----------------|
| 01 <1500       | 07 16001-20000 |
| 02 1501-2500   | 08 > 20000     |
| 03 2501- 4000  | 77 Don't know  |
| 04 4001-8000   | 88 N/A         |
| 05 8001-12000  | 99 No Answer   |
| 06 12001-16000 |                |

C29. On days you do NOT harvest from your garden, approximately how much money does your household spend per day on food? \_\_\_\_\_

- |            |               |
|------------|---------------|
| 01 < 50    | 06 200-250    |
| 02 50-80   | 07 > 250      |
| 03 80-100  | 77 Don't know |
| 04 100-150 | 99 No Answer  |
| 05 150-200 |               |

C30. On days that you DO harvest from your garden, approximately how much money does your household spend per day on food? \_\_\_\_\_

- |            |               |
|------------|---------------|
| 01 < 50    | 06 200-250    |
| 02 50-80   | 07 > 250      |
| 03 80-100  | 77 Don't know |
| 04 100-150 | 99 No Answer  |
| 05 150-200 |               |

## Section D: Social Capital

D1. What, if any, kinds of groups are you involved in? \_\_\_\_\_

- 01 Formal (registered) sack gardening group
- 02 Informal sack gardening group
- 03 Formal group, other
- 04 Informal group, other
- 05 Not part of a group

→ IF NO, SKIP TO D14

<b>D2-7</b>	<b>As part of these groups, do you do any of the following activities:</b>	00= No, 01= Yes
D2	Discuss farming issues	
D3	Share the costs of fertilizer or pesticides	
D4	Receive training about gardening together	
D5	Plant and harvest together	
D6	Contribute money to a merry-go-round	
D7	Religious activities	
D8	Other _____	

<b>D8-13</b>	<b>Have you ever, as part of a group or informally, done the following activities?</b>	00= No, 01= Yes
D8	Share seeds or seedlings	
D9	Help friend/neighbor carry soil	
D10	Help friend/neighbor construct their sacks	
D11	Share space for placing sacks	
D12	Consult with friend/neighbor about farming issues	
D13	Other _____	

D14. How would you best describe your relationship with your neighbors? \_\_\_\_\_

- 01 speak/share goods every day
- 02 Speak/share goods occasionally
- 03 Never speak/ don't get along
- 04 Other \_\_\_\_\_
- 05 Don't know

D15. Has your relationships with your neighbors changed since beginning sack gardening? \_\_\_\_\_

- 01 Same as before
- 02 Interact with them more frequently
- 03 Interact with them less frequently
- 77 Don't Know

	Does your household <b>RECEIVE</b> any products or services from relatives, neighbors, or friends?			What kind of goods or services were received?
	From Whom?	Received? 01= Yes 00= No	In the LAST MONTH No. of times?	
D16a-c	From rural relatives/friends			
D17a-c	From urban relatives			
D18a-c	From urban neighbors/friends			
D19a-c	Other: _____			

Goods/service codes:

01 Cash loans  
02 Harvested foods (including from sack gardens)  
03 Cooked foods  
04 Agricultural inputs (seeds, composts, etc)  
05 Labor for agriculture  
06 Labor for house construction/maintenance

07 Child-minding  
08 Information or "know-how"  
09 Gifts for family functions/ceremonies  
10 Cash or mobile money transfer (mpesa)  
11 Other \_\_\_\_\_

	Does your household <b>GIVE</b> any products or services to relatives, neighbors, or friends?			What kind of goods or services were given?
	To Whom?	Received? 01= Yes 00= No	In the LAST MONTH No. of times?	
D20a-c	To rural relatives/friends			
D21a-c	To urban relatives			
D22a-c	To urban neighbors/friends			
D23a-c	Other: _____			

Goods/service codes:

01 Cash loans  
02 Harvested foods (including from sack gardens)  
03 Cooked foods  
04 Agricultural inputs (seeds, composts, etc)  
05 Labor for agriculture  
06 Labor for house construction/maintenance

07 Child-minding  
08 Information or "know-how"  
09 Gifts for family functions/ceremonies  
10 Cash or mobile money transfer (mpesa)  
11 Other \_\_\_\_\_

## **Section E: Human Capital**

E1-5	What kind of previous experience have you had with farming?	00= No 01 = Yes
E1	Rural Experience (mixed vegetable, livestock, and/or other crops)	
E2	Rural Experience (vegetables only)	
E3	Urban experience (mixed vegetable, livestock, and/or other crops)	
E4	Urban experience (vegetables only)	

E6-10	Have you ever received training about sack gardening from any of the following?	00= No 01 = Yes
E6	Solidarites	
E7	Other NGO _____	
E8	Friend or family member (in Kibera)	
E9	Friend or family member (outside Kibera)	
E10	Other _____	

E11. Have you ever taught anyone else about any aspect of sack gardening (e.g. how to prepare pesticides, how to plant, etc.)? \_\_\_\_\_

[FARMERS ONLY]

01 = Yes, 00 = No

### **Section F: Environmental Risk Perception**

F1. What, if any, concerns do you have about the quality of the **soil** you collected to use in your sack gardens? \_\_\_\_\_

- 01 No concerns
- 02 Poor quality/ low fertility
- 03 Polluted
- 04 Other \_\_\_\_\_

F2. If the respondent says **soil** is polluted, what is the source of the pollution? \_\_\_\_\_

- 01 Glass
- 02 Solid/liquid waste (specify types \_\_\_\_\_)
- 03 Human waste
- 04 Other \_\_\_\_\_

F3. What, if any, concerns do you have about the quality of the **water** you use to irrigate your sack gardens? \_\_\_\_\_

- 01 No concerns
- 02 Poor quality/ low fertility
- 03 Polluted
- 04 Don't know source
- 05 Other \_\_\_\_\_

F4. If the respondent says the **water** is polluted, what is the source of the pollution?

- 01 Detergents/soaps
- 02 Type of container used to collect water
- 03 Solid waste
- 04 Human waste
- 05 Water taps that pass through open drains
- 06 Don't know the source of water
- 07 Other \_\_\_\_\_

	Do you believe that <u>food</u> from your sack garden could be contaminated by any of the following?			
	Source	Polluted? 01 = Yes, 00 = No	Mitigation Method 01 Use different soil or water 02 Sweep near vegetables 03 Wash vegetables before eating 04 Grow different type of vegetables 05 Grow different veg (same type) 06 Limit consumption 07 No action 08 Remove waste from near sacks 09 Fence around sacks 10 Select clean place for sacks 01 Other (specify)	Does the action taken eliminate the risk? 01 = Yes, 00 = No
F5a-c	Polluted soil			
F6a-c	Contaminated irrigation water			
F7a-c	Trash near vegetables			
F8a-c	Dust			
F9a-c	Flies			
F10a-c	People urinating or defecating near sacks			
F11a-c	Other			

F12. Are you concerned about the eating vegetables from any of the following sources? (Note all that apply) \_\_\_\_\_

- 01 Sack gardens
- 02 Vegetables from kiosks or the market
- 03 Vegetables from farms (\_\_\_\_\_)
- 04 Not concerned

F13. Do you personally know anyone that has been affected by eating contaminated vegetables? \_\_\_\_\_

- 01 Yes, vegetables from sack gardens
- 02 Yes, vegetables from kiosk or market
- 03 No
- 77 Don't know



## Section H: Food Security

	<b>Food frequency: During the previous 24-hour period did you consume any of the following?</b>	00=No, 01=Yes, 77=NK (not known)	<b>Type of Foods Eaten</b>	<b>Ingredients</b>
H1	Any food before breakfast?			
H2	A morning meal (breakfast)			
H3	Any food between breakfast and lunch (a snack)?			
H4	Lunch			
H5	Any food between lunch and dinner (a snack)?			
H6	Dinner			
H7	Any food after dinner (a snack)?			

## Household Dietary Diversity

	During the previous 24-hour period did you consume any of the following? (Including food Name ate at home or outside your home and food Name bought, for example on the street)	
		Did you consume item? 00=No, 01=Yes, 77=NK, 88=N/A
H8	Any ugali, rice, bread, noodles, maize, sorghum, biscuits, or other cereal or grain?	
H9	Any pumpkin, carrots, yellow/orange sweet potatoes or orange vegetable?	
H10	Any potatoes, cassava, yam, white sweet potato, matoke, or other tubers?	
H11	Any dark, green, leafy vegetables such as spinach, or kale ?	
H12	Any other vegetables (cabbage, eggplant, peppers, tomatoes)? (don't count onion or garlic)	
H13	Any mangoes, papayas, yellow orange fruit (not oranges and lemons).	
H14	Any other fruits (citrus fruit, bananas, passion fruit, apples, grapes)?	
H15	Any liver, kidney, heart, spleen, or other organ meats? (iron rich, not tripe)	
H16	Any other meat (beef, pork, goat, lamb, chicken) or other offal?	
H17	Any eggs?	
H18	Any fresh or dried fish or shellfish?	
H19	Any foods made from legumes such as beans, peas, lentils, groundnuts, or nuts?	
H20	Any cheese, yogurt, milk or other milk products?	
H21	Any foods made with oil, fat, margarine, or butter?	
H22	Any sugar, honey, sweets, sugary sweet drinks?	

H23. Which of the following statements best describes the food situation at your home in the last four weeks? \_\_\_\_\_

- 01 We always eat enough of what we want
- 02 We eat enough, but not always what we would like
- 03 = We sometimes do not eat enough
- 04= We frequently do not eat enough
- 77 Don't know
- 99 No answer

<b>How does the consumption of food from your sack gardens affect your family (choose all that apply)?</b>	00= No 01= Yes 77 = Don't know 88 = NA		
24a. It saves money for purchase of other types of food		24b. List the most common food purchase <u>in 6 months</u>	
25a. Do you know how much money you saved on vegetable purchases by harvesting from your gardens?		25b. How much money was saved on your vegetable purchases <u>in 6 months</u> ?	
26a. It saves money for other household purchases		26b. List the most common purchase <u>in 6 months</u>	
27. It provides extra food			
28. It provides a more diverse diet			
29a. It has an effect in another way		29b. Specify the effect	

	How frequently do you consume the following vegetables?	No. of times consumed/month	Cost of vegetables for a single meal (estimate cost of vegetables if harvested from farm)	No. of times per month vegetable is harvested from sack rather than purchased [SKIP FOR NON-FARMERS]	When vegetables are harvested from the sack, is the amount consumed greater or less than the amount HH would have purchased? 01 Greater 02 Less 03 Same
30a-d	Kale (sukuma)				
31a-d	Spinach				
32a-d	Green onions				
33a-d	Coriander (dhania)				
34a-d	Beans				
35a-d	Eggplant (biringanya)				
36a-d	Sweet potatoes (leaves)				
37a-d	Tomatoes				
38a-d	Amaranth (terere)				
39a-d	Kanzira				
40a-d	Kunde (cowpea leaves)				
41a-d	Managu (African nightshade)				
42a-d	Murenda				
43a-d	Nderema				
44a-d	Sageti				
45a-d	Other vegetable _____				

**SAY:** Now I am going to ask you more specific questions about the food the family eats and the problems that some people experience

<b>H50-59</b>	Questions: In the last 12 months...	00 = No 01=Yes 77= Don't know, 99=No answer  If the answer is NO, skip to the next question	<b>How often did this happen?</b> 00 = Never 01 = Rarely 02 = Sometimes, some months, but not always 03= Always or nearly always in all months 77 = Don't know 99= No answer	<b>Were the children affected?</b>  01 Yes 00 No
H50a-b	In the past 12 months, did you <u>ever</u> <u>worry</u> that your HH would run out of food before you would be able to get more money to buy or could acquire more food?			
H51a-b	Were you or any HH member not able to eat the <u>kinds of foods you</u> <u>want</u> because of lack of money? (e.g. no meat)			
H52a-b	Did you or any HH member have to eat a <u>limited variety of food</u> due to lack of money? (e.g. only ugali)			
H53a-b	Did you or any HH member have to eat <b>foods you did not want to eat</b> because of lack of money or a way to obtain other foods (e.g. discarded food)			
H54a-b	Did you or any HH member have to <b>eat less (portion size) in a meal</b> than you wanted because there was not enough?			
H55a-b	Did you or any HH member have to <b>reduce the number of meals eaten</b> <b>per day</b> because there was not enough food (e.g. skip lunch)?			
H56a-b	Was there ever <b>no food to eat</b> in your HH because of lack of money to get food?			
H57a-b	Did you or any HH member <b>go to</b> <b>sleep at night hungry</b> because there was not enough food to eat?			
H58a-b	Did you or any HH member go a <b>whole day and night</b> without eating anything because there was not enough food?			

<b>H60-66</b>	<b>Why do you not eat enough or eat what you would like to eat at home (in general)?</b>	00 = No, 01 = Yes, 77= NK, 88= N/A, 99 = Not answered
H60	We do not have enough money to buy food	
H61	It is difficult to access the store	
H62	We are dieting	
H63	We do not have a stove that works	
H64	We cannot eat/cook due to health reasons	
H65	Cost of fuel to cook	
H66	Other (specify):	

## Appendix G. Survey instrument for non-farming households

Checked By: \_\_\_\_\_ Date Checked: \_\_\_\_\_

### **Section A: Socio-demographic Information**

Note: Interviewee must be the primary person who cares for the household's sack gardens.

Enumerator (Name) \_\_\_\_\_ ☐ Oral Consent given

Respondent Name \_\_\_\_\_

Telephone # of the respondent \_\_\_\_\_

A1. Household #: \_\_\_\_\_ A2. Interview type \_\_\_\_\_ 01 farmer 02 non-farmer

A3. Gender: M F A4. Age \_\_\_\_\_ A5. Date: \_\_\_\_/\_\_\_\_/2011  
(day) (month)

A6. Village within Kibera: \_\_\_\_\_  
01 Soweto East/West 03 Laini Saba 05 Makina 07 Siranga 09 Kisumu dogo  
02 Gatwekera 04 Kianda 06 Lindi 09 Mashimoni

A7a-c. Place birth (if not Kibera):

Province:

District:

Village:

A8. Number of years the respondent has lived in Kibera \_\_\_\_\_

A9. Are you the household head? \_\_\_\_\_  
00=No 01= Yes → go to A11

A10. Who is the HH head in relation to you? \_\_\_\_\_  
01 Husband 02 Wife 88 = N/A 03 = Other (specify)

A11. How many people live (i.e. regularly sleep and eat) in this household? \_\_\_\_\_

A12. Type of household \_\_\_\_\_  
01 Joint- husband and wife present on regular basis  
02 Female headed- husband lives elsewhere, does not regularly sleep in house  
03 Female headed- woman is single, separated, divorced or widowed  
04 Male headed- wife lives elsewhere, does not sleep regularly in house  
05 Male-headed- male is single, separated, divorced or widowed  
06 Other (identify)

A13. Marital Status \_\_\_\_\_  
01 Married monogamous 05 Separated  
02 Married polygamous 06. Divorced  
03 together but unmarried 07. Widowed/widower  
04 Single (never married) 08. Other: \_\_\_\_\_

77. Don't know  
88. N/A

99. No answer



<b>Family Member</b> (Only those <u>living</u> in the household)	<b>A14. Sex</b> 1. Male 2. Female	<b>A15. Age</b> *Children less than 1 year should be written as mo./12	<b>A16. Relation to Household head</b> 01. Husband 02. Wife 03. Son 04. Daughter 05. Grandchild 06. Male relative 07. Female relative 08. Orphan 09. No relation	<b>A17. Primary occupation over last one yr</b> 11. Cannot work due to illness/injury 12. Unemployed 13. Farmer 14. Salaried employee 15. Formal business owner 16. Informal business owner 17. Casual laborer 18. Caregiver 19. Student 20. Child (too young for work) 77. Others (specify)_____ 88. Don't Know 99. No Answer	<b>A18. No. of days a week devoted to occupation</b>	<b>A19. Secondary occupation over last one yr</b> 08. Farmer 09. Salaried employee 10. Formal business owner 11. Informal business owner 12. Casual laborer 13. Caregiver 14. Student 08. Others ( specify)_____ 77. N/A 88. Don't Know 99. No Answer	<b>A20. Number of days a week devoted to occupation</b>	<b>A21. Highest level of education</b> 01. No formal schooling 02. Nursery school 03. Lower primary (1-3) 04. Upper primary (4-8) 05. Ordinary secondary (1-4) 06. Advanced secondary (5-6) 07. Vocational Training 08. Tertiary education 09. College/university 10. Child (too young) 77. Other (specify)_____ 88. Don't Know 99. No Answer
A								
B								
C								
D								
E								
F								
G								
H								
I								
J								

## **Section B: Physical and Natural Capital**

B47. GPS location of neighborhood: Waypoint No. \_\_\_\_\_ Location \_\_\_\_\_

## **Section C: Financial Capital**

C1. How many rooms are in the house? \_\_\_\_\_

*Note: A room is a place with a permanent division, including fabric, such as a curtain that opens and closes between a bedroom and a kitchen.*

C2. What kind of seats does the farmer or non-farmer have in the house? \_\_\_\_\_

- 01 None
- 06 Stools or chairs
- 07 Skeleton seats (sofa)
- 08 Butterfly seats (sofa)
- 09 Other \_\_\_\_\_

C3. Does the house use electricity? \_\_\_\_\_

- 00 No
- 01 Yes

C4. If no electricity, what is their primary source of light? \_\_\_\_\_

- 01 none
- 02 kerosene carboy
- 07 candles
- 08 kerosene lantern
- 09 Other \_\_\_\_\_
- 10 N/A

C5-C16	Does the respondent own the following household items:	00 No, 01 Yes
C5	Charcoal stove (jiko)	
C6	Gas cooker	
C7	Plastic cups and plates	
C8	Porcelain cups and plates	
C9	Carpeting	
C10	Radio	
C11	Mobile phone	
C12	Television	
C13	DVD player	
C14	Computer	
C15	Refrigerator	
C16	Microwave	

C17. Do you own the plot and the house that you live in? \_\_\_\_\_

- 05 House owned, plot owned
- 06 House owned, plot leased
- 07 House leased, plot leased
- 08 Other: \_\_\_\_\_
- 77 Don't know
- 99 No Answer

	<b>SOURCE OF INCOME</b>	Practiced by Household?	Approximate proportion of total annual income 01 = less than 25% 02 = 25-49% 03 = 50-75% 04 = 75- 100% 88 = N/A
	Please tell me if your household gets monetary income from the following sources:	00= No 01 = Yes 77 = Don't know 99 = No answer	
<b>C19a-b</b>	Agriculture (sack gardening)		
<b>C20a-b</b>	Agriculture (other)		
<b>C21a-b</b>	Salaried employee		
<b>C22a-b</b>	Medium size business (with employees and permanent premises)		
<b>C23a-b</b>	Small business (e.g. kiosks, doing small repairs, etc)		
<b>C24a-b</b>	Casual laboring (e.g. finding day work, jua kali)		
<b>C25a-b</b>	Relatives/friends outside HH (remittances and payments)		
<b>C26a-b</b>	Other: _____		

C27. What was your household's MONTHLY income last month?

If exact amount known, enter here: \_\_\_\_\_

C28. If not, circle approximate income (in kshs):

- |                |                |
|----------------|----------------|
| 09 <1500       | 15 16001-20000 |
| 10 1501-2500   | 16 > 20000     |
| 11 2501- 4000  | 77 Don't know  |
| 12 4001-8000   | 89 N/A         |
| 13 8001-12000  | 99 No Answer   |
| 14 12001-16000 |                |

C29. Approximately how much money does your household spend per day on food? \_\_\_\_\_

- |            |               |
|------------|---------------|
| 08 < 50    | 13 200-250    |
| 09 50-80   | 14 > 250      |
| 10 80-100  | 77 Don't know |
| 11 100-150 | 99 No Answer  |
| 12 150-200 |               |

## Section D: Social Capital

D1. What, if any, kinds of groups are you involved in? \_\_\_\_\_

- 01 Formal (registered) sack gardening group
- 02 Informal sack gardening group
- 03 Formal group, other
- 04 Informal group, other
- 05 Not part of a group

→ IF NO, SKIP TO D14

D2-7	As part of these groups, do you do any of the following activities:	00= No, 01= Yes
D2	Discuss farming issues	
D3	Share the costs of fertilizer or pesticides	
D4	Receive training about gardening together	
D5	Plant and harvest together	
D6	Contribute money to a merry-go-round	
D7	Religious activities	
D8	Other _____	

D14. How would you best describe your relationship with your neighbors? \_\_\_\_\_

- 06 peak/share goods every day
- 07 Speak/share goods occasionally
- 08 Never speak/ don't get along
- 09 Other \_\_\_\_\_
- 10 Don't know

	Does your household <b>RECEIVE</b> any products or services from relatives, neighbors, or friends?			What kind of goods or services were received?
	From Whom?	Received? 01= Yes 00= No	In the LAST MONTH No. of times?	
D16a-c	From rural relatives/friends			
D17a-c	From urban relatives			
D18a-c	From urban neighbors/friends			
D19a-c	Other: _____			

### Goods/service codes:

- 01 Cash loans
- 02 Harvested foods (including from sack gardens)
- 03 Cooked foods
- 04 Agricultural inputs (seeds, composts, etc)
- 05 Labor for agriculture
- 06 Labor for house construction/maintenance

- 07 Child-minding
- 08 Information or "know-how"
- 09 Gifts for family functions/ceremonies
- 10 Cash or mobile money transfer (mpesa)
- 11 Other \_\_\_\_\_

	Does your household <b>GIVE</b> any products or services to relatives, neighbors, or friends?			What kind of goods or services were given?
	To Whom?	Received? 01= Yes 00= No	In the LAST MONTH No. of times?	
D20a-c	To rural relatives/friends			
D21a-c	To urban relatives			
D22a-c	To urban neighbors/friends			
D23a-c	Other: _____			

Goods/service codes:

01 Cash loans  
02 Harvested foods (including from sack gardens)  
03 Cooked foods  
04 Agricultural inputs (seeds, composts, etc)  
05 Labor for agriculture  
06 Labor for house construction/maintenance

07 Child-minding  
08 Information or “know-how”  
09 Gifts for family functions/ceremonies  
10 Cash or mobile money transfer (mpesa)  
11 Other \_\_\_\_\_

**Section E: Human Capital**

<b>E1-5</b>	<b>What kind of previous experience have you had with farming?</b>	<b>00= No 01 = Yes</b>
E1	Rural Experience (mixed vegetable, livestock, and/or other crops)	
E2	Rural Experience (vegetables only)	
E3	Urban experience (mixed vegetable, livestock, and/or other crops)	
E4	Urban experience (vegetables only)	

<b>E6-10</b>	<b>Have you ever received training about sack gardening from any of the following?</b>	<b>00= No 01 = Yes</b>
E6	Solidarites	
E7	Other NGO _____	
E8	Friend or family member (in Kibera)	
E9	Friend or family member (outside Kibera)	
E10	Other _____	

**Section G: Environmental Risk Perception**

G1. Have you ever considered trying to plant a sack garden? \_\_\_\_\_

01 Yes  
00 No

G2. If YES, why haven't you planted a sack garden? \_\_\_\_\_

- 01 Lack of time
- 02 Lack of knowledge (doesn't know how to garden)
- 03 Lacks access to soil, seedlings, etc.
- 04 Lack of space
- 05 Other \_\_\_\_\_
- 88 N/A

G3. If NO, why isn't the respondent interested in planting a sack garden? \_\_\_\_\_

- 01 Lack of time
- 02 Lack of interest
- 03 Too much effort required
- 04 Concerned about quality of the food
- 05 Sacks don't last long
- 06 Other \_\_\_\_\_
- 88 N/A

Do you believe that food from your neighbors' sack gardens could be contaminated by any of the following?		
	Source	Polluted? 01 = Yes, 00 = No
G4	Polluted soil	
G5	Contaminated irrigation water	
G6	Trash near vegetables (mtaaros)	
G7	Dust	
G8	Flies	
G9	People urinating or defecating near sacks	
G10	Other _____	

G11. Are you concerned about the eating vegetables from any of the following sources? (Note all that apply) \_\_\_\_\_

- 01 Sack gardens
- 02 Vegetables from kiosks or the market
- 03 Vegetables from farms (\_\_\_\_\_)
- 04 Not concerned

G12. Do you personally know anyone that has been affected by eating contaminated vegetables? \_\_\_\_\_

- 01 Yes, vegetables from sack gardens
- 02 Yes, vegetables from kiosk or market
- 03 No
- 77 Don't know

**Section H: Food Security**

	<b>Food frequency: During the previous 24-hour period did you consume any of the following?</b>	00=No, 01=Yes, 77=NK (not known)	<b>Type of Foods Eaten</b>	<b>Ingredients</b>
H1	Any food before breakfast?			
H2	A morning meal (breakfast)			
H3	Any food between breakfast and lunch (a snack)?			
H4	Lunch			
H5	Any food between lunch and dinner (a snack)?			
H6	Dinner			
H7	Any food after dinner (a snack)?			

## Household Dietary Diversity

	During the previous 24-hour period did you consume any of the following? (Including food Name ate at home or outside your home and food Name bought, for example on the street)	
		Did you consume item? 00=No, 01=Yes, 77=NK, 88=N/A
H8	Any ugali, rice, bread, noodles, maize, sorghum, biscuits, or other cereal or grain?	
H9	Any pumpkin, carrots, yellow/orange sweet potatoes or orange vegetable?	
H10	Any potatoes, cassava, yam, white sweet potato, matoke, or other tubers?	
H11	Any dark, green, leafy vegetables such as spinach, or kale ?	
H12	Any other vegetables (cabbage, eggplant, peppers, tomatoes)? (don't count onion or garlic)	
H13	Any mangoes, papayas, yellow orange fruit (not oranges and lemons).	
H14	Any other fruits (citrus fruit, bananas, passion fruit, apples, grapes)?	
H15	Any liver, kidney, heart, spleen, or other organ meats? (iron rich, not tripe)	
H16	Any other meat (beef, pork, goat, lamb, chicken) or other offal?	
H17	Any eggs?	
H18	Any fresh or dried fish or shellfish?	
H19	Any foods made from legumes such as beans, peas, lentils, groundnuts, or nuts?	
H20	Any cheese, yogurt, milk or other milk products?	
H21	Any foods made with oil, fat, margarine, or butter?	
H22	Any sugar, honey, sweets, sugary sweet drinks?	



H23. Which of the following statements best describes the food situation at your home in the last four weeks? \_\_\_\_\_

- 02 We always eat enough of what we want
- 02 We eat enough, but not always what we would like
- 03 = We sometimes do not eat enough
- 04= We frequently do not eat enough
- 77 Don't know
- 99 No answer

	<b>How frequently do you consume the following vegetables?</b>	<b>No. of times consumed/month</b>	<b>Cost of vegetables for a single meal (estimate cost of vegetables if harvested from farm)</b>
30a-d	Kale (sukuma)		
31a-d	Spinach		
32a-d	Green onions		
33a-d	Coriander (dhania)		
34a-d	Beans		
35a-d	Eggplant (biringanya)		
36a-d	Sweet potatoes (leaves)		
37a-d	Tomatoes		
38a-d	Amaranth (terere)		
39a-d	Kanzira		
40a-d	Kunde (cowpea leaves)		
41a-d	Managu (African nightshade)		
42a-d	Murenda		
43a-d	Nderema		
44a-d	Sage		
45a-d	Other vegetable _____		

**SAY:** Now I am going to ask you more specific questions about the food the family eats and the problems that some people experience

<b>H50-59</b>	Questions: In the last 12 months...	00 = No 01=Yes 77= Don't know, 99=No answer  If the answer is NO, skip to the next question	<b>How often did this happen?</b> 00 = Never 01 = Rarely 02 = Sometimes, some months, but not always 03= Always or nearly always in all months 77 = Don't know 99= No answer	<b>Were the children affected?</b>  01 Yes 00 No
H50a-b	In the past 12 months, did you <u>ever</u> <u>worry</u> that your HH would run out of food before you would be able to get more money to buy or could acquire more food?			
H51a-b	Were you or any HH member not able to eat the <u>kinds of foods you</u> <u>want</u> because of lack of money? (e.g. no meat)			
H52a-b	Did you or any HH member have to eat a <u>limited variety of food</u> due to lack of money? (e.g. only ugali)			
H53a-b	Did you or any HH member have to eat <b>foods you did not want to eat</b> because of lack of money or a way to obtain other foods (e.g. discarded food)			
H54a-b	Did you or any HH member have to <b>eat less (portion size) in a meal</b> than you wanted because there was not enough?			
H55a-b	Did you or any HH member have to <b>reduce the number of meals eaten</b> <b>per day</b> because there was not enough food (e.g. skip lunch)?			
H56a-b	Was there ever <b>no food to eat</b> in your HH because of lack of money to get food?			
H57a-b	Did you or any HH member <b>go to</b> <b>sleep at night hungry</b> because there was not enough food to eat?			
H58a-b	Did you or any HH member go a <b>whole day and night</b> without eating anything because there was not enough food?			

<b>H60-66</b>	<b>Why do you not eat enough or eat what you would like to eat at home (in general)?</b>	00 = No, 01 = Yes, 77= NK, 88= N/A, 99 = Not answered
H60	We do not have enough money to buy food	
H61	It is difficult to access the store	
H62	We are dieting	
H63	We do not have a stove that works	
H64	We cannot eat/cook due to health reasons	
H65	Cost of fuel to cook	
H66	Other (specify):	

Appendix H. Program from sack gardening feedback workshop with policy makers



**Urban Agriculture in Informal Settlements:  
The Impacts of Vertical Gardening in Kibera on Livelihoods, Food Security and  
Environmental Risks**

**To be Held at All Africa Conference of Churches,  
Opposite Safaricom House Waiyaki Way, Nairobi  
25<sup>th</sup> May 2011**

**Workshop Program**

<b>SESSION I</b> <b>Chairperson: Mary Njenga, Researcher, University of Nairobi</b>	
8.30-9.00am	Arrivals and registration
9.00-9.10am	Participants introductions and welcome remarks <b>Prof. Nancy Karanja, Researcher, University of Nairobi</b>
9.10-9.25 am	Importance of urban agriculture and its relation to informal settlements <b>Diana Lee-Smith, Researcher and Founder of Mazingira Institute</b>
9.25-9.55am	Impacts of vertical/sack gardening on livelihoods and food security: Case of Kibera, Nairobi <b>Courtney Gallaher, PhD student, Michigan State University</b>
9.55-10.10am	Discussions
10.10-10.25am	Vertical farming in the USA: Milwaukee and Chicago <b>Peris Mugo, DLPO Njeru and MSc. Student, University of Nairobi</b>
<b>SESSION II</b> <b>Chairperson: Albin R. Sang, Ministry of Agriculture</b>	
10.25-10.50 am	Tea/Coffee Break
10.50-11.10am	Vertical gardens and exposure to environmental risks: Case of Kibera, Nairobi <b>Courtney Gallaher, PhD Student, Michigan State University</b>
11.10-11.25 am	Discussions
11.25-11.40	Previous and current experiences on garden-in-a-sack intervention in Nairobi <b>Marion Ng'ang'a, Food Security Technical Assistant, Solidarités</b>
11.40- 11.50am	Discussions
11.50-12:30pm	Panel discussion with sack farmers from Kibera <b>Moderator: Mary Njenga, Researcher, University of Nairobi</b>
12.30-1.30	<b>Lunch and Departure</b>