Food Security Attainment Role of Urban Agriculture: A Case Study from Adama City

By
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Abstract

This study was conducted with the main objective of assessing the role of urban agriculture in attaining urban food security with special reference to smallholdings in Adama city. In so doing, as studies on urban agriculture are limited, if not inexistent, it would attempt to bridge such research gap and raise the awareness of urban administrators and planners towards addressing the strategies to appropriately handle and develop the sector. To that effect, the necessary data were generated from both primary and secondary sources. Field observations, sample household survey, key informant interview and focus group discussions were the principal means of generating data from primary sources. Secondary data were also obtained from concerned organizations. Both qualitative and quantitative techniques were employed to analyze the data. A quantitative technique known as household food balance model was used to look into the household per capita dietary energy contribution of urban agriculture in Adama. Moreover, regression analysis was employed to see the determinants of agricultural productivity in the study area. The findings of this study confirm that urban agriculture plays a great role in attaining urban household food security. Over 40per cent of the surveyed sample households were obtaining well over the nationally set minimum dietary energy requirement only from their urban farmlands. Based on the findings of the study, both short term and long term urban agriculture development intervention schemes, strategies and policy issues have been recommended.

Key Words: Food security, urban agriculture

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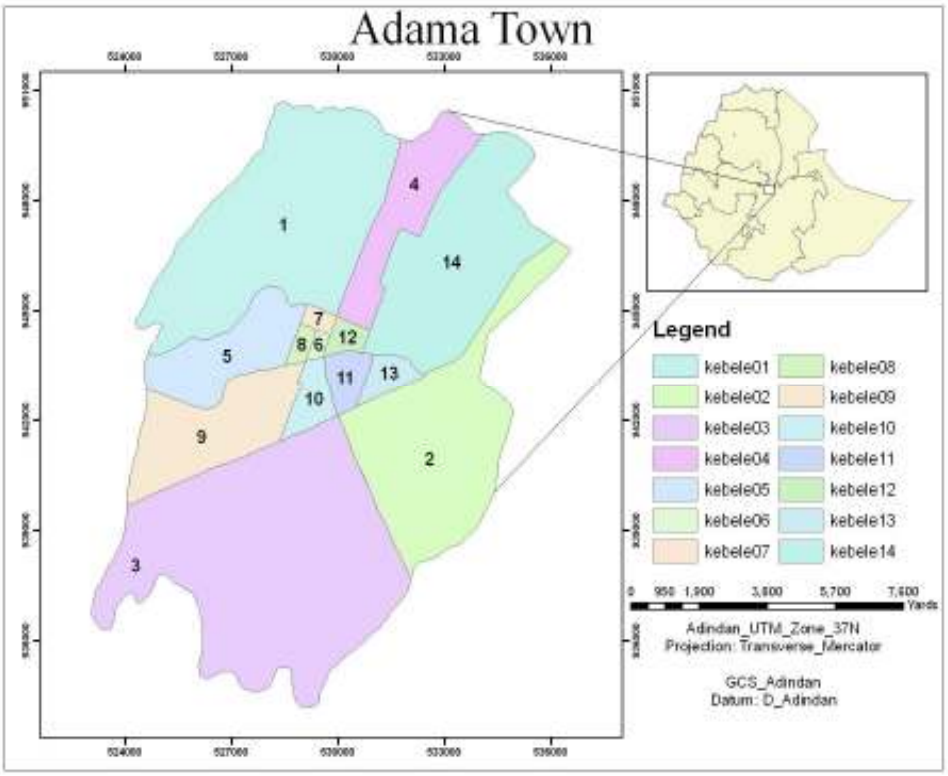
1. Introduction: Physical and Socio-economic Profile of Adama City

1.1The Study Area

Adama is one of the largest and most populated towns in Oromiya National Regional State. It is located at $8^{o}33`35``N$ - $8^{o}36`46``N$ latitude and $39^{o}11`57``E$ – $39^{o}$ $21`15``E$ longitude. It is about 100 kilometers away from Addis Ababa in the southeast direction. Adama has a total area of about 13,000 hectares, which has been sub-divided into 14 urban *kebele* administrations.

Available documents evidenced that Adama had been known as Nazreth (the name given to it by Emperor Haile Sellasie I) for most of the 20^{th} century up until it was officially reverted to its original Oromo name, Adama, in 2000. Adama had been serving as the capital city of Oromiya National Regional State during 2000 - 2005. It was on 10^{th} June of 2005 that the Oromiya National Regional Government announced the move of the regional capital back to Finfinne, the Oromo name for Addis Ababa. The current total population of Adama Woreda is 155, 321 of whom 76,325 (49.14 per cent) were females and 78,996 (50.86 per cent) were males, according to the 2007 population and housing census of Ethiopia (CSA 2008).

Figure 1: Adama City in Its National and Regional Settings



There is no well organized survey depicting the incidence of urban poverty and food insecurity for the city of Adama. However, the case of Adama may not be different from the general picture of other urban centers in the country where urban food poverty incidence ranges between 36 per cent to 44 per cent and the overall urban poverty incidence is assumed to be 40 per cent to 50 per cent (Tadesse 1997 cited by Tesfaye 2006, MEDaC 1999, FDRE 2002).

1.2Physiology and Drainage

Adama is found within the Wonji Fault Belt which is one of the main structural systems in the Ethiopian Rift Valley. Its physiographic condition is, therefore, mainly the result of volcano-tectonic activities that occurred in the past, and also partly the result of the deposition of sediments, which are considered largely of fluvial and lacustrine origin. Adama is regarded as seismically active area concerning earthquake hazards with the probability occurrence of 0.99 in every 100 years.

The altitude of Adama varies from about 1600m to 1970m above mean sea level. The only perennial river in the vicinity of Adama is Awash into which all the streams in the town empty (NUPI 2005).

Precipitation and Temperature Conditions
The information indicated in Adama Master Plan (1995) reveals that the mean annual precipitation depth recorded for Adama is 8225mm for 39 years (i.e. 1952 to 1991). The mean annual rainfall for the period 1998 -2006 was computed to be 727mm. This figure is a little bit lower than the average total annual rainfall for most highland areas of Ethiopia. (Alemneh 1990, Mesay 2001).

Table 1: Mean annual rainfall in centimeter. (1998-2006)

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total	Avg.
1998	11.8	25.6	105.2	19.8	49.3	55.3	196.5	220.6	144.7	132.8	0.0	0.0	961.6	80.13
1999	9.2	0.0	34.6	1.2	18.6	74	283.2	194.4	66.3	164.7	3.1	0.0	849.3	70.78
2000	0.0	0.0	20.2	16.1	51.5	60.8	355.1	269	133.6	85.7	57.8	12.9	1062.7	88.56
2001	0.0	6.2	108.3	28.7	177	51.2	216.8	145.3	107.8	1.7	0.0	6.6	849.6	70.80
2002	20.9	11.1	*	51.3	22.5	50.2	129.9	205.7	65.3	1.1	0.0	34.5	592.5	53.86
2003	46.5	69.1	151.2	88.9	3.6	75.2	235.6	279.7	122.8	0.0	5.3	48.8	1126.7	93.89
2004	28.8	3.3	77.4	53.1	1.9	63.3	114.4	227.3	77.1	58.6	12.8	1.6	719.6	59.97
2005	72.5	6.3	90.1	41.3	71.1	50.2	144.3	165	68.4	6.0	5.3	0.0	720.5	60.04
2006	17.6	88.4	64.6	88.7	27.8	58.7	173.5	225	128.8	10.1	0.5	28.5	912.2	76.02
Average	23.1	23.3	81.5	43.2	47.1	59.9	205.5	214.7	101.6	51.2	9.4	14.8	866.1	72.7

Source: National Metrological Service Agency (Computed).

However, similar to most parts of the country, rainfall in this area is characterized by fluctuations in amount and periodicity from year to year. There is significant seasonal variation in the amount of rainfall. More than 67 per cent of the mean annual rainfall occurs in the four rainy months: June, July, August and September. Some additional rain (about 23 per cent) occurs in the remaining dry season months with mean monthly values of rainfall reaching as low as zero millimeters. On the other hand, the period of large rainfall coincides mostly with that of higher monthly mean temperature, and thus favoring larger evapo-transpiration in the area. (Compare Table 1 & Table 2)

This fluctuating nature of rainfall both in amount and periodicity no doubt adversely affects the agricultural practices and the availability of food items in the area. In connection to this, the investigated households in the peri-urban areas said that both the sowing and harvesting periods are fluctuating as a result of untimely rains. They complain that the unreliability of rainfall is one of the primary reasons for food grain shortfalls and low productivity level of the livestock agricultural sub-sector.

Table 2: Monthly mean maximum, minimum and average temperature in Adama town (1998 – 2007)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yearly
Mean Max (^oC)	26.7	28.9	29.3	29.9	31.1	29.8	26.2	25.7	27.1	27.6	27.0	25.9	26.7
Mean Min (^oC)	13.1	14.4	15.0	15.9	16.6	17.6	16.3	16.2	15.2	13.9	13.1	12.3	13.1
Average (^oC)	19.9	21.7	22.2	22.9	23.9	23.7	21.3	21.0	21.2	20.8	20.1	19.1	19.9

Source: National Metrological Service Agency (Computed)

As indicated in Table 2 above, the highest temperature occurs just before or during the months of highest rainfall; whereas the least temperature occurs during the driest months: November, December and January. This may be because of the clear sky in the driest months which lets the temperature escape to the upper layer of the atmosphere.

2.Objective of the Study

The purpose of this study was to assess the role of urban agriculture in food security attainment and urban poverty alleviation with special reference to the city of Adama. More specifically, it aims to inspire the integration of urban agriculture into municipal sectoral strategies and stimulate local stakeholders regarding the identification and formulation of projects on the development of urban agriculture in the town. It also aims to create awareness among the administrators of the town all about the peculiarities and role of urban agriculture in addressing urban food insecurity, environmental greening, job creation and reutilization of urban organic wastes.

3.Literature Review and Conceptual Framework

Food security is a broad and flexible concept encompassing issues related to the nature, quality, access, causes and coping strategies of food shortfalls (Tarasuk 2001, Clay 2002). Food security as a concept originated only in the mid 1970s in the discussions of international food problems at a time of global food crises. Since then, there was a substantive change in definition and concept of food security. The initial focus of attention was primarily on food supply problems that is assuring the availability and price stability of basic food stuffs at international and national levels.

Food security was first defined in the Proceedings of the 1974 World Food Summit as: ‘availability at all times of adequate

world food supplies of basic food stuffs. . to sustain a steady expansion of food consumption...and to offset fluctuations in production and prices' (UN 1975). In 1983, FAO expanded its concept to include a third prong: 'Ensuring that all people at all times have both physical and economic access to the basic food that they need.' (FAO 1983). In the World Bank's (1986) report of Poverty and Hunger, this concept of food security has been further elaborated in terms of: 'access of all people at all times to enough food for an active, healthy life.' The 1996 World Food Summit in its Plan of Action adopted a still more complex definition: 'Food security at the individual, household, national, regional and global levels [is achieved] when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.'

(FAO 1996). Many researchers have adopted this definition to their works (Markos 1997, Hailu 2000) This definition is again refined in 'The State of Food Insecurity 2001': 'Food security [is] a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary food preferences for an active and healthy life.' (FAO 2002).

The continuing evolution of food security as an operational concept in public policy has reflected the wider recognition of the complexities of the technical and policy issues involved. The most recent and careful redefinition of food security is that negotiated in the process of international consultation leading to the World Food Summit (WFS) in November 1996. A comparison of these definitions highlights the considerable reconstruction of official thinking on food security that has occurred over 33 years. These statements also provide signposts to researches and policy analyses, which have re-shaped our understanding of food security as a problem of international and national responsibility.

In general, the recent concept of food security has given more attention to households and individuals than its availability at international, national, regional, woreda or kebele levels. This is because, as already indicated, increasing food production, supply and sufficiency at broader levels does not necessarily ensure that each and every individual is food secure. This is why, as reported by the WFP (2009), over 1 billion people throughout the world have been suffering from hunger and malnutrition despite the fact that there is more than sufficient food supply at global level at present.

Be it in the urban or rural areas, food security as a concept has four core components (availability, entitlement, access utilization, consumption and asset ownership).

Availability refers to the supply-side while access indicates the capacity of a household to acquire food. The term 'access' is more clearly explained by Debebe (1995:2) in such a way that 'access' marks the ability of a household to get command over '... enough supply of food through production, purchase, exchange, gift or aid'. Utilization refers to the way the food ought to be consumed. It includes such aspects of food consumption as nutritional balance, cultural/religious acceptance, hygienic preparation and preservation of food, as well as access to potable water. As noted by Kifle and Yoseph (1999) 'asset ownership' is also a crucial component as assets are inputs of food production systems or households sale their belongings or 'assets' to purchase food items during food shortfalls.

Depending on its level of influence and the duration of occurrence, researchers have identified at least two types of food insecurity in the Ethiopian context: chronic and transitory food insecurity (Getachew 1995, Degefa 2002). Chromic food insecurity is a continuous inadequate food intake while transitory food insecurity implies a temporary decline in the required quantity and quality of food.

On the basis of the food security concept indicated hereinbefore, Ethiopia is found to be one of the most food insecure and food aid dependent countries in the world. A great majority of people, both in urban and rural areas, have been suffering from chronic and transitory food shortfalls particularly over the past recent decades. The number of food insecure households has been increasing, whilst per capita food availability has been decreasing.

For instance, as Woldeamlak (2009) noted, the average per capita food availability was 128.08kg for the period 1961-1974, and it declined to 119.99kg in 1975-1991. Though the average per capita food availability was 125.41kg during 1992-2001, still it remained far below the recommended average per capita daily requirement. This suggests that the per capita food supply simply stagnated far below the minimum required level for over four decades. The large gap between food demand and food supply was filled by food imports and food aid, the later contributing the largest share.

In this regard, different researchers agree that the causes of the existing food insecurity problems in Ethiopia are numerous and interrelated. These include rainfall variability, soil degradation, inappropriate storage facility, pre- and post harvest crop loss, inability of the households to purchase adequate food, less and fragmented farmland size, lack of off-farm income opportunity, the underdevelopment of livestock sub-sector, inadequate credit and extension services, and tenure insecurity (Mesfin 1984/1999, Itana 1995, Debebe 1995, Markos 1997, Kifle and Yosef 1999, Mesay 2001,Degefa 1996/2002,Bekure 2005, Dessalegn 2009, Woldeamlak 2009).

At this juncture, one can forward the question addressing what urban agriculture is as well as the role of urban agriculture in food security attainment. Urban agriculture is a dynamic concept that comprises systems ranging from subsistence

farming at household level to a fully commercialized agriculture. It is defined in different ways by different scholars (Gundel 1999, Smith 1996, Sawio 1998). However, the definition by Tinker (1994) seems most appropriate for this research. Tinker (1994) defines urban agriculture as the practice of food production within the city boundary or on the immediate periphery which includes the growing of food crops, fruits, trees, herbs, flowers, firewood as well as the raising of animals including cattle, poultry, fish, bees and pigs. It is a labor intensive farming requiring only small area around small residential areas such as vacant plots, outdoors, gardens, parks, balconies, containers, road strips and even on the roofs or upper covering of buildings.

Urban agriculture is not a recent phenomenon. Archaeological findings are unraveling agricultural practices of urban settlements achieved by ancient civilizations for the production of food, feed and fodder, firewood, building materials, windbreak, medical plants and transportation (Sawio 1994, Smith 1994, Tinker 1994, Falve 1999, Teferee 2003).

Since the 1970s, urban agriculture has been growing in the developing world as a result of rapid urbanization, crippled domestic food distribution systems, wage cuts, soaring inflation, rising unemployment, declining purchasing power, limited urban land use regulations, civil strife and natural disasters in urban areas. To meet part of the food needs of urban dwellers, urban farming both in intra-urban and peri-urban areas, is becoming a familiar and almost permanent feature in the developing world.

Spatially juxtaposed with other urban activities and resources, urban farming makes a vital contribution to the household economy of the urban residents (Falve 1999, Sawio 1994, Smith 1994, Tinker 1994). It is supplying food to over 800 million urban dwellers worldwide. It is the source of food for 40 percent

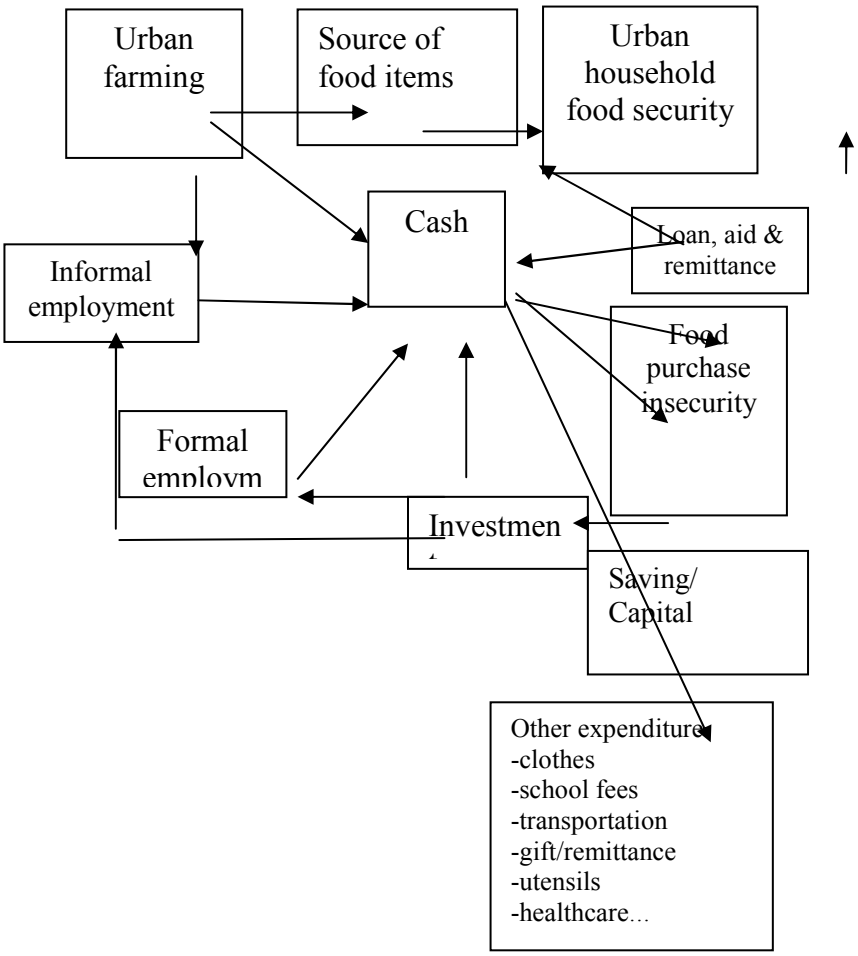
of African and 50 percent of Latin American urban dwellers (UNDP 1996, Zezza and Tasciotti 2008).

Today, even in and around large metropolitan areas like Beijing, urban farming not only provides residents with safer and healthier food, it also keeps farmers in business. Urban agriculture has also been practiced in the cities of developed countries. For example, in Vancouver, Canada, 44 percent of the people grow vegetables, fruits berries, nuts or herbs in their yards, on their balconies or in community gardens. In general, nowadays, cities worldwide produce about one-third of food consumed by their residents on average. Hence, urban farming is neither a new nor a declining activity in towns and it remains the cornerstone of many urban economies (Tacio 2007).

Urban agriculture can be practiced for a variety of reasons. A study by Maxwell (1994) in Kampala indicated that there were at least two major categories of logic by households to be engaged in urban agriculture. These included include commercial production and household food self-sufficiency. It is also useful in urban greening, waste recycling, and microclimatic conditioning. Urban agriculture is, therefore, contributing a lot in reducing the problems of urban household food insecurity by improving access to fresh and low price food and raising the nutritional status of the residents. Hence, it is assumed to be one of the key areas in urban poverty alleviation and food security attainment.

Based on the concepts and discussions, hereinbefore, it is now possible to visually frame the role of urban agriculture in food security attainment in the Ethiopian context as depicted below.

Figure 2: Visual Conceptual Framework of the Role of Urban Farming to Food Security in the Ethiopian Context



Source: Developed by the writer

4.Materials and Methods

4.1 Sources of Data

The data used for this study were collected both from primary and secondary sources. Much of the primary data were collected through household survey, field observations, key informant interview and focus group discussions. Sample household heads filled structured questionnaires supported by trained enumerators. Interviews and target group discussions were also made to substantiate the data obtained through questionnaire-based survey. Kebele officials, household heads, elders and agricultural development agents had provided crucial information for this study.

Secondary data were obtained from several published and unpublished literatures. Central Statistical Authority (CSA), Adama City Administration, Oromiya Planning and Economic Development Bureau, Oromiya Works and Urban Development Bureau, and National Metrological Service Agency were among the best sources of the secondary data for this research.

4.2 Sampling Techniques and Sample Size

Judgmental and snowball sampling techniques were employed to generate primary data for this research. Firstly, 3 sample kebeles were purposely selected from different parts of the city particularly where the researcher thinks there are more urban farming households.

This was done purposely so that the sample kebeles could spatially and sufficiently represent the study area, Adama city. It also helps to see the varied significance of urban agriculture from the center to the peripheral areas of the town.

Secondly, snowball sampling technique was employed to select sample urban farming households from each kebele. With this approach, the researcher initially contacted few respondents (snowballs) and then asked them whether they know anybody practicing urban agricultural activities in their residence to recruit future subjects from among their acquaintances.

This was done mainly because it was hardly possible to get the exact number of urban agricultural producers in each kebele. The number of samples from each kebele was decided on the basis of the proportion of the population in the kebele to the total population of Adama city.

At this juncture, it is obvious that one of the challenges of a researcher is how to decide what should actually be the sample size to be selected from a population. Obviously, large sample size is advantageous in terms of accuracy of the study. However, sample size depends on a number of considerations of which the homogeneity of population, resources allotted for the study and the precision required are the most important ones (Agarwal 2006, Sharma 2004). Taking this concept into account, this study was based upon a questionnaire administered to 60 farm households in Adama city.

5. Data Analysis

The methodologies employed to analyze the data for this research include both descriptive and inferential statistics. Much of the quantitative data were analyzed by the use of statistical software known as SPSS (Statistical Package for Social Sciences). Statistical techniques like mean, percentage, standard deviation, regression and coefficient of variation were used in the analysis of the data for this research. The strength and direction of a linear relationship between two variables was analyzed using correlation coefficient.

The contribution of urban farming to dietary calorie supply for the households was computed using simple arithmetic formulas. The quantity of food produced was calculated and converted into dietary calorie equivalent based on the Ethiopian Health and Nutrition Research Institute (EHNRI)'s food composition table. The calculated calorie was compared against the national average daily caloric requirement for a moderately active adult (2100 kcal) to look into the contribution of urban agriculture to the dietary calorie supply of the households in the study area.

A modified form of a simple equation termed as Household Food Balance Model, originally adapted by Degefa (1996) from FAO Regional Food Balance Model and thenceforth used by different researchers in this field (Eshetu 2000, Mesay 2001/09), was used to calculate the per capita food available.

Household Food Balance Model

NGA = (GP + GB + FA + GG) - (HL+ GU + GS +GV)

Where,

NGA	*= Net grain available/year/household*
GP	*= Total grain produced/year/household*
GB	*= Total grain bought/year/household*
FA	*= Quantity of food aid obtained/year/household*
GG	*= Total grain obtained through gift or remittance/year/household*
HL	*= Post harvest losses/year*
GU	*=Quantity of grain reserved for seed/year/household*
GS	*=Amount of grain sold/year/household*
GV	*=Grain given to others within a year*

6.Results and Discussions

Demographic Characteristics of the Sample Small-holding Urban Farmers

According to a recent report released by the UNFAO, the number of hungry people living in cities is growing at alarming rate. "Over 60 million people are now added to the planet's burgeoning cities and suburbs each year, mostly in low-income urban settlements in developing countries," noted the State of the World 2007. Urban residents, particularly children are suffering from food shortages as well as micronutrient deficiencies in the cities of the developing countries.

The survey data for this paper also justify this fact in that the average family size of the small-holding urban farmers is over 5.6. This seems a bit larger than both the average family size of the whole of Ethiopia in general and that of urban of population in the country in particular.

Table 3: Sample households' family size

	Family size		
Residence	Female	Male	Total
Kebele 03	2.8	3.0	5.8
Kebele 04	2.7	2.8	5.4
Kebele 14	3.0	2.6	5.6
Average	2.8	2.8	5.6

Source: Writer's sample survey

6.1The Current Situation of Urban Farming in Adama City

There is no adequate data related to urban farming in Adama city. However, it is safe to say that many poor urban households engage in local production of food, vending and related activities (e.g. production of food grains, vegetables, dairy and feed supply) as a main or complementary strategy to secure food supply for their families and/or to earn cash.

It is worth-mentioning here that agriculture in Ethiopia is still considered predominantly as a rural activity discrediting the food security, socio-economic development, urban greening, job creation and environmental management values of urban agriculture. In the capital of the country, Addis Ababa, for instance, the city government has wrongly tried to organize agricultural activities under the Bureau of Trade and Industry Development. The case of Adama is also not different from this general picture of Ethiopia as it is part and parcel of the country. Urban agriculture in the city of Adama is the most neglected sector in that there is even no concerned governmental office or individual that is currently concerned about the sector in the administrative structure of Adama city administration.

There is no written plan or strategy concerning current and future issues related to this sector. The consequence of all these has given rise to the deterioration of urban agriculture and environmental degradation as depicted in Figure 3 below.

Figure.3: Unprotected urban farmland at fringe zone: Adama

Source: Photo by the writer, May 2009

Small-scale urban farmers in the city of Adama are prone to lack of basic agricultural supplies, extension and veterinary services and credit facilities. This indicates the fact that the sector has not been given due attention and it remains to be the most neglected one, though the urban farmers themselves and several related experts agree in the indispensability of urban farming.

There is no comprehensive strategy that could effectively address the sustainable development, management and function of urban farming. Due to this lack of recognition by concerned organs, such as planners and executives, the role and functions of urban agriculture have remained invisible in Adama.

According to respondents for this study, this sector still lacks appropriate attention from concerned bodies. As a result, there is low level of support services such as extension services and access to credit, minimum user rights of farmlands (roadsides, riverbanks, along railroads, idle public lands and parks) and insecure land-tenure situation. Some urban producers have to move to very marginal or outer ridge of the town to practice urban framing. Even those urban farmers who owned farmlands at the fringe zone of the town avoid investments in soil quality, tree and shrub components, erosion prevention, and water-harvesting measures in fear of eviction from their lands because of the prevailing rapid rate of urbanization. They plant mostly to produce quick-yielding seasonal crops such as tomato, onion, cabbage and green-pepper.

Next to land, access to water, manure and compost is crucial to urban farmers, and all are difficult to obtain for urban farmers in the city of Adama. The combination of the existing high poverty situation of the urban farmers and the insecure land-tenure situation lead to low investments in the land, low productivity and further deterioration of the soil.

Another issue worth-mentioning here is the fact that urban farmers in Adama, as the case may be in other towns in the country, are not organized in a formal way. This no doubt limits the representation of their interests in decision making at various levels and also limits their capacities to improve their farming systems and marketing opportunities. It hampers their efforts to engage in well-managed and more advanced agri-business activities. It also restricts their strenuous effort or exertion to engage in direct marketing to consumers or acquiring an improved position in the marketing chain. Absence of well-organized urban agricultural associations may also hamper innovation and dissemination of indigenous farming technologies among the practitioners.

Most of the small-scale farmers in the city seem to have very little idea of intensive land utilization. They think that agriculture is practiced only on large farmlands and is only of rural business and not of urban dwellers. Most respondents for this study claim for larger plots of farmlands to cultivate crops and herd their livestock. Few of them in the peri-urban areas even demand more plots of land for shifting cultivation.

This indicates the fact that they have no clear idea about the very nature of urban farming, which is super intensive cultivation and can be practiced on small areas, including outdoors, parks, road and railway sides, on top of buildings and containers.
Due to the factors mentioned above, the actual productivity and profitability of urban farming in Adama seems generally low despite high market demand and sharply increasing food prices at present.

As a result, one can safely say that it is a high time for the experts and administrators of the town to look into options to enhance the awareness of the farmers on issues related to the practices, resource utilization and management of urban farming so that urban agriculture could contribute its maximum potential in reducing urban food insecurity and poverty.

6.2 Food Security Role of Peri-urban Arable Farming in Adama

Different scholars and institutions agree that urban agriculture contributes a lot to food security and poverty alleviation in the cities/towns of the developing world. Just because of its proximity to large human settlements, unlike rural agriculture, urban farming provides the low and middle-income urban dwellers with low-price food items, agricultural jobs and cash income in the developing world. It provides the dwellers with fresh dairy products, vegetables, fruits, edible flowers, and

grains (Sawio 1994, Smith 1994, Tinker 1994, UNDP 1996, Falve 1999, Teferee 2003).

Table 4: Small-holding sample urban farmers' major crops output

Crops	Output per year per household (in quintals)				Output per year per person (in quintals)			
	Kebele 03	Kebele 04	Kebele 14	Average	Kebele 03	Kebele 04	Kebele 14	Average
Teff	10.5	8.4	8.4	9.1	1.81	1.56	1.50	1.63
Wheat	7.0	5.3	2.7	5.0	1.21	0.98	0.48	0.89
Barley	1.8	3.6	1.5	2.3	0.31	0.62	0.27	0.41
Pulses	1.5	0.7	0.7	1.0	0.23	0.13	0.13	0.18
Maize	4.4	3.1	3.3	3.6	0.78	0.57	0.59	0.64
Average (Cereals)	5.04	4.22	3.32	4.19	0.87	0.77	0.59	0.75
Onion	1.8	1.6	2.3	5.7	0.31	0.30	0.41	1.01
Carrot	0.5	0.0	2.7	1.1	0.09	0.00	0.48	0.20
Potato	3.0	2.4	5.6	3.7	0.52	0.44	1.00	0.66
Tomato	1.5	3.5	1.3	2.1	0.23	0.65	0.24	0.38
Average (Vegetables)	1.70	1.88	2.98	3.15	0.29	0.90	0.53	0.56

Source: Writer's sample survey, April 2009

According to *the 2006 Revised Master Plan* of the town of Adama, the soil and climatic conditions of the town and its environs are suitable both for arable farming and livestock husbandry. In fact, there is no well- documented survey that indicates what proportion of the urban families in Adama is engaged in growing food crops and raising animals.

There is also no data as to what proportion of the urban farming in Adama contributes to the food consumed by its residents. However, it is safe to say that the contribution of urban farming to the town's food requirement may be comparable with other towns in the developing world. It also seems that the contribution of the sector is likely to expand owing to the existing rapid growth in urban population and soaring food prices in the country. Then, it appears that the role of urban agriculture in the town is greater now than ever before and will continue to increase in the coming decades.

The small-scale farmers in the town, particularly those in the peri-urban areas, produce important agricultural outputs such as maize, *teff*, wheat, barley and pulses in order of their significance. They also produce vegetables like tomato, onion, potato, carrot, green-pepper and beetroot as well as livestock products like dairy and dairy outputs, poultry and apiculture. They supply some of the vegetable and animal outputs to the market to supplement their household financial requirements. The family members of the households vend the outputs themselves or sell it out to the formal shop owners. No sample farming household is reported to have been engaged in floriculture, pisciculture and lumbering.

The result of this study reveals that urban agriculture as a means of acquiring food grains constituted about 43 percent of the total household food grain requirement in 2008/9. The producers obtained 4.19 quintals of food grain per household per year or 0.75 quintals per person per year. Grain purchase was found to be the second most important source of food grain (accounting for 13 percent of the net
quantity required) followed by remittance and food aid in order of their significance.

Table 5: Major traditional food kinds in the study area and their average dietary energy composition

Major Sources of Foods	*Products (Major traditional foods in the area)*	*Average Dietary Energy (kcal/ 100 gram)*
Teff	Injera, porridge	182.38
Wheat	Bread, porridge, nifro (boiled grains), qollo (roasted grains), injera, qinche (split-boiled grains)	200.23
Barley	Injera, bread, porridge, qollo, talla (fermented local drink).	243.90
Maize	Bread, whole-boiled, whole-roasted, on cob-boiled, on cob-roasted.	251.64
Pulses	Nifro, qollo, kik (roasted, split then boiled), ashuqi (roasted then boiled grains)	223.05
Wheat	Bread, porridge, injera	190.00

Source: computed based on EHNRI's food composition table and survey data

An attempt was made to convert the average quantity of grain production per household into dietary calorie equivalent using EHNRI's food composition table. To this effect, the average calorie value per 100 gram of each type of food grain was computed based on the kind of food that the community consumes utmost.

This is because the calorie equivalent of the grains varies by the kind of the end product prepared for consumption.

For instance, a 100 gram of teff grain (white) is equivalent to a dietary energy equivalent of 240.30 kcal when prepared in the form of bread and 145.00 kcal when it is consumed in the form of *enjera* (See Table 5). The average value of the major end product of each crop has been taken for conversion processes in this paper.

The entire grain quantity/household/year was converted into dietary calorie equivalent using the above table to look into the contribution

of urban farming to the annual total dietary calorie requirement. Accordingly, it was found that urban farmers secured the nationally set minimum dietary energy requirement (about 2100 kcal/capita/day) from urban farming on the average.

However, it does not mean that each and every household or individual has access to this minimum requirement in that some households (about 43 per cent) are surplus producers while others could not meet their daily requirements.

Table 6: Total quantity of grain obtained and the dietary energy equivalent by types of grains

Types of food grains	Production (kg/capita/day)	Conversion Scale (kcal/100 gram)	Dietary Energy Equivalent (kcal/capita/day)	Contribution to daily per capita calorie requirement (per cent)
Teff	0.4466	182.38	814.51	38.79
Wheat	0.2438	195.12	475.70	22.65
Barley	0.1123	243.90	273.90	13.04
Pulses	0.0493	223.05	109.96	5.24
Maize	0.1753	251.64	441.12	21.00
Total	1.0273	------	2115.19	100.72

Source: Computed from survey data based on EHNRI's food composition table

Note that the analysis of the contribution of urban farming to food security as presented in the Table 6 above has been done based on the nationally recommended minimum requirement of 2100 kcal/day for a moderately active adult.

Accordingly, the sample small-scale urban farmers in Adama secured, on average, more than the minimum dietary requirement (100.72per cent) only from cereal production in 2008/9 crop year. This is said to be very high compared to the country's available daily average per capita consumption of about 1,770kcal, which accounts only for 84per cent of the minimum level (2100kcal/day/person) accepted by the Ethiopian government (Woldeamlak 2009.

6.3 Determinants of Dietary Calorie Intake from Urban Agriculture

It is obvious that there are numerous and multifaceted cases affecting households' or individuals' access to adequate dietary calorie supply in general and the investigated small-scale farmers in the town of Adama in particular. These adverse factors can be categorized broadly into two: environmental and socio-economic constraints. The former broad category includes such environment-oriented factors like climatic conditions, prevalence of plant/animal diseases, land slope and soil fertility; whereas the later includes farmland size, quality and quantity of farm animals, family size, labor supply, fertilizer usage, and access to extension, credit and veterinary services.

The variables selected for this analysis, however, are more of socio-economic factors taking the other things to be similar (constant) for all the households. This is because the writer thinks the environmental factors bring no significant difference among the households as all of them are more or less exposed to similar biophysical conditions. The variation in dietary energy available among the sample households are, therefore, mainly due to the prevailing socio-economic constraints.

Hence, it seems very important to analyze the role of the major socio-economic factors and put them in order of their significance in affecting the peasants' food security situation. Eight major explanatory variables (See Table 7) that are assumed to determine the food security status (level of dietary energy supply per person per day) of the households were selected for this analysis. It should be noted that these by no means are the only variables; rather they are assumed to have more significant effect on the households' per capita dietary

energy supply. As indicated earlier, the effect of other factors such as climatic conditions, soil fertility and policy issues are held constant or considered as if they have similar impact on all the households under consideration in the area.

Table 7: Summary of the Results of Multiple Regression Analysis

Variables	*ß*	*t*	*Sig*
Constant	*1605.343*	*3.432*	*0.004*
Family size	*-5.756*	*-0.236*	*0.817*
No. of livestock per household	*47.389*	*2.724*	*0.016*
No. of oxen per household	*669.596*	*5.791*	*0.000*
Education level of household head	*-6.035*	*-0.423*	*0.678*
Size of farmland per household	*-30.713*	*-0.281*	*0.783*
Sex of household head (M=2, F=1)	*586.028*	*2.715*	*0.016*
Fertilizer per unit of hectare	*1446.719*	*4.453*	*0.000*
Dung in put (yes=2, No=1)	*365.023*	*2.212*	*0.043*
R	*0.995*		
R square	*0.990*		
F change	*177.010*		
Sig. F change	*0.000*		

Dependent Variable: Dietary energy/day/person

The relationship between per capita food availability in kilocalorie and various variables was examined. As indicated in the table above, the eight selected independent variables explained about 99.5 per cent of the variations of food availability among the small-scale farming households in Adama town, ($r = 0.995$, $r^2 = 0.990$). The food availability variation with an ANOVA of F-ratio of 177.010 was found to be significant.

Among the independent variables, the amount of commercial fertilizer applied per unit hectare, number of oxen (availability

of traction power), dung input and sex of household head were found to be the major determinants of food availability in order of their significance. Here, we should bear in mind that female-headed households are more at risk of food insecurity than their male counterparts. Size of farmland, education level of the household head and family size negatively affect the variation in dietary calorie availability though not statistically significant at 5 per cent level of confidence. As for family size, it is obvious that the larger the family size, the less will be the share of an individual in the household.

The inverse relationship between dietary calorie available per person per day from urban agriculture and education level of the household head may probably be because of the fact that more educated households head may give more attention to other businesses than agriculture. As for the negative influence of larger farmland is concerned, it may be explained in such a way that urban agriculture, from its very nature, requires intensification on smaller farmlands which enables those urban producers who effectively perform on smaller farmlands to be more successful than those who try to cultivate extensively.

6.4 Urban Livestock Sub-sector

The small-scale urban farmers in Adama breed several livestock types in traditional style. As it has been seen in the regression analysis just earlier in this paper, the livestock sub-sector determines the food security position of the farmers, helping as a source of traction power, food, cash and manure. However, a significant number of the survey respondents had no adequate number of livestock population which could presumably be one of the major causes for lack of access to adequate food supply for some households in the area.

Table 8: Size and Species of Livestock Owned by Sample Households

Kind of Animals	*per cent of owner hhlds*	*Number of animals per hhld*
Draft oxen	95.00	2.50
Fatten oxen	35.00	0.68
Milking Cows	86.67	1.70
Calves	80.00	2.08
Goats	30.00	1.65
Sheep	73.33	4.25
Equine	86.67	1.51
Chickens	93.33	10.16
Bee hives	1.67	0.14

Source: Sample Survey, May. 2009

The summary of the households' livestock ownership in Table 8 shows that 95 percent of the sample households in the area had access to some number of traction animal, typically oxen. About 35 percent of them owned some number of fattened oxen of different level for sale. Eighty-seven percent of the sample households owned some number of milking cows. Chickens, equine, sheep and goats are also important livestock types being bred by small-scale urban farmers in the town. The overwhelming majority of the peasants (93.33 percent) owned chickens. Apiculture (bee-keeping) is the scarcest animal breeding sub-sector in the town being practiced only by 1.67 percent of the sample households.

The enquiry in Table 9 was made to assess the livestock ownership position of the households under investigation. In addition to its crucial importance as a direct source of food (meat, milk, cheese, butter and egg) and traction power, the sale of live animals and animal products was found to be a lucrative source of household cash. However, as summarized in Table 8

above, the livestock ownership position of the households is not remarkable. The ratio of the animals to the sample households was found to be very small. A considerable number of the respondents owned no or very small number of livestock population. Moreover, as elsewhere in Ethiopia, it was verified during the field survey for this paper that the livestock breeding style of the urban farmers in Adama was too traditional and the animals are of poor quality to provide them with optimum outputs such as milk, meat and eggs. It was also found that the households who owned more quantity and quality of agricultural animals are less likely affected by lack of cash and food insecurity problems than those who do not.

Table 9: Some Livestock Outputs in Absolute and Relative Terms
Source: Sample Survey, May. 2009.

Output	Output/Hhld/Day	per cent of owner hhlds	Unit price (ETB)	Gross Cash Income (ETB/Hhld/Day)
Eggs	In number			
	< 1	38.4		< 1.15
	1	8.3	1.15	1.15
	2	25.0		2.30
	3	13.3		3.45
	4	0.0		4.60
	5	1.7		5.75
	≥ 5	13.3		>5.75
Average	2.45	---		2.82
Butter	In Kilogram			
	< 1	50.0		<60.00
	1	33.3		60.00
	2	13.3		120.00
	3	3.3		180.00
	4	3.3		240.00
Average		---		32.00
Cheese	In Kilogram			
	< 1	50.0		<12.00
	1	33.3		12.00
	2	13.3		24.00
	3	3.3		36.00
	4	3.3		48.00
Average		---		6.00
Milk	In Liter			
	< 1	33.4	6.00	< 1.00
	1	1.7		6.00
	2	8.3		12.00
	3	5.0		18.00
	4	3.3		24.00
	5	5.0		30.00
	≥ 5	43.3		>30.00
Average	6.90	----		41.40

Note: ETB: Ethiopian Birr

7. Concluding Remarks

The series of discussions hereinbefore have shown that urban agriculture is a super intensive farming practice within the urban boundary for varied purposes. It is learnt from the discussion that urban agriculture is one of the crucial sectors in urban poverty alleviation and food security attainment. Similarly, the study has shown that urban agriculture in the town of Adama is found to have great importance in urban poverty alleviation, food security attainment, job creation, and urban greening. About 43 percent of the small-scale grain, dairy and vegetable producers have been found to attain the minimum nationally set dietary energy requirement, 2100kcal/person/day, from their urban agricultural activities alone. Even some of them have been found supplying their agricultural related products to local consumers and vendors.

However, urban agriculture seems to have been one of the most neglected sectors in the city of Adama in the sense that there is no concerned governmental organ that has been working towards the development of the sector. At its current situation, it is entirely rain-fed, resource-poor and disorganized. It has been constrained by lack of credit, extension and veterinary services as well as inadequate awareness among the executives and the practitioners themselves as to what the role and basic peculiarities of urban agriculture are.

Valuable recommendations and policy implications can be drawn from the study results so that urban agriculture could play its optimal role in creating a more food secure, environmentally friendly, green, attractive and livable city of Adama. The findings of the study reveal that urban agriculture could play a great role in the overall development of the city if the

executives, practitioners and the urbanites at large are well aware of the role, practices and peculiarities of the sector. The sector needs to be well organized and the urban farm households should be provided with appropriate technical support, training, modern farm inputs, credit facilities and extension services.

The reutilization of urban organic wastes for soil fertilization needs great inspiration and awareness creation activities. The inclusion of a well-staffed and equipped urban agricultural development bureau in the administrative structure of the town is also highly required.

The identification and establishment of specialized intensive agricultural production zones, such as urban dairy zones, vegetable zones along rivers/streams, fattening zones, green or recreation zones and poultry zones, may result in a more productive and environmentally friendly urban agriculture in the town. Roadsides, railway-sides and other vacant urban areas in the town may be leased to interested urbanites to be covered by temporary crops, vegetables, salable flowers and seedlings.

The study reveals that outdoors, balconies and even roof-tops may be used as medium for high-value crop growing in urban areas which may be applicable to the situation of Adama. In this regard, urban planners, engineer and architects are expected to give appropriate attention to urban farming whilst they plan, design and construct urban infrastructures.

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