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Evaristo Mwaba Kapungwe[1]

[1] University of Zambia

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Abstract

The urban poor use heavy metal contaminated wastewater in production of crops to sustain their livelihood in Zambia. Despite the inherent dangers of food crop contaminations and potential health risks associated with consumption of heavy metal contaminated food crops, a lot of people engaged in wastewater irrigation farming as a source of livelihood in peri urban areas in Zambia. The study focused on the urban poor engaged in cultivation of crops using heavy metal contaminated industrial wastewater and domestic sewage in order to sustain their livelihoods in peri urban areas of Mufulira and Kafue towns in Zambia. To study investigated the livelihoods of people engaged in crop production using heavy metal contaminated wastewater. Two study field sites were selected in the peri-urban areas of Mufulira in the Copperbelt Province and Kafue in Lusaka Province in Zambia. The snowball principle was used to select informal crop cultivators at two study sites. A total of 31 crop cultivators were sampled at New Farm study site in Mufulira from 26th April, 2007 to 14th November, 2007 whilst a total of 29 crop cultivators were sampled at Chilumba Gardens study site in Kafue from 17th September, 2013 to 12th December, 2013. The interview schedules were administered to selected crop cultivators.The results indicated that the majority of informal crop cultivators had attained primary education and engaged in multiple livelihood activities for self sustenance. The majority of crop cultivators were poor by Zambian Government standards. There were multiple sources of labour while there were multiple markets for selling of crops. The benefits of crop production include improved food security at the households and income generation which contribute to accumulation of capital used to invest into other economic activities apart from crop production. Consumption of heavy metal contaminated food crops and informal access to the land cultivated were the major challenges. In conclusion the

Index terms— multiple livelihood activities, wastewater irrigation farming, poverty, land tenure, peri urban areas, zambia.

M u l t i p l e L i v e l i h o o d s a n d W a s t e w a t e r I r r i g a t i o n F a r m i n g i n P e r i E v a r i s t o M w a b a K a p u n g w e U n i v e r s i t y o f Z a m b i a , Z a m b i a

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1 Multiple Livelihoods and Wastewater Irrigation

Farming in Peri Urban Areas in Zambia:

2 Opportunities and Challenges

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Abstract-The urban poor use heavy metal contaminated wastewater in production of crops to sustain their livelihood in Zambia. Despite the inherent dangers of food crop contaminations and potential health risks associated with consumption of heavy metal contaminated food crops, a lot of people engaged in wastewater irrigation farming as a source of livelihood in peri urban areas in Zambia. The study focused on the urban poor engaged in cultivation of crops using heavy metal contaminated industrial wastewater and domestic sewage in order to sustain their livelihoods in peri urban areas of Mufulira and Kafue towns in Zambia. To study investigated the livelihoods of people engaged in crop production using heavy metal contaminated wastewater. Two study field sites were selected in the peri-urban areas of Mufulira in the Copperbelt Province and Kafue in Lusaka Province in Zambia.

The snowball principle was used to select informal crop cultivators at two study sites. A total of 31 crop cultivators were sampled at New Farm study site in Mufulira from 26th April, 2007 to 14th November, 2007 whilst a total of 29 crop cultivators were sampled at Chilumba Gardens study site in Kafue from 17th September, 2013 to 12th December, 2013. The interview schedules were administered to selected crop cultivators.The results indicated that the majority of informal crop cultivators had attained primary education and engaged in multiple livelihood activities for self sustenance. The majority of crop cultivators were poor by Zambian Government standards. There were multiple sources of labour while there were multiple markets for selling of crops. The benefits of crop production include improved food security at the households and income generation which contribute to accumulation of capital used to invest into other economic activities apart from crop production. Consumption of heavy metal contaminated food crops and informal access to the land cultivated were the major challenges. In conclusion the informal crop cultivators engaged in multiple livelihood activities to sustain household needs and accumulate capital. The mode of production of crops was low cost under informal non capitalist relations of production systems while the mode of distribution was through the formally organised economy by sales at the market. The opportunities of crop production included income generation and improved food security at household of crop cultivators. The major challenges were consumption of heavy metal contaminated food crops, poverty and informal access to the land cultivated. The results from this study were similar to findings from other studies in developing countries. The research findings would further the development of programmes that would improve livelihoods of urban poor. It is recommended relevant authorities can promote alternative

3 Background

tudies in wastewater irrigation farming conducted in developing countries indicated that a lot of people were engaged in production and selling of crops from waste water irrigation farming in peri-urban areas in towns (Faruqui, 2002). The main drivers of the wastewater use in crop farming included lack of alternative cheaper or safer water sources; the increased urban water demand; high demand for food in urban areas; poverty and rural-urban migration (Raschid-Sally and Jayakody, 2008). According to **??**uechler et al., (2002) wastewater use for livelihood activities in urban and peri-urban areas is a reality that planners and policy makers must face.

The majority of people in sub-Saharan African countries are poor and live below the poverty datum line **??**Potts, 2002). There has been drastic fall in real income for the urban people and subsequent decline in the standard of living in the last 20 years starting from the 1960's **??**Potts, 2002). There was the gap between the incomes and survival needs of urban household. In the absence of socio-welfare, the urban dwellers had to find ways of adapting to the urban 'wages puzzle' **??**Potts, 2002) which include increase in the urban agriculture which included informal wastewater use in crop farming (Drechsel et al., 2011).

The rate of poverty is relatively high in urban areas in Zambia **??**GRZ, 1998; **??**RZ, 2004). In order to sustain their standard of living, poor people in urban areas engage in informal activities such as peri-urban agriculture (Hampwaye et al., 2007Hampwaye, 2013) including wastewater irrigation farming (Kapungwe, 2011). The urban poor use heavy metal contaminated wastewater in production of crops to sustain their livelihood in Zambia (Simukanga et al., 2002;Marshall et al., 2004;Kapungwe, 2011). Despite the inherent dangers of food crop contaminations and potential health risks associated with consumption of heavy metal contaminated food crops, a lot of people were engaged in wastewater irrigation farming as source of livelihood at the two study sites (Kapungwe, 2011;Kapungwe, 2013a). The benefits of using wastewater in crop irrigation in Zambia included increased in crop yield, income generation and improved food security at the household **??**Mtonga, 2001 Holden andKapungwe, 2007). The study focused on the urban poor engaged in cultivation of crops using heavy metal contaminated industrial wastewater and domestic sewage in order to sustain their livelihoods in peri urban areas of Mufulira and Kafue towns in Zambia. To study investigated the livelihoods of people engaged in

crop production using heavy metal contaminated wastewater. It was hypothesised that there was no significant relationship between the cropping systems and livelihoods of crop cultivators.

4 II.

5 Theoretical Framework

In this study the livelihood model developed by **??**arney (1998 a, b) were used to analyse the livelihoods of the urban poor engaged into crop production using the heavy metal contaminated wastewater in peri-urban areas of Mufulira and Kafue towns in Zambia. According to Carney (1998 a, b), the livelihood comprises the capabilities, assets and activities done to earn a living. The livelihood activities can be either on farm or off-farm activities. Capacities refer to the ability of the community to take part in decision making, the acquired indigenous technical knowledge that makes the community to have the resilient to respond to environmental stress and socio-economic changes. The five livelihood assets (Carney, 2002;Carney, 1998a;b) **??**re: i. Natural resources include the natural resources such as water, land and air. ii. Human resources include skills, knowledge and health status of the people. iii. Financial resources include income, saving and credit. iv. Physical resources include the tools and equipment. v. Social resources include the socio-organisation such as institutions, legislations and policy People continue to build on assets endowments so that they can enjoy sustainable livelihoods **??**Little and Edward, 2003). For the urban poor property rights to land, water together with labour, form the most common endowments used to produce for home consumption as well as for cash that allow the family or individual to pay for other needs such as education, health and shelter (FAO, 2002). It is argued that property rights to land and water are the most powerful resources available to people to increase and extend their collection of assets beyond land and labour to full portfolio necessary for sustainable livelihoods (FAO, 2002).

It is argued that improving livelihoods can help people to become less vulnerable to poverty (Bradbear, 2004). This is achieved by helping the people to gain access to a range of assets and supporting their capacity to build these assets into successful livelihood activities (Bradbear, 2004). Furthermore, people who have limited cash or financial savings often have the capacity to ameliorate against the socio-economic stress and minimise disposal of household assets significantly by being members of organisations that provide assistance when they experience financial problems (Bradbear, 2004;Saasa and Carlson, 2002). Therefore, assessment of trends in the assets, capabilities and activities over time can indicate if livelihoods are deteriorating or improving (Little and Edwards, 2003) among the urban poor.

6 III.

7 Study Areas a) Location of study areas

Two study field sites were selected in the periurban areas of Mufulira in the Copperbelt Province and Kafue in Lusaka Province in Zambia (Figure **??**). Mufulira is located between latitudes 12o 30' South and 12o 40' South and between longitudes 28o 10' East and 28o 20' East. Kafue is located between latitudes 15o 45' South and 15o 50' South and extends from longitude 28o 05' East to 28o 15' East. The New Farm study site in Mufulira is located along the Kansuswa River adjacent to Kantanshi Stabilization Ponds in the triangle shaped area between the Kansuswa River and tailing dams (Figure **??**). The Chilumba Gardens study site in Kafue is located along Kasenje and Shikoswe Rivers in the Kafue Estate Industrial area between Zambia and Soloboni Compounds behind Nitrogen Chemicals of Zambia (Figure **??**). IV. Socio-Economic Characteristics of the two Study Sites

The crop cultivators at the study sites engaged in crop production as an informal activity because they were not officially recognised by the relevant authorities (Kapungwe et al., 2007). The crop cultivators were both full time and part time. The dominant crop grown was sugarcane interspersed with vegetables and maize while there were seven distinct cropping systems at the study sites (Kapungwe, 2011). There was heavy metal contamination of wastewater, soil and crops at the study sites (Kapungwe, 2013a). Previous preliminary findings indicated that the informal crop cultivators engaged in multiple livelihood activities to sustain their living at the two study sites (Holden and Kapungwe, 2007;Kapungwe, 2011). The Kansuswa Peasant Farmers Association at New Farm in Mufulira and the Chilumba Peasant Farmers Association at Chilumba Gardens in Kafue allocated times of watering by different crop cultivators and controlled the selling of crops (Holden and Kapungwe, 2007;Kapungwe et al., 2007). The summary of socio-economic characteristics of the study sites as shown in Table 1.

8 Methodology a) Sampling techniques

The snowball principle was used to select informal crop cultivators at two study sites. The snowball principle which is a non-probability sampling technique was usually used by researchers to identify potential subjects in studies where subjects are difficult to locate. The potential respondents were approached and only those people who showed willingness to take part in the research were selected as respondents. The people who were willing to take part in research were interviewed until a reasonable number of respondents were interviewed. The initial respondents had to willingly and freely take part in the interview. Then researcher had to seek guidance from the initial respondent on who could be suitable and willing to be interviewed freely without suspicion until a reasonable number of respondents were reached. A total of 31 crop cultivators were sampled at New Farm in

Mufulira from 26th April, 2007 to 14th November, 2007. whilst a total of 29 crop cultivators were sampled at Chilumba Gardens in Kafue from 17th September, 2013 to 12th December, 2013. The interview schedules were administered to selected crop cultivators. The questions in the interview schedule included questions on livelihood and farming activities b) Data analysis

The frequencies and percentages were used to analyse the responses from questions in the interview schedule. The Chi-square statistical test was used to ascertain the association between livelihoods and socioeconomic characteristics of informal crop cultivators.

9 VI.

10 Results and Discussions a) Demographic characteristics of crop cultivators

The results indicated that both males and females engaged in crop production which indicated a fair proportional representation of male and female engaged in wastewater irrigation farming (Table 2). The results from this study confirmed the findings in the study by Hampwaye et al., (2007) on seasonal farming in City of Lusaka, Zambia where both females and males engaged in crop production. The results indicated that the majority of crop cultivators at the two study sites had attained either primary or secondary education (Table **??**). The results indicated that the majority of respondents have large families which they supported (Table 4). The results indicated that the average the household size was seven persons with the minimum of three persons and maximum of eighteen persons at New Farm while the average the household size six persons with the minimum of two persons and maximum of thirteen persons at Chilumba Gardens which implied that the crop cultivators had a lot of people dependants. The results from this study were similar to findings in the study by Hampwaye et al., 2007 in rain fed farming areas of Lusaka where an average household size ranged from seven persons up to maximum of fifteen persons. The results indicated that the majority of respondents resided in high density residential areas and unplanned settlements at the two study sites (Table 5). The urban residential areas were potential sources of labour for crop production and provided readily available markets for crops. The results indicated that the average number of years of residence in a particular residential area by respondents was twenty two years with the minimum of five years to maximum of thirty eight years at New Farm in Mufulira while at Chilumba Gardens in Kafue the average number of years of residing in the residential area by the respondents was twenty four years with the minimum of one year to maximum of forty seven years The results indicated that the crop cultivators and members of their household were engaged in diverse of livelihood activities to earn a living at the two study sites (Table 6 and Table 7). The livelihood activities included on-farm activities such as crop production and the off-farm activities included formal employment, livestock rearing and business especially selling merchandise in grocery stalls (Tuntemba). The majority of the crop cultivators (54%) and their members of the households (21.4%) engaged in crop production as source of livelihood on full time basis at New Farm whiles a total of 65.5% of the crop cultivators and 44.4% of members of the households engaged in crop production as source of livelihood on full time basis at Chilumba Gardens. Some of the informal crop cultivators engaged in formal employment took part in crop production on part-time basis at New Farm (3.2%) and Chilumba Gardens (3.4%) which indicated that the informal crop cultivation provides an alternative means of supplementing income from wage labour for most of the urban poor who were engaged in formal employment which was similar to findings in the study by Saasa (1982) in seasonal farming in Kaunda Square residential area in Lusaka, Zambia and the study by Mac Gaffey (1983) in Kivu, North Eastern of Democratic Republic of Congo (DRC). the crop cultivators practising wastewater irrigation and seasonal farming were engaged in multiple livelihood activities for self sustenance because it was likely that the people engaged in the two types of farming had similar socio-economic backgrounds.

It was hypothesised that there was no significant relationship between the cropping systems and livelihoods of crop cultivators. The Chi-square test indicated that: a) there was no significant association between livelihood activities and cropping systems at Chilumba Gardens (?2 =33.163 df=30, P>0.05) b) there was a significant association between selling at market and cropping systems at New Farm (?2 =38.08, df=22, P<0.05). All of respondents involved in selling at market were engaged in sugarcane mono cropping system. It can therefore be argued that the probable reasons which account for the fact that the crop cultivators involved in selling at markets were engaged in sugarcane mono cropping system included:

? low labour and inputs requirements;

? high returns on sugarcane; and

? less time spent attending to sugarcane production activities.

From the foregoing explanation, it can be argued that there was a significant relationship between cropping systems and livelihood activities. The results indicated that the crop cultivators practised the cropping systems such as sugarcane mono cropping which apparently contribute to sustenance of households through accumulation of capital to invest into other economic activities apart from crop production. The results from this study were similar to the findings from the study on wastewater irrigation in Hubli-Dharwad, India **??**Bradford et al., 2003).

11 c) Reasons for engaging in crop production

The results indicated that the wastewater irrigated farming has been going for a long period of time. The results indicated that the average number of years of crop production by the respondents was 18 years with the minimum of 2 year to maximum of 41 years at New Farm in Mufulira while at Chilumba Gardens in Kafue the average number of years of crop production by the respondents was 13 years with the minimum of 1 year to maximum of 30 years. The results from this study were similar to findings in the study by Hampwaye et al., (2007) in Lusaka where the average length of time for cultivation was nine years with maximum of forty years.

The respondents indicated several reasons for starting crop growing which included lack of basic needs and income generation (Table 8). The reasons for starting crop growing using wastewater were similar to findings in the studies in seasonal farming in Zambia (Hampwaye et al., 2007; **??**ulenga, 1991;2001). According to the study by Hampwaye et al., (2007) in Lusaka, Zambia where the majority of crop cultivators indicated income generation. Earlier studies by Mulenga, **??**1991, **??**001) in Lusaka and Chipata, Zambia identified several reasons which included poverty, high population growth, strategic position of peri-urban areas in relation to urban markets and deteriorating economy associated with economic structural adjustment.

12 d) Multiple of labours for crop farming

The results from this study revealed three sources of labour comprising hired labour, members of household and crop cultivators(Table 9) while the methods of payment for hired labour included money and kind such giving workers crops (Table 10) which implied that there was lack of separation of labour and means of crop production. Those in formal employment tended to their field plots during the weekend and when off duty while other household members or workers tended to field plots during the weekdays. The results indicated that the hired people were a source of labour for crop production in wastewater irrigation farming which was similar to the findings of the study by Raschid-Sally and Jayakody (2008) on wastewater irrigation farming in other developing countries.

Volume XIV Issue II Version I 20 (B) The results indicated that the informal crop cultivators and members of household provides a widely available alternative source of labour in order to avoid proletarianization through hired labour which implied that the crop commodities were produced at low cost under the non-capitalist relations of production and there was lack of separation of labour and means of crop production which was similar to findings in the study by Mac Gaffey (1983) in Kivu, North Eastern of Democratic Republic of Congo (DRC) and the study by Raschid-Sally and Jayakody (2008) on wastewater irrigation farming in other developing countries.

13 e) Multiple markets for selling of crops

The crops were sold to multiple markets which included the local people in residential areas; local markets within town, urban markets in other towns and any other market (Figure **??** and Figure **??**). The crops were consumed at the community or township level through the sales of crops in the local markets and other markets. The results indicated that the heavy metal contaminated crops were consumed by other members of the public and people in distant places such as Lusaka from Chilumba Gardens in Kafue and Kitwe from New Farm in Mufulira. The residential areas provide the readily available markets for crop produced in wastewater irrigation farming areas which was similar to the findings from study by Raschid-Sally and Jayakody (2008) on wastewater irrigation farming in other developing countries. The crops were sold at the local markets and any other markets which imply that the crops were sold at high prices in the capitalist markets hence the mode of distribution was through the formally organised economy by sales at the market which was similar to findings in the study by Mac Gaffey (1983) in Sample number (n=31) The respondents indicated that they used food crops for both domestic consumption (Table 11 Table 12 and Figure 6) and income generation through sale of crops (Table 13 and Table 14). Crops are consumed at household level which indicated that the heavy metal contaminated crops were consumed by the crop cultivators and members of their households. It can be argued that there is the likelihood of potential health risks associated with consumption of heavy metal contaminated food crops grown in wastewater irrigation farming systems in peri urban areas in Zambia. There were variations in terms of the proportion of total income of the households which came from the sale of crops (Table 15). The contribution of urban crop production to household income varied considerably which ranged from 100%, 75%, 16.7%, and 10% of household income respectively. These figures of income contribution to household are similar to findings from studies in urban agriculture in Zambia which indicated the proportion of 75%, 50% and 25% in Lusaka City Council (2005 cited in Hampwaye et al., 2007) while the proportion ranged from 48% to 53% as contribution to annual household income in Ndola, Kitwe and Kabwe (Hampwaye, 2013). The results from this study were similar to findings from the studies by Hampwaye et al., 2007 andHampwaye, 2013 in seasonal farming and the study by Mtonga, 2001 in wastewater irrigation in Zambia where crop cultivators indicated that they used crops for both domestic consumption and income generation. The results on the total income per year from livelihood activities are shown in Table 16. Results from this study indicated that the total income per year by crop cultivator was estimated at US$ 1,021=67 while the average total income per year was US$ 1,000=00 from the livelihood activities done by the members of their household at New Farm in Mufulira (the exchange rate was one US Dollar equivalent to four Zambian Kwacha in 2007). The total income per year by crop cultivators at Chilumba Gardens in Kafue was estimated at US$ 977=85 while the average total income per year was US$ 904=00 from

the livelihood activities done by the members of their household (the exchange rate was one US Dollar equivalent to five Zambian Kwacha in 2013). Some of the income was generated from crop production activities. The total average income per year from sale of crops was US$ 815=91 (one United States Dollar to four Zambian Kwacha in 2007) with the minimum figure of US$50=00 and the maximum figure of US$ 2,000=00 at New Farm while the total average income per year from sale of crops was US$ 906=40=00 (One United States Dollar to five Zambian Kwacha in 2013) with the minimum of US$100=00 and maximum of US$ 2800=00 at Chilumba Gardens in Kafue. The total income per month as compared to non-taxable income threshold, basic needs and food basket showed that their living conditions were below the poverty datum line (Table 17) specified by the Zambian Government Central Statistical Office (Zambia Daily Mail, 2008a) which indicated that the majority of the crop cultivators were poor. The results from this study confirmed the perception that the majority of crop cultivators engaged in wastewater irrigation farming were seemingly poor in developing countries (Marshall et al., 2004; Raschid-Sally and Jayakody, 2008). The results from this indicated that wastewater urban agriculture provides livelihoods to the lowest income groups in the society in Zambia which was similar to findings from wastewater irrigated farming in Hyderabad City, Andhra Pradesh, India (Buechler et al., 2002). The foregoing explanation supports the view of urban agriculture as a coping strategy to challenging urban living conditions which is similar to findings from the studies by Jaeger and Hackabay, (1986), Mulenga, The land cultivated by crop cultivators was characterised by a complex multiple land tenure system. There was official ownership of the land by the private companies, local councils and commercial farmers who have the official title deeds issued by the Ministry of Lands. The cultivated land legally belongs to Mufulira Farms and Mufulira Municipal Council at New Farm in Mufulira while at Chilumba Gardens in Kafue the cultivated land officially belongs to the Nitrogen Chemicals of Zambia and Kafue District Council. On other the hand there was the unofficial ownership of land by the individual crop cultivators which is attained by the exchange of user rights through money, gift and inheritance (Table 18). It was apparently that the crop cultivators informally accessed the land cultivated at the two study sites. There were conflicts of interests between the formal owners of land and the crop cultivators who informally accessed land through inheritance, buying the land from others and being given as a gift. The kinship relationship among the crop cultivators is evident in the way the people transfer the user rights of cultivable land through inheritance, gifts from relatives and buying from other crop cultivators. The crop cultivators have developed the sub culture based on the customary traditional values of land tenure even though they did not officially own the land which they cultivate.

It can be argued that informal access to land by crop cultivators at the two study sites was an impediment to long term investment into farm infrastructures such as construction of permanent irrigation furrows and discouraged crop cultivators from practicing conservation farming. The findings confirmed results from the studies on seasonal farming in Zambia **??**Jaeger and Hackabay, 1986;Steckley and **??**uleba, 2003 Hampwaye et al., 2007) and wastewater irrigated farming in developing countries (Obuobie et al., 2003;2006) including Zambia (Kapungwe, 2011).

14 VII.

15 Conclusion

In conclusion the poor informal crop cultivators engaged in multiple livelihood activities to sustain household needs and accumulate capital. The mode of production of crops was low cost under informal non capitalist relations of production systems while the mode of distribution was through the formally organised economy by sales at the market. The opportunities of crop production included income generation and improved food security at household of crop cultivators. The major challenges were consumption of heavy metal contaminated food crops, poverty and informal access to the land cultivated. The results from this study were similar to findings from other studies in developing countries. The research findings would further the development of programmes that would improve livelihoods of urban poor. It is recommended relevant authorities can promote alternative income generation livelihood activities which can sustain the living standard of the crop cultivators engaged in heavy metal contaminated wastewater irrigation farming in Zambia.

16 VIII.

123

Figure 1: Figure 1 :Figure 2 :Figure 3 :

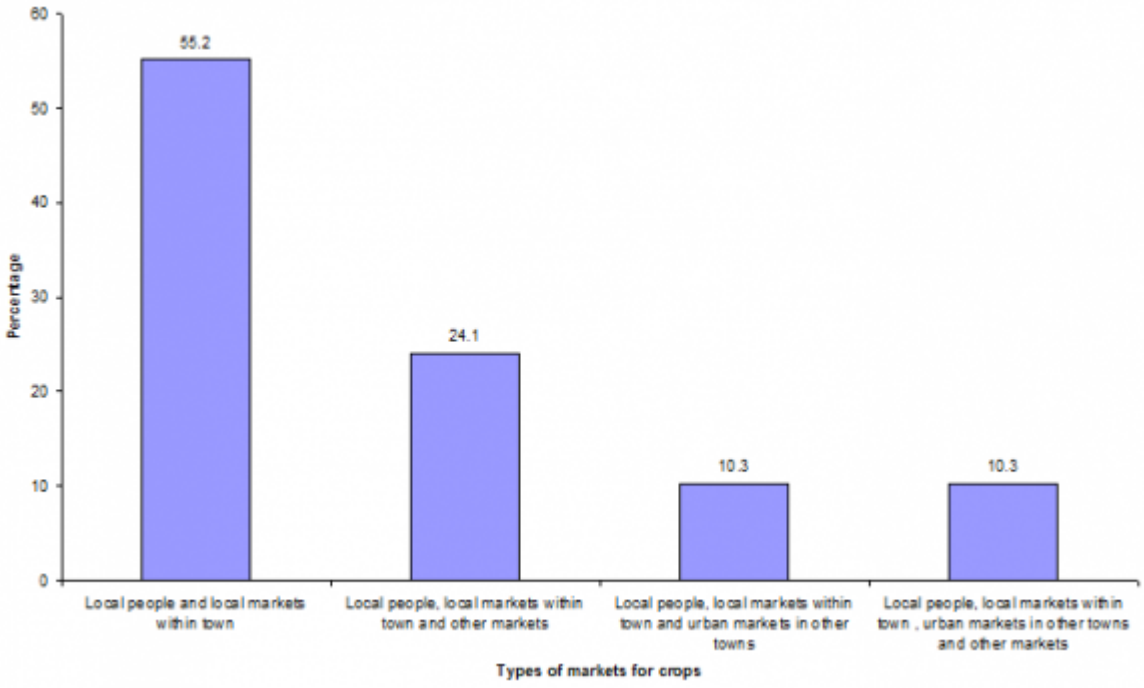

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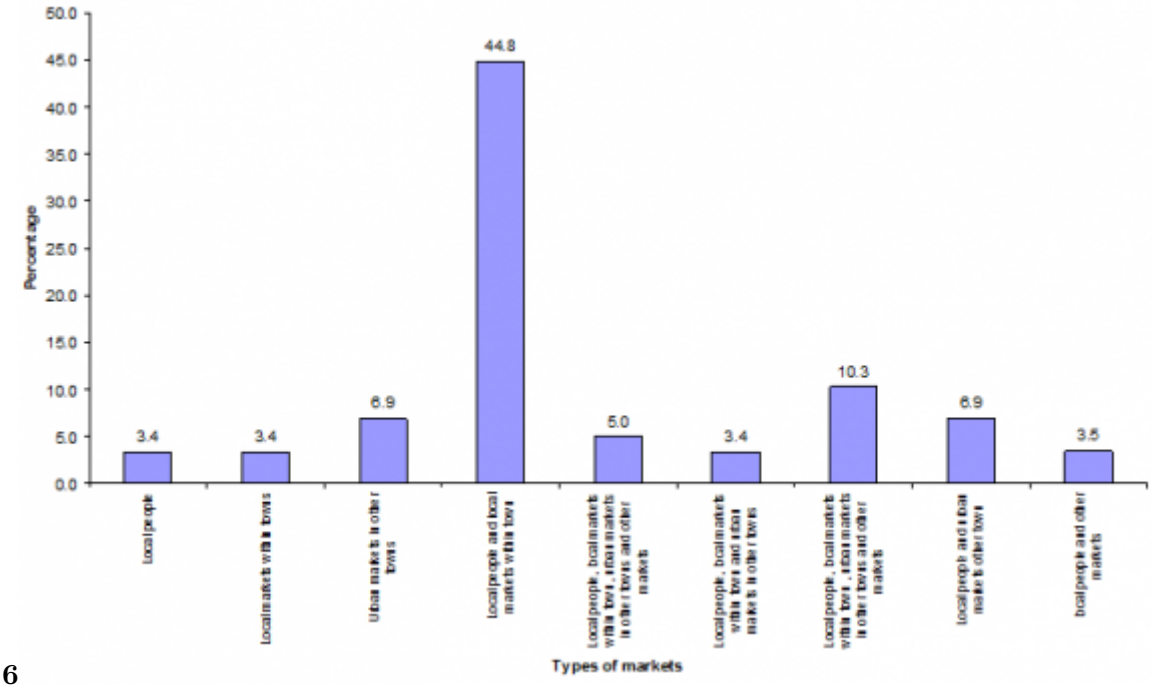
Figure 2: Figure 4 :Figure 5 :



6

Figure 3: Figure 6 :

1

Characteristics		New Farm in Mufulira	Chilumba Gardens in Kafue
Livelihood activities		Crop production Livestock rearing Formal employment Grocery stall such as Tutemba	Crop production Livestock rearing Fishing Selling firewood Transportation Brick making Street vending Grocery stall such as Tutemba
Types	Field crops	Sugarcane**, maize	Sugarcane**, maize
of	Indigenous	Common beans, Cowpeas, Pumpkins** Sweet	Common beans, Cowpeas, Pumpkins**, Sweet
crops	vegetables	potatoes, Aprior rape, Aubergines, Groundnuts, Common okra**, b Mponda (Bottled gourd)	potatoes**, Aprior rape, Aubergines, Common okra, Bottle gourd a Lubanga (Spiderplant) Sorghum,
	Exotic vegetables	Tomatoes**, Rape, Carrots, Chinese cabbage,	Tomatoes, Rape, Chinese cabbage**, Swiss chard,
		Swiss chard** Onions, Cabbage, , Green pepper, Irish potatoes	Onions, Cabbage, b Fwakafwaka (Mustard spinach c Komatsuna)
Types of cropping systems		Sugarcane mono cropping Maize mono cropping Vegetable growing Sugarcane-vegetable cropping Maize-vegetable cropping Sugarcane -maize-vegetable cropping Sugarcane-maize cropping	Sugarcane mono cropping Maize mono cropping Vegetable growing Sugarcane-vegetable cropping Maize-vegetable cropping Sugarcane -maize-vegetable cropping Sugarcane-maize cropping
Type of wastewater		Domestic wastewater	Industrial effluents
Registered organisation		Kansuswa Peasant Farmers Association	The Chilumba Peasant Farmers Association
Number of informal farmers		150-200 members	900-1200 members
Type of informal farmers		Part time/full time	Part time/full time

*[Note: a Bemba vernacular language, b Chinyanja vernacular language, c Japanese ** heavy metal contamination recorded Source: Holden and Kapungwe, 2007;Kapungwe et al., 2007;Kapungwe, 2011Kapungwe, , 2013aKapungwe, , 2013b V.]*

Figure 5: Table 1 :

2

Sex of respondents	New Farm in Mufulira		Chilumba Gardens in Kafue	
	No.	Percentage (%)	No.	Percentage (%)
Female	16	51.6	18	62.1
Male	15	48.4	11	37.9
Total	31	100.0	29	100.0

Source: Field data, 2007, 2013

Table 3 : Education level

Education level	New Farm in Mufulira		Chilumba Gardens in Kafue	
	No.	Percentage (%)	No.	Percentage (%)
Secondary	16	51.2	8	27.6
Primary	11	35.5	15	51.7
None	3	9.7	3	10.3
Others: tertiary	1	3.2	3	10.3
Total	31	100.0	29	100.0

Source: Field data, 2007, 2013

Figure 6: Table 2 :

4

Number of people in the household	New Farm in Mufulira		Chilumba Gardens in Kafue	
	No.	Percentage (%)	No.	Percentage (%)
1-2 people	0	0	1	3.7
3-8 people	20	64.5	19	70.4
9-15 people	10	32.3	7	25.9
above16 people	1	3.2	0	0
Total	31	100.0	27	100.0

Source: Field data, 2007, 2013

Figure 7: Table 4 :

5

New Farm in Mufulira		
1 Kansuswa	1	9.1
1 Kantanshi	2	18.2
2 Kawama west	8	72.1
Total	11	100.0
Chilumba Gardens in Kafue		
2 Mutendere	9	31.0
2 Soloboni	20	69.0
Total	29	100.0
1 high density residential areas		
2		

Figure 8: Table 5 :

6

Livelihood activities	New Farm in Mufulira		Chilumba Gardens in K	
	No.	Percentage (%)	No.	Percentage (%)
Crop production	17	54.8	19	65.5
Crop production and livestock rearing	4	12.9	1	3.4
Crop production and grocery stall (Tuntemba)	4	12.9	3	10.3
Crop production and selling at Market	2	6.5	3	10.3
Crop production and others: bicycle repair, selling local beverage (munkoyo)	2	6.5	0	0
Crop production, livestock rearing and grocery stall (Tuntemba)	0	0	1	3.4
Crop production, livestock rearing and formal employment	1	3.2	1	3.4
Crop production and formal employment	1	3.2	1	3.4
Total	31	100.0	29	100.0

Source: Field data, 2007, 2013

Figure 9: Table 6 :

1

Livelihood activities	New Farm in Mufulira		Chilumba Garde	
	No.	Percentage (%)	No.	Percentage (%)
None	15	53.6	7	24.1
Crop production	6	21.4	13	44.8
Selling at market	3	10.7	0	0
Grocery stall (Tuntemba)	1	3.6	0	0
Employment	1	3.6	0	0
Crop production and livestock rearing	0	0	3	10.3
Crop production and selling at market	0	0	4	13.4
Grocery stall and selling at market	0	0	1	3.4
Crop production and formal employment	0	0	1	3.4
Street vending and other activities	1	3.6	0	0
Other activities:	1	3.6	0	0
Total	28	100.0	29	100.0

Source: Field data, 2007, 2013

It can be argued that the crop cultivators practising wastewater irrigation engaged in multiple livelihood activities for self sustenance which confirmed the findings from studies on seasonal farming in Zambia (Jaeger and Huckabay, 1986; Simukanga et al., 2002; Lusaka City Council, 2005 cited in Hampwaye, 2007, Hampwaye 2013), wastewater irrigation farming in Zambia (Kapungwe, 2011) and other developing countries (Mubvami and Toriro, 2008; Obuobie et al., 2003, 2006

[Note: ;Buechler et al., 2002). It can be argued that]

Figure 10: Table 1 :

8

Reasons for crop growing	New Farm in Mufulira			Chilumba Gardens		
	n	No.	Percentage (%)	n	No.	Percentage (%)
Lack of formal employment	31	4	12.9	29	2	7.7
Income generation	31	7	22.6	29	16	61.6
Poverty reduction	31	1	3.2	29	3	11.5
Earn a living	0	0	0	29	5	19.5
Drop out of school	31	3	6.5			
Hunger problem	31	3	9.7			
Introduced to farming by friends	31	3	9.7			
Introduced to farming by relatives	31	1	3.2			
Orphaned	31	1	3.2			
Lack of basic needs	20	12	60.0			
Hobby and interest	11	2	18.2			

Source: Field data, 2007, 2013

Figure 11: Table 8 :

9

Source of labour for crop farming	New Farm in Mufulira		Chilumba Gardens in Kafue	
	No.	Percentage (%)	No.	Percentage (%)
Household members only	3	10.7	17	58.6
Hired people only	10	35.7	1	3.4
Household members and hired labour	14	50.0	11	37.9
Other sources	1	3.6	0	0
Total	28	100.0	29	100.0

Source: Field data, 2007, 2013

Figure 12: Table 9 :

10

Methods of payment for hired labour	New Farm in Mufulira		Chilumba Gardens in Kafue	
	No.	Percentage (%)	No.	Percentage (%)
Money only	23	88.46	10	37.0
Kind only	2	7.69	1	3.7
Money and kind	1	3.84	4	14.8
Others:	0	0	12	44.4
Total	26	100.0	27	100.0

Source: Field data, 2007, 2013

Figure 13: Table 10 :

11

Proportion of vegetables consumed	New Farm in Mufulira		Chilumba Gardens in Kafue	
	No.	Percentage (%)	No.	Percentage (%)
Three quarters (75%)	2	8.0	2	6.9
Half (50%)	2	8.0	3	10.3
Quarter (25%)	0	0	1	3.4
Less than quarter (<25%)	9	36.0	23	79.3
Others	10	40.0	0	0
I do not know	2	8.0	0	0
Total	25	100.0	29	100.0

Source: Field data, 2007, 2013

Figure 14: Table 11 :

Proportion consumed	of sugarcane	New Farm in Mufulira	Chilumba (%)	Gardens in Kafue No.	Percentag (%)
Half (50%)		1	4.8	0	
Quarter (25%)		0	0	1	
Less than quarter (<25%)		5	23.8	19	
Others		11	52.4	0	
I do not know		4	19.0	0	
Total		21	100.0	20	

Source: Field data, 2007, 2013

Figure 15: Table 12 :

13

Proportion of vegetables sold	New Farm in Mufulira		Chilumba Gardens in Kafue	
	No.	Percentage (%)	No.	Percentage (%)
Three quarters (75%)	7	28.0	23	82.1
Half (50%)	1	4.0	3	10.7
Quarter (25%)	0	0	1	3.6
Less than quarter (25%)	1	4.0	1	3.6
Others	13	52.0	0	0
I do not know	3	12.0	0	0
Total	25	100.0	28	100.0

Source: Field data, 2007, 2013

Figure 16: Table 13 :

14

Proportion of sugarcane sold	New Farm in Mufulira		Chilumba Gardens in Kafue	
	No.	Percentage (%)	No.	Percentage (%)
Three quarters (75%)	4	14.8	23	100.0
Others	20	74.1	0	0
I do not know	3	11.1	0	0
Total	27	100.0	23	100.0

Source: Field data, 2007, 2013

Figure 17: Table 14 :

15

Proportion of total income of the households	New Farm in Mufulira		Chilumba Gardens in Kafue	
	No.	Percentage (%)	No.	Percentage (%)
All income (100%)	5	16.7	0	0
Three quarters (75%)	3	10.0	23	82.1
Half (50%)	1	3.3	2	7.1
Quarter (25%)	0	0	1	3.6
Less than quarters (<25%)	1	3.3	0	0
Others (10%)	5	16.7	2	7.1
I do not know	15	50.0	0	0
Total	30	100.0	28	100.0

Source: Field Data, 2007, 2013

g) Living conditions of crop cultivators

Figure 18: Table 15 :

16

Amount in US$	New Farm in Mufulira		Chilumba Gardens in Kafue	
	1 Crop cultivators	1 Household members	2 Crop cultivators	2 Household members
Maximum	2000=00	1500=00	3000=00	2600=00
Mean	1021=75	1000=00	977=85	904=00
Minimum	250=00	375=00	70=00	120=00

1 exchange rate of one US Dollar equivalent to four Zambian Kwacha in 2007)

2 exchange rate of one US Dollar equivalent to five Zambian Kwacha in 2013)

** Missing values

Source: Field data, 2007, 2013

Figure 19: Table 16 :

17

standards in Zambia

Figure 20: Table 17 :

18

Methods of acquisition of field plots	New Farm in Mufulira		Chilumba Gardens in Kafue	
	Number of field plots	Percentage (%)	Number of field plots	Percentage (%)
Gift only	5	6.17	12	6.45
Bought only	19	23.46	87	46.77
Inheritance only	11	13.58	45	24.19
Bought and inheritance	17	20.99	40	21.50
Gift and bought	5	6.17	2	1.07
Bought and others	7	8.64	0	0
Gift and others	5	6.17	0	0
Inheritance and others	4	4.94	0	0
Bought, inheritance and others	6	7.41	0	0
Others: renting of field plots	2	2.47	0	0
Total	81	100.0	186	100.0

Source: Field data, 2007, 2013

Figure 21: Table 18 :

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[Dhaka and Leicestershire] , Bangladesh Dhaka , Leicestershire . University of Loughborough

[(2013)] , 10.5539/jgg.v5n4p106OnlinePublished. http://dx.doi.org/10.5539/jgg.v5n4p106 November 22. 2013. 5 p. .

[Carney ()] *(ed) Sustainable rural livelihoods-What contribution can we make. London: Department of International Development*, D Carney . 1998a.

[Obuobie et al. ()] *Access to land and water for urban vegetable farming in Accra*, E Obuobie , G Danso , P Drechser . 2003. Urban Agriculture Magazine. 11 p. .

[Saasa and Carlson ()] *Aid and Poverty Reduction in Zambia: Mission Unaccomplished*, O Saasa , J Carlson . 2002. Uppsala: Nordic Africa Institute.

[Bradbear ()] *Beekeeping and Sustainable Livelihoods: Diversification Booklet No.1. Rome: Food and Agricultural Organisation of United Nations*, N Bradbear . 2004.

[Hampwaye ()] 'Benefits of urban agriculture: reality or illusion?'. G Hampwaye . 10.1016/j.geoforum.2013.03.008. R7-R8. http://dx.doi.org/10.1016/j.geoforum.2013.03.008 *Geoforum* 2013. 49.

[Marshall et al. ()] *Contaminated irrigation water and food safety for the urban and peri-urban poor: Appropriate measures for monitoring and control from field research in India and Zambia*, B Marshall , T Bowyer-Bower , B H Chishala , E M Kapungwe , M Agrawal , R Agrawal , D Lintelo , J Holden , M Macwani , J Volk , V Krishnan , R Sharma . 2004. (Main Inception Report: Department for International Development (DFID) project No.R8160. London: Department for International Development (DFID-UK)

[Raschid-Sally and Jayakody ()] *Drivers and characteristics of wastewater agriculture in developing countries-results from global assessment*, L Raschid-Sally , P Jayakody . 2008. IWMI.

[Steckley and Muleba ()] *Facilitating land access for the Copperbelt's peri urban farmers*, G Steckley , M Muleba . 2003.

[Kapungwe (2013)] 'Heavy metal contaminated water, soils and crops in peri urban wastewater irrigationfarming in Mufulira and Kafue in, Zambia'. E M Kapungwe . Dio:10.5339/jgg.v5n2p55. http://dx.doi.org/jgg.v5n2p55 *Journal of Geography and Geology* 2013a. April 18, 2013. 5 (2) p. .

[Gaffey ()] 'How to survive and become rich amidst devastation: The second economy in Zaire'. Mac Gaffey , J . *African Affairs* 1983. 238 (82) p. .

[Simukanga ()] 'Impacts of mining effluents on the water quality, sediments, soils and crops in the Mwambashi Catchment area of the Copperbelt of Zambia'. Simukanga . *Ministry of Tourism*, (Lusaka) 2002. 2002. (Environment and Natural Resources Pilot Environmental Fund)

[Carney (ed.) ()] *Implementing the sustainable rural livelihoods approach*, D Carney . D. Carney (ed.) 1998b.

[Saasa ()] 'In the Shadow of Lusaka: Land and People under pressure of urban growth'. M N Saasa . *Studies in Zambian Society Number* Van Den Berg, L. (ed.) 1982. 6. University of Zambia (Uses of vacant land in Kaunda Square-Munali area of Lusaka)

[Kapungwe ()] 'Industrial land use and heavy metal contaminated wastewater used for irrigation in peri-urban Zambia'. E M Kapungwe . *Singapore Journal of Tropical Geography* 2011. 32 (1) p. .

[Little and Edwards ()] *Integrated Livestock-Fish Farming Systems. Rome: Food and Agriculture Organisation*, D C Little , P Edwards . 2003.

[Obuobie et al. ()] *Irrigated urban vegetable production in Ghana: characteristics, benefits and risks*, E Obuobie , B Keraita , G Danso , P Amoah , O Cofie , L Raschid-Sally , P Drescher . 2006. Accra: International Water Management Institute.

[Jesuit Centre for Theological Reflection (JCTR) basic needs basket Jesuit Centre for Theological Reflection (2012)] 'Jesuit Centre for Theological Reflection (JCTR) basic needs basket'. 12/02/14. http://consumerdiaries.wordpress.com/consumer-news/JesuitCentreforTheological *Jesuit Centre for Theological Reflection* 2012. August, 2012.

[Fao ()] *Land tenure and rural development*, Fao . 2002. Rome.

[Buechler et al. ()] *Livelihoods and wastewater irrigated agriculture: Musi River in Hyderabad City*, S Buechler , G Devi , L Raschid . 2002b. Andhra Pradesh, India. Urban Agriculture Magazine. 8 p. .

[Living Conditions Monitoring Survey in Zambia Lusaka: Central Statistical Office ()] 'Living Conditions Monitoring Survey in Zambia'. *Lusaka: Central Statistical Office* 1998. 1998. (Government of Republic of Zambia)

[Living Conditions Monitoring Survey Report Lusaka: Central Statistical Office ()] 'Living Conditions Monitoring Survey Report'. *Lusaka: Central Statistical Office*, 2004. 2002-2003. (Government of Republic of Zambia)

[Jaeger and Huckabay (ed.) ()] *Lusaka and its Environs: A Geographical Study of a Planned Capital in Tropical Africa, Zambia Geographical Association, Handbook Series No*, D Jaeger , J D Huckabay . G.F. Williams (ed.) 1986. Lusaka. University of Zambia (The Garden City of Lusaka: Urban Agriculture)

[Drechsel et al. ()] *Recovery and reuse of resources: Enhancing urban resilience in low-income countries. Urban Agriculture Magazine*, P Drechsel , O O Cofie , B Keraita , P Amoah , A Evans , Amerasinghe , P . 2011. 25 p. .

[Potts et al. ()] *Regional urbanisation and urban livelihoods in the context of globalisation*, D Potts , Potts , T Bower-Bower . 2004. London: Pearson Education. (Eastern and Southern Africa: Development challenges in a volatile region)

[Carney ()] *Sustainable Livelihoods Approaches: Progress and Possibilities for*, D Carney . 2002.

[Sustainable rural livelihoods-What contribution can we make. London: Department of International Development] *Sustainable rural livelihoods-What contribution can we make. London: Department of International Development*,

[Mtonga ()] *The effects of wastewater irrigation*, J Mtonga . 2001.

[Kapungwe ()] 'Traditional irrigation practices, high crop diversification and multiple agricultural cycles in wastewater irrigation farming in peri urban areas'. E M Kapungwe . *Zambia Journal of Geography and Geology* 2013b.

[Hampwaye et al. ()] *Urban agriculture as local initiative in Lusaka, Zambia. Environment and Planning C: Government and Policy*, G Hampwaye , E Nel , C M Rogerson . 2007. 23 p. .

[Page ()] 'Urban Agriculture in Cameroon: anti-politics machine in the making?'. B Page . *Geoforum* 2002. 33 p. .

[Faruqui ()] *Wastewater treatment and reuse for food and water security. Urban Agriculture Magazine*, N I Faruqui . 2002. 8 p. .

[Mubvami and Torrio ()] *Water supply and urban agriculture in Bulawayo*, T Mubvami , P Torrio . 2008. Urban Agriculture Magazine. 20 p. .

[Holden and Kapungwe ()] *Zambian Livelihoods at Three Urban Agriculture Localities. Contribution 2007-001 to DFID Project R8160 "Contaminated irrigation water and food safety for the urban and peri-urban poor: Appropriate measures for monitoring and control from field research in India and Zambia*, J A Holden , E M Kapungwe . 2007a. (London: Department for International Development (DFID-UK)

[Kapungwe et al. ()] *Zambian Urban Agriculture Cropping Methods. Contribution 2007-002 to DFID Project R8160 "Contaminated irrigation water and food safety for the urban and peri-urban poor: Appropriate measures for monitoring and control from field research in India and Zambia*, E M Kapungwe , J A Holden , B H Chishala . 2007. London. (Department for International Development (DFID-UK)