IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT)
e-ISSN: 2319-2402,p- ISSN: 2319-2399.Volume 13, Issue 9 Ser. I (September. 2019), PP 18-22
www.iosrjournals.org

Empirical Evaluation of Environmental Implications of Urban and Peri-Urban Agricultural Practises in KISII Town

Amos M. Okwoyo[1], Dr. Fredrick O.Owino[2], Dr. Joshua O. Wanga[3]
[1,2,3]*Schoolof Spatial Planning And Natural Resource Management, JaramogiOgingaOdinga University of Science and Technology*
Corresponding Author: Amos M. Okwoyo

Abstract-*Half of the world's population live in cities and towns where many poor urban dwellers are facing problems in gaining access to adequate supplies of nutritionally balanced food. For many urban populations, an important source of food is urban and peri-urban agriculture (UPA). A number of people in the urban centers around the world practice urban and peri-urban farming, which offers to make food available to the urban population. Unfortunately, UPA has become a controversial debate due to uncertainties of its positive verses negative effects. As UPA is gaining popularity, its environmental implications are yet to be understood and documented. If not managed well, UPA may lead to serious degradation of the environment like any other human activity. The continued reference to undocumented implications of urban agriculture causes confusion and results in difficulties in policy and decision making. As such, this paper sought to investigate UPA activities and provide empirical evaluation of the various impacts that these activities have on the environment. The results obtained indicated that the common UPA activities included crop production, livestock rearing, agro-forestry and mixed farming, with crop production having the greatest impact on the environment. The environmental effects included health risks, waste management, economic importance, health and nutrition, increase in food security, social and cultural benefits, environmental sustainability and pollution from agro-chemicals, with increase in food productionhaving the highest impact.*

Keywords:*UPA typologies, urban agriculture, peri-urban agriculture, environment, empirical evaluation.*

Date of Submission: 29-08-2019 Date of Acceptance: 14-09-2019

I. Introduction

In developing countries, urban areas account for over 90 per cent of the world's urban demographic growth, and it is estimated that as many as 60 per cent of all urban dwellers will be under the age of 18 by 2030, with most living in slums and informal settlements. Nearly 45 per cent of young people around the world, almost 515 million, live on less than two US dollars a day. The high expected rural urban migration will lead to increased demand for food supply in urban and peri-urban areas (UN Habitat, 2013).

For cities to prosper, urban authorities have to ensure balanced development by targeted interventions on productivity, infrastructure, equity, quality of life, and environmental sustainability. Environmentally sustainable cities are likely to be more productive, innovative, and prosperous (UN-Habitat, 2013). Urban agriculture especially in the developing countries contributes significantly to social economic development of towns and cities (Bellows et al., 2010). The need to reduce environmental footprint as a result of transporting food from rural areas has encouraged the growth of urban agriculture.

Smit (1996), one of the proponents of urban agriculture, worked on various continents developing city and regional plans that promoted research and practice of urban and peri-urban agriculture (UPA). Smit (1996) pursued the ramification of UPA on planning for environmental systems and infrastructure, waste water recycling, air cooling and cleaning, urban composting and provision of green zones (Bellow & Nasr, 2010). The importance of urban agriculture was accelerated throughout the world during the 1980s with surveys in Moscow showing an increase of families engaged in urban agriculture from 20% to 65%.

Intra-urban agriculture is agriculture that takes place within the inner city. It is mostly in small scale and subsistence oriented. It is mainly done at the front and backyards, plot waiting for construction and institutional gardens (FAO, 2013). On the other hand, peri-urban agriculture is agriculture that takes place in the outskirts or periphery of cities or towns and mainly involves the growing of vegetables and horticulture, rearing of livestock, rising of poultry fish farming. It tends to incorporate multiple land uses.

It is estimated that by 2030, Africa will be 51% urbanized and therefore puts into focus the quality of urban centers. The growth of urban centers creates both economic opportunities and environmental problems. There is an increase in environmental pressure on water and energy resources while unplanned or poorly planned urban centers bring about environmental degradation. Urban agriculture is a permanent feature of many

cities in both the developing and developed countries (Veehuizen, 2006). In the case of Latin America, a massive increase in urban agriculture in Havana, Cuba was triggered by conditions created by the United States of America blockade. By 2006, urban agriculture covered about 12% of the city area in Havana (Lee et al., 2006). In Kampala Uganda, favorable climate for water supply from Lake Victoria, civil war and economic chaos encouraged urban farming. Political will and active civil society organizations helped farmers improve farming (Cole et al., 2008).

Our contribution is the development of models that depict how various UPA activities impact the environment. The rest of this paper is organized as follows: section II presents the research approach that was adopted in this study, section IIIgives a presentation of the results that were obtained while section IV discuses the obtained results.Section V concludes the paper and gives future directions in this research area.

Research Approach

The study used various methods of data collection and these included observation, interviews, questionnaires, and photographs.The total number of households in the selected area who practice some form of UPA was 1,200, out of which 30% of them were selected. As such, 360 of the residents practicing UPA were selected for this research work. Respondents for the household survey were selected using cluster sampling and purposive sampling techniques.The data collected was coded and descriptive statistics such as frequencies, percentages, mean minimum and maximum values used to summarize the data.

Multiple linear regression form of analysis was employed to determine environmental implications of UPA in Kisii town. The multiple linear regressionwas accomplished using the following multiple regression mean function:

$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + e$

In this case:

β_0= intercept

Y = Environmental implications of UPA

X_1 = Crop production

X_2 = Livestock rearing

X_3 = Agro-forestry

X_4 = Mixed Farming

e = model deviations

and$\boldsymbol{\beta_1}, \boldsymbol{\beta_2}, \boldsymbol{\beta_3}$ and $\boldsymbol{\beta_4}$, are the respective coefficients for crop production, livestock rearing, agro-forestry and mixed farming respectively.

Within the environmental impacts themselves, multiple linear regression was also ran to determine the impact that had the highest influence on the environment. To accomplish this, the following multiple regression mean function:

$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + e$

In this case:

β_0= intercept

Y = Environmental implications of UPA

X_1 = Health Risks

X_2 = Waste Management

X_3 = Economic Importance

X_4 = Health and Nutrition

X_5 = Increase in Food Security

X_6 = Social and Cultural Benefits

X_7 = Environmental Sustainability

X_8 = Pollution from Agro Chemicals

e = model deviations

and $\beta_1, \beta_2, \beta_3, \beta_4, \boldsymbol{\beta_5}, \boldsymbol{\beta_6}, \boldsymbol{\beta_7}, \boldsymbol{\beta_8}$ are the respective coefficients for health risks, waste management, economic importance, health and nutrition, increase in food security, social and cultural benefits, environmental sustainability and pollution from agro-chemicals respectively.

II. Results

A total of 360 urban farming households were sampled for the survey, out of which 296 managed to return the questionnaires and participate interviews effectively. This represented 82.2% return rate which was considered sufficient for representative analysis. It was established that urban and Peri-urban agriculture in the study area can be classified based on location where urban agriculture takes place and in terms of agricultural activity being undertaken. In terms of location, the study had intra-urban or peri-urbanagriculture while

agricultural activities being undertaken included crop production, livestock rearing, agro-forestry and mixed cropping.

Famers in the study area practice both peri- urban and intra-urban agriculture. The results showed that 234 farms are located in the peri-urban areas and account for 79.05% while 62 intra-urban farms account for 20.95% as shown in Figure 1.

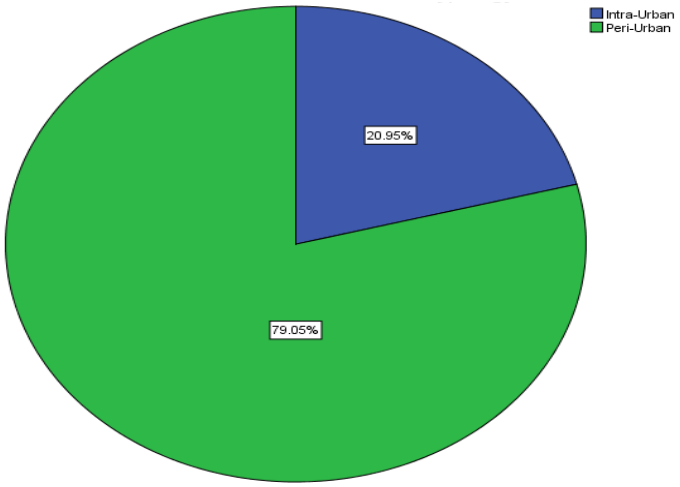

Figure 1: Location of Urban Farms

The findings of the research undertaken in Kisii town determined that various agricultural activities are practiced. The activities include crop production, livestock rearing, mixed cropping and agro-forestry as shown in Table 1.

Table 1: UPA Typology

	Frequency	Percent	Valid Percent	Cumulative Percent
Crop Production	132	44.6	44.6	44.6
Livestock rearing	40	13.5	13.5	58.1
Agro-forestry	66	22.3	22.3	80.4
Mixed Farming	58	19.6	19.6	100.0
Total	296	100.0	100.0	

As Table 1 shows, 132 respondents practiced crop production while 40, 66, and 58 of them practiced livestock rearing, agro-forestry and mixed farming respectively. This represented 44.6%, 13.5%, 22.3% and 19.6% for crop production, livestock rearing, agro-forestry and mixed farming respectively.

To determine the level of agreement among the respondents concerning the impacts of UPA on the environment, a five Likert scale was used: strongly agree (SA), moderately agree (MA), agree (A), disagree (DA) and strongly disagree (SDA). The results obtained from the field are shown in Table 2.

Table 2: UPA Environmental Impacts

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	176	59.5	59.5	59.5
	Moderately Agree	88	29.7	29.7	89.2
	Agree	20	6.8	6.8	95.9
	Disagree	10	3.4	3.4	99.3
	Strongly Disagree	2	.7	.7	100.0
	Total	296	100.0	100.0	

This table shows that 176 respondents strongly agreed that UPA activities have an impact on the environment while 88, 20, 10 and 2 respondents moderately agreed, agreed, disagreed and strongly disagreed respectively. This represented 59.5%, 29.7%, 6.8%, 3.4% and 0.7% for SA, MA, A, DA and SDA respectively. Cumulatively, 95.9% of the respondents agreed, moderately agreed and strongly agreed that UPA impact the environment in one way or the other.

To determine the overall environmental impact of crop production, livestock rearing, agro-forestry, and mixed farming, multiple regression was run to yield the results shown in Table 3 below. By observing the unstandardized coefficients, B, it is clear that the various predictors for environment impact had diverse values.

Table 3: Multiple Linear Regression Output for UPA Activities

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.102	.037		-2.794	.006
	Crop Production	.511	.037	.508	13.870	.000
	Livestock Rearing	.020	.014	.028	1.414	.159
	Agro Forestry	.322	.035	.334	9.222	.000
	Mixed Farming	.145	.027	.158	5.286	.000

a. Dependent Variable: UPA Environmental Impacts

Table 3 shows that crop production had the greatest impact with regression coefficient of 0.511 while livestock had the least impact with a regression coefficient of 0.020. Agro-forestry was second in terms of environmental impact while mixed farming was third in terms of its environmental impact with a regression coefficient of 0.145. Substituting these coefficients in the multiple regression mean function yields:

$Y = -0.102 + 0.511X_1 + 0.02X_2 + 0.322X_3 + 0.145X_4$

Table 4 gives the model summary of this regression. Using the adjusted R square values, it is evident that the model accounted for 90.5% of the variability.

Table 4: Model Summaryfor UPA Activities

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.952[a]	.907	.905	.251

a. Predictors: (Constant), Mixed Farming, Livestock Rearing, Agro Forestry, Crop Production

Since the most ideal model approaches unity (1), the obtained value of 0.905 provides an ideal model fit for all the independent variables. To determine the specific impacts of the above UPA practices, multiple linear regression was once again ran and the results obtained are shown in Table 5.

Table 5: Multiple Linear Regression Output for Environmental Impacts

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.120	.069		-1.733	.084
	Health Risks	.001	.014	.001	.057	.955
	Waste Management	.120	.034	.123	3.562	.000
	Economic Importance	.002	.041	.002	.045	.964
	Health and Nutrition	.057	.055	.069	1.022	.308
	Social and Cultural Benefits	-.051	.055	-.062	-.921	.358
	Environmental Sustainability	.149	.043	.145	3.471	.001
	Pollution from Agro Chemicals	.205	.029	.226	7.154	.000
	Increase in Food Security	.576	.039	.542	14.660	.000

a. Dependent Variable: UPA Environmental Impacts

Table 5 shows that whereas increase in food security had the highest coefficient at 0.576, social and cultural benefits had the lowest coefficient at -0.51. On their part, health risks, waste management, economic importance, health and nutrition, environmental sustainability, and pollution from Agro-chemicals had coefficients of values 0.01, 0.120, 0.02, 0.057, 0.149 and 0.205 respectively. Substituting these coefficients in the multiple regression mean function yields:

$Y = -0.12 + 0.01X_1 + 0.12X_2 + 0.002X_3 + 0.057X_4 + 0.576X_5 - 0.051X_6 + 0.149X_7 + 0.205X_8$

Regarding the negative impacts of UPA on the environment, pollution from Agro-chemicals was the greatest with a coefficient of 0.205 while health risks trailed with a coefficient of 0.01. Consequently, pollution from agro-chemicals is a major factor that inhibits inhabitants of Kisii County from engaging in UPA activities. Although health risks were cited by some respondents, its correlation coefficient was minimal at 0.01 and as such, it was not a major hindrance for UPA activities. Table 6 provides the model summary for the regression.

Table 6: Model Summary for Environmental Impacts

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.956[a]	.913	.911	.244

a. Predictors: (Constant), Increase in Food Security, Health and Nutrition, Health Risks, Waste Management, Pollution from Agro Chemicals, Environmental Sustainability , Economic Importance, Social and Cultural Benefits

Once again, using the adjusted R value, it is evident that the model accounted for 91.1% of thevariability in predictor variables. As such, the model fits the predictors quite well.

III. Discussions

The results showed that intra-urban agriculture is done within the CBD and is only for crop production purposes. It was also established that most of the farming takes place in the backyards, front yards, and leave ways. On its part, peri-urban agriculture is done outside the CBD but within the town planning area and both crop and livestock production is practiced within the peri-urban area.

Regarding the various UPA typologies, crop production was the most common type of UPA within Kisii while livestock rearing was the least common. The farmers cultivate a variety of crops, mainly vegetables which are in some cases intercropped and the main purpose of production being self - consumption. Onions, kale (Sukumawiki),*CucurbitaCarinata, Cleome gynandra*, *Solanumvillosum, andVignaunguiculata* are the most commonly cultivated vegetable crops which is consistent to the findings of the research done by Abukusta (2007). Other crops include maize, beans, and bananas.

Concerning impacts on the environment, it was noted that since crop production was practiced by 44.6% of the respondents (Table 1), its effect on the environment were clearly visible, hence the high regression coefficient. Agro-forestry was practiced by 22.3% of the respondents while mixed farming was practiced by 19.6% and this explains their relatively high regression coefficients of 0.322 and 0.145 respectively. On the other hand only 13.5% of the respondents practiced livestock rearing hence its low regression coefficient.

The implications of results in Table 5 are that within Kisii County, UPA is mainly practiced as a way of increasing food security. Other benefits of UPA included waste management, economic importance, health and nutrition and environmental sustainability.It was also established that pollution from agro-chemicals is a major factor that inhibits inhabitants of Kisii County from engaging in UPA activities.

IV. Conclusion

The findings of this study have revealed that within Kisii town, a number of UPA typologies are practiced, which include crop production, livestock rearing, agro-forestry and mixed farming. All these UPA activities can be practiced eitherin intra-urban or peri-urban areas.Among the UPA activities, the results indicate that crop production was the most predominant, followed by agro-forestry, mixed farming and livestock rearing in that order. Regarding the implication of UPA activities in the environment, crop production had the highest impact followed by agro-forestry, mixed farming in that order while livestock rearing had the least impact.Despite UPA being practiced by many residents in various parts of Kisii town to meet their domestic needs, it remains largely ignored and considered undesirable by government officials. It was observed that various types of urban agriculture contribute to environmental problems and this research study suggests that they should be discouraged. These activities included grazing on road side and dumpsites, maize farms, livestock keeping, farming along river lines and way leaves, and keeping bees. Future research in this area should investigate the empirical negative impact of these activities on the environment.

References

[1]. UN-Habitat (2013). State of the world's cities 2012/2013; prosperity cities. Routledge publishers, Canada.
[2]. Bellows, A. C. & Nasr, J. (Eds.). (2010). Fall on the past and the future of the urban agriculture movement: Reflections in tribute to JacSmit [Special section]. *Journal for Agriculture, Community Development and Food Systems, 1:2:17-39*
[3]. Smit J., Ratta A. & Nasr J. (1996). *Urban Agriculture: Food, Jobs and Sustainable cities*. New York, UNDP
[4]. FAO (2013). Profitability and sustainability of urban and Peri-urban agriculture. Agricultural Management, Marketing and Finance Occasional Paper. VailedellTerme di Caracalla, 00153 Rome, Italy.
[5]. Rene van, Veehuizen (2006). Cities farming for the future: Urban Agriculture for Green and Productive Cities. Ottawa: RUAF Foundation, IDRC and
[6]. Lee Smith, Diana and Gordon P. (2006). 'Urban agriculture and health'. In corina Hawkes and Marie T. (eds). *Understanding the links between agriculture and health*. Focus 13, brief of 16.
[7]. Cole, D.C., Lee-Smith, D. &Nasinyama G.W., (eds.). (2008). Healthy city harvests: generating evidence to guide policy on urban agriculture, Makerere university press. Lima, Peru.
[8]. AbukustaOnyango, M O. (2007). The diversity of cultivated African leafy vegetable in three communities in western Kenya. *African journal of food, agriculture, nutrition and development Vol 7 2007* online.

Amos M. Okwoyo. " Empirical Evaluation of Environmental Implications of Urban and Peri-Urban Agricultural Practises in KISII Town." IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT) 13.9 (2019): 18-22.