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FOOD SECURITY ATTAINMENT ROLE OF URBAN AGRICULTURE: A CASE STUDY FROM ADAMA TOWN, CENTRAL ETHIOPIA

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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 smallholders in Adama town. As studies on urban agriculture in Ethiopia are limited, if not inexistent, it would attempt to bridge such research gaps and aware the urban administrators and planners towards addressing the strategies to appropriately handle and develop the sector. To that effect, the necessary data were generated both from 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 obtained from the offices of Oromiya Finance and Economic Development, Adama City Administration and Central Statistical Authority. 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 finding of this study confirms that urban agriculture plays a great role in attaining urban household food security. Over 40% 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 are recommended so that it could contribute a lot to urban food security, job creation, urban greening and the betterment of micro-climatic condition.

Keywords: Urban agriculture, food security/insecurity, Adama

BIOPHYSICAL AND SOCIO-ECONOMIC PROFILE OF ADAMA TOWN

Adama is one of the largest and most populated towns in Oromiya National Regional State. It is located at 8°33`35``N - 8°36`46`` N latitude and 39°11`57`` E – 39° 21`15`` E longitude. It is about 100 kilometers away

from Addis Ababa in southeast direction. Adama has a total area of about 13,000 hectares, which has been sub-divided into 14 urban kebele (least administrative structure) 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 20th century up until it was officially reverted to its original Oromo language name, Adama, in 2000. Adama had been serving as the capital city of Oromiya National Regional State during 2000-2005. It was on the 10th of June 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 district is 155, 321 of which, 76,325 (49.14%) were females and 78,996 (50.86%) were males according to the 2007 population and housing census of Ethiopia (CSA, 2008).

There is no well-organized survey depicting the incidence of urban poverty and food insecurity for the town 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% to 44% and the overall urban poverty incidence is assumed to be 40% to 50% (FDRE, 2002; Tadesse, 1997 cited in Tesfaye, 2006).

Physiology 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 (NUPI, 1995).

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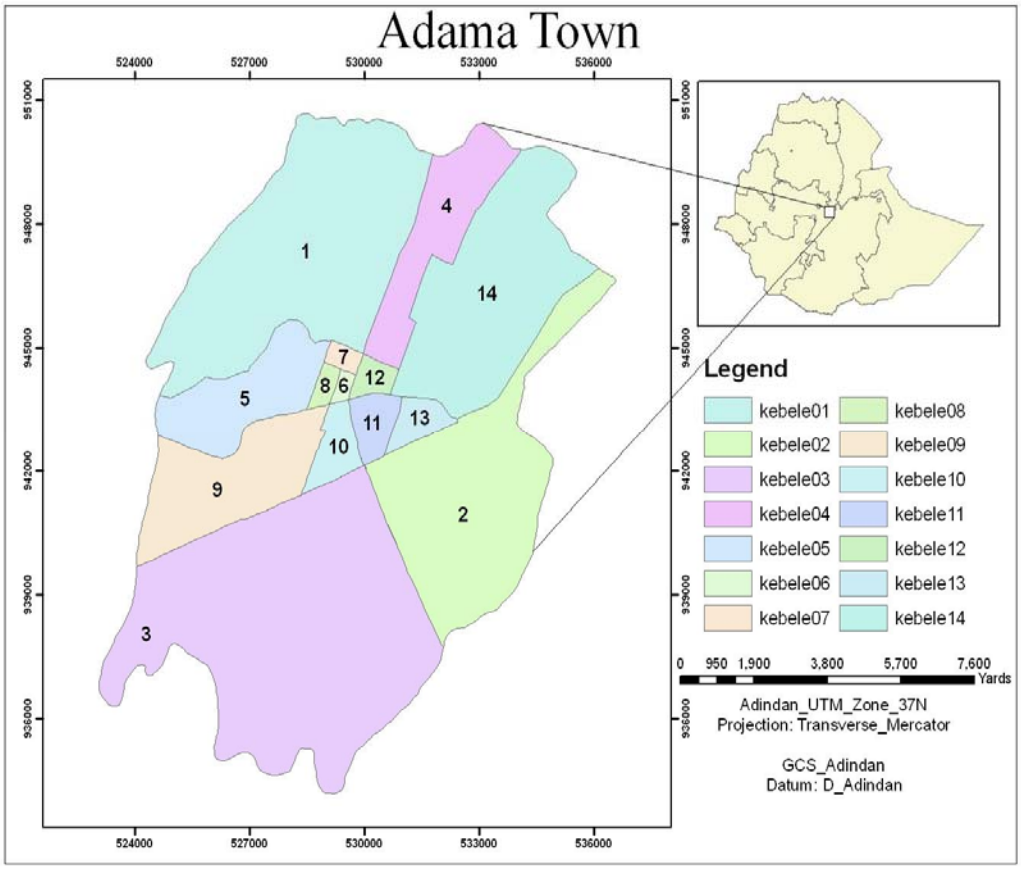


Figure 1: Adama Town National and Regional Settings

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 join (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 82.25cm for the period of 39 years, 1952 to 1991. The mean annual rainfall for the period of 1998 to 2006 was computed to be 72.67cm. This figure is a little bit lower than the average total annual rainfall for most highland areas of Ethiopia (Alemneh, 1990; Messay, 2001).

Rainfall in this area is erratic in nature. There is a significant seasonal variation in the amount of rainfall. More than 67% of the mean annual rainfall occurs in the four rainy months: June, July, August and September. Some additional rains (about 23%) occur in the remaining dry months with mean monthly values of rainfall 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 higher evapo-transpiration in the area. (Compare Table 1 & Table 2).

Table 1: Mean Annual Rainfall in Centimeter (1998-2006)

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total	Average
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)

The fluctuating nature of rainfall, no doubt, adversely affects the agricultural practices and the availability of food items in the area. In connection to this, the investigated households said that both the sowing and harvesting periods are fluctuating as a result of untimely rains. They complain for the unreliability of rainfall as one of the primary reasons for food grain shortfalls and livestock deaths.

As indicated in Table 2 below, 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 condition in the driest months, which lets the temperature escape to the upper layer of the atmosphere.

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)

OBJECTIVE OF THE STUDY

The purpose of this study was to assess the role of urban agriculture in urban households' food security attainment. More specifically, the study addressed the following objectives:

- To promote the integration of urban agriculture into municipal sectoral strategies in Adama town.
- To stimulate local stakeholders/initiatives regarding identification and formulation of projects on the development of urban agriculture in the town.
- To create awareness among the administrators of Adama town about the role of urban agriculture in addressing urban food security, environmental greening, job creation and reutilization of urban wastes.
- To stimulate urban planners, architects and advisors to think of urban agriculture whilst they plan for town development or design for building.

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

Tinker's (1994) definition of urban agriculture 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, herb, 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, 2004; Tinker, 1994; Falvey, 1999; Teferee, 2003).

Since 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 (Falvey, 1999; Sawio, 2004; 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 (Zezza and Tasciotti, 2008). Today, even in and around large metropolises 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).

At this stage it is logical to coin the definition of urban agriculture so that we will have a clear meaning and concept of the term. Urban agriculture is, therefore, a super intensive crop and animal production practiced within the boundary of a city/town on different medium such as piece of land, roadside, balcony, rooftop and pond for the purpose of household consumption and market.

Urban agriculture can be practiced for a variety of reasons. A study by Maxwell (1994) in Kampala indicated that there are at least two major categories of household logic to be engaged in urban agriculture, which include commercial production and household food self-sufficiency. Urban agriculture is, therefore, contributing a lot in reducing the problems of urban household food insecurity by improving access to fresh and low priced food and raises the nutritional status of the residents.

At this juncture, one can forward the question addressing what food security is. Food security is a broad and flexible concept, encompassing issues related to the nature, quality access, causes, and coping strategies of food shortfalls. 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 the definition and concept of food security. The initial focus of attention was primarily on food supply problems that are 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 foodstuffs…to sustain a steady expansion of food consumption…and to offset fluctuations in production and prices'. 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'. In the World Bank's (1996) 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 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'. 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' (UNFAO,1998; UNFAO, 2001).

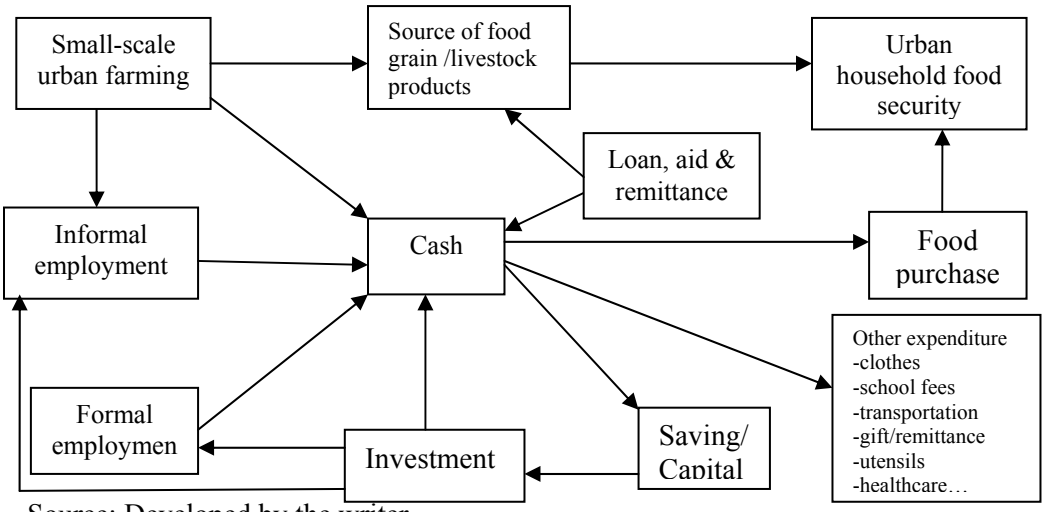
The continuing evolution of food security as an operational concept in public policy has reflected the wider recognition of the complexities of the technical and policy issues involved. The most recent and careful redefinition of food security is that negotiated in the process of international consultation 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 securing. This is why, as reported by the World Food Program in 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.

In case of Ethiopia, it is not only the individuals' or households' inability to obtain adequate food that matters but the inadequate food production at the national level is also a source of great concern for the prevailing severe food insecurity in the country. Ethiopia is presently one of the most food insecure and food aid dependent sub-Saharan African countries. It has been food self-insufficient since 1959 when the country received food aid for the first time because of crop damage by drought and pests in some areas. In fact, according to G. Ramakrishna and

Assefa (2002), Ethiopia has a long history of famines and food shortfalls that can be traced back to 250 BC. As researchers documented at least 40 periods of such severe food shortfalls occurred in Ethiopia since then. Particularly, since 1959, Ethiopia has remained one of the major food aid recipient countries in the world, as domestic production of food has never been sufficient to meet the food requirements of the national population. Indeed, since the 1960s, the number of food insecure households has been increasing, whilst per capita food availability has been decreasing. The per capita food availability was, on average, 128.08kg for the period 1961-1974, and it declined to 119.99kg in 1975-1991. Though average per capita food availability was 125.41kg during 1992-2001, still it remained far below the recommended average per capita daily requirement set by the Ethiopian government (2,100 kcal, which is equivalent to about 225kg) of grain per annum. This implies that the per capita food supply simply stagnated far below the minimum required level for over four decades. The large gap that remained between food demand and food supply was filled by food imports and food aid, the later contributing the largest share (Woldeamlak, 2009).

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



Source: Developed by the writer

According to FDRE's food security strategy document (1996 and 2002), the causes of food insecurity both in rural and urban areas of Ethiopia are varied and multifaceted. The document indicates that low income households in informal sector, the elderly, disabled and sick, female-headed households, street children and urban poor vulnerable to economic shocks (eg. rising food price) and HIV/AIDS victim families are among the most food insecure group of people in urban Ethiopia.

MATERIALS AND METHODS

Sources of Data

The data used for this study were collected both from primary and secondary sources. Majority 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. Key informant interviews and targeted group discussions were made to substantiate the data obtained through questionnaire survey. Kebele officials, selected household heads, elders and agricultural development agents also 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.

Sampling Techniques and Sample Size

Judgmental and snowball sampling techniques were employed to generate primary data for this research. Firstly, three sample kebeles were purposely selected from different parts of the town particularly where the researcher thinks there are more urban farming households in the town. This was done purposely so that the sample kebeles could spatially and sufficiently represent the study area, Adama town. It also helps to see the change in the 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 farming 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 town.

At this juncture, it is obvious that one of the challenges of the researcher was how to decide what should actually be the number of samples to be selected from a population. Obviously, large size of sample 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 living in Adama town.

Data Analysis

The methodologies employed to analyze the data for this research include both descriptive and inferential statistics. Majority of the quantitative data were analyzed by the use of statistical software known as SPSS (Statistical Package for Social Sciences). Statistical techniques such as 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 net available food for the households was computed using a modified form of a simple equation known 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). The quantity of food produced was calculated and converted into dietary calorie equivalent based on 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 dietary calorie status of the resettled households in the study area.

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

RESULTS AND DISCUSSIONS

Demographic Characteristics of the Sample Smallholding Urban Farmers

According to a recent report released by the UNFAO, the number of hungry people living in cities is growing at an 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 justifies this fact in that the average family size of the small-holding urban farmers is over 5.6 heads which seems a bit larger than both the average family size of the whole Ethiopia and that of urban population in the country.

Table 3: Sample Household's 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**

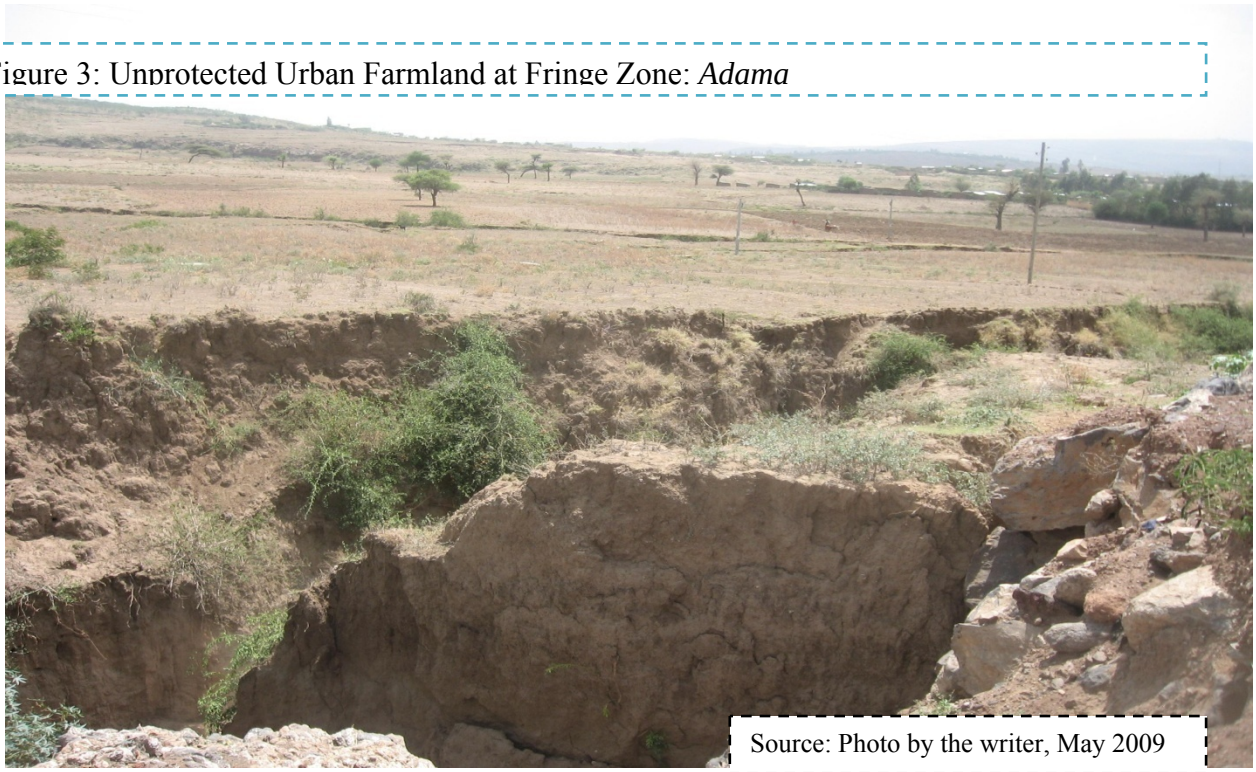
Source: Writer's sample survey

THE CURRENT SITUATION OF URBAN FARMING IN ADAMA TOWN

There is no adequate data related to urban farming in Adama town. 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 main or complementary strategy to secure food supply for their families and/or to earn some cash income in the town.

It is worth-mentioning 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 the sector. 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 town of Adama is the most neglected sector in that there is even no concerned governmental office or individual in the administrative structure of Adama city administration. There is no any written plan or strategy concerning the current and future issues related to this sector. This fact has been resulting in urban agricultural deterioration 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

As a result, the small-scale urban farmers in the town of Adama are suffering from lack of basic agricultural supplies, extension and veterinary services and credit facilities. This indicates the fact that the sector has been lacking attention and is the most neglected one though the urban farmers themselves and several related experts agree in the indispensability of urban farming. Even there is no comprehensive policy or strategy that could effectively address the sustainable development, management and function of urban farming in the town. Due to this lack of recognition by city authorities, urban planners and government institutions, the role and functions of urban agriculture has remained invisible in Adama.

According to the respondents of this study, the sector still lacks appropriate attention from concerned bodies. As a result, there is a low degree support service 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 edge 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 (Figure 2) 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 maize, teff, wheat, barley, tomato, onion, garlic, cabbage and red 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 town of Adama. In combination with the poverty of majority of the urban farmers and the insecure

land-tenure situation, this leads 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 the town of 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 limits their capacities to improve their farming systems and marketing opportunities. It hampers their efforts to engage in well managed and more advanced agri-businesses. It also restricts their strenuous effort or exertion to engage in direct marketing to consumers or acquiring an improved position in the marketing chain. Well managed and organized urban producer groups and associations may also play important functions in sharing ideas, innovation and dissemination of indigenous farming technologies, training their members, product quality control and enhancing access to credit and other productive resources.

Figure 4: Severe Soil Loss through Gully Erosion: Adama

Source: Photo by the writer, May 2009

Most of the small-scale farmers in the town have also no clear idea of how and where to cultivate their crops and animals. They think that agriculture can be practiced only on large farmlands and is only of rural business, 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 even demand more land for fallowing asserting that they cultivate on a single plot of

land year after year; the practice that has been hindering soil revitalization. This indicates the fact that the farmers have no clear idea about the very nature of urban farming which is intensive cultivation and can be practiced on small area 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 town seems generally low, despite high market demand and sharply increasing food prices at present. As a result, one can safely say that it is high time for the experts and governors 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 they could contribute their maximum potential in reducing urban food insecurity and poverty.

FOOD SECURITY ROLE OF 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 market access to low-priced food items, agricultural jobs and incomes in the developing world. It provides the dwellers with fresh dairy products, vegetables, fruits and grains (Sawio, 2004; Tinker, 1994; UNFAO, 1998/2001; Falvey, 1999; Teferee, 2003).

Table 4: Small-Holding Sample Urban Farmer's Major Crops Output

Crops	Output per year per household (in quintal)				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 is 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 raising food crops and 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 is not less than that of other towns in the developing world. It also seems the contribution of the sector is likely growing owing to the existing rapid growth in urban population and soaring food prices in the country. Then, it seems that the role of urban agriculture in the town is greater now than ever before and even may become greater in the coming decades.

The small-scale farmers in the town 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 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 sale it out to the formal shop owners. No sample farming household is reported to have engaged in floriculture, pisciculture and lumbering.

The result of this study reveals that urban agriculture, as a means of acquiring food grains, constituted for 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 (accounted for 13 percent of the net quantity required) followed by remittance and food aid in order of their significance.

An attempt was made to convert the average grain produced 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

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

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 is 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%) 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/100gram)	Dietary Energy Equivalent (kcal/capita/day)	Contribution to Daily per Capita Calorie Requirement (%)
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 above (Table 6) 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, over the minimum dietary requirement (100.72%) 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 1,770 kcal, which accounts only for 84%of the minimum level (2100kcal/day/person) accepted by the Ethiopian government (Woldeamlak, 2009).

DETERMINANTS OF DIETARY CALORIE INTAKE

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 environmental conditions. The variations in dietary energy available among the sample households are, therefore, mainly due to the prevailing socio-economic constraints.

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

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 in the area.

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% 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 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 the counterparts. Size of farmland, education level of the household head and family size negatively affects the variation in dietary calorie availability though not statistically significant at 5% level of confidence. The analysis obviously depicts that family size and per capita dietary calorie available relate negatively. 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 household 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.

URBAN LIVESTOCK SUB-SECTOR

The small-scale urban farmers in Adama breed several livestock types in traditional style. As has been seen in the regressions 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 dung. However, a significant number of the survey respondents had no adequate number of livestock population, which could presumably be one of the major causes of lack of access to adequate food supply for some households in the area.

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, 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.

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

Kind of Animals	% 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 above enquiry of livestock resources either in absolute or relative figures is to identify the households' livestock ownership position based on the fact that those peasants who owned more quantity and quality of agricultural animals are less likely to be affected by food insecurity than those who do not. Rather than the crucial importance of the animals as a direct source of food (meat, milk, cheese, butter, and egg) and traction power, the sale of live animals and animal products is 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 farmers' breeding style was found to be too traditional and backward and the animals are of poor quality to provide the small-scale farmers with optimum outputs such as milk, meat and eggs.

Table 9: Some Livestock Outputs in Absolute and Relative Terms

Output	Output/Hhld/Day	% of owner hhlds	Unit price (ETB)	Gross Cash Income (ETB/Hhld/Day)
	In number			
Eggs	< 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**
	In Kilogram			
Butter	**< 1**	50.0	60.00	<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**
	In Kilogram			
Cheese	**< 1**	50.0	12.00	<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**
	In Liter			
Milk	**< 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**

Source: Sample Survey, May (2009) Note: ETB: Ethiopian Birr

THE ROLE OF URBAN FARMING IN RECYCLING URBAN WASTES

Urban agriculture can make use of existing but somewhat neglected or wasted resources such as nontoxic wastewater and solid urban wastes. An urban landscape by its very nature is rich in these wastes streaming from business areas, streets, residential areas, schools and animals. The case of Adama town is not different from this general picture of other urban areas in that huge quantity of organic wastes has been continuously flowing into the environment every day. The reutilization of this waste for fertilization has double importance in that it may be the process of throwing away or getting rid of urban wastes on the one hand and the process of applying organic fertilizer to the soil or plants on the other hand. Hence, well organized collection, categorization and reutilization of such urban wastes in the fertilization of soils and plants in urban agriculture has multifaceted effect in attaining urban food security, creating more jobs cleaning-up the environment and protecting the health of the urbanites.

In this regard, attempts have been made to briefly look into the status of the reutilization of urban wastes for urban agricultural fertilization in the town of Adama. At the city level there is no well-organized institution or bureau working on relevant affairs in connection with urban agriculture in the town. Nobody or no institution is currently talking about the well-organized collection, categorization and reutilization of any type of urban wastes for soil fertilization. However, very few sample small-scale urban producers reported that they make use of decomposable household wastes and dung to fertilize their farmlands. Some of them rather use dung to fulfill their household energy requirements for heating and cooking after preparing it in the form of dry pancake. Very few of them use it for biogas production at the small scale or household level. The reutilization of residuals from food processing industries such as leftovers from oil mills is also found to be small owing to the scarcity and high prices of such residuals. Hence, it is safe to conclude that the status of recycling urban wastes for the purpose of urban agricultural development, either for soil fertilization or animal feed, is almost scanty in Adama town.

URBAN FARMING FOR URBAN GREENING, RECREATION AND MICRO-CLIMATIC IMPROVEMENT

As Tacio (2007) quoted J.A. Mougeot, a senior program specialist of the International Development Research Center in Ottawa, Canada. “Farming in the city is not a straightforward business…[It] requires much finer technological and organizational precision than rural agriculture because it must be more intensive, more tolerant of environmental stress, more responsive to market behavior, and more carefully monitored to protect public health". The deep analysis of this quotation reveals that urban agriculture is more capital and labor intensive, more

market oriented, more dangerous for health if not carefully managed, and more advantageous for environmental greening, recreational service provision and micro-climate improvement unlike the ordinary rural based farming. This is because urban agriculture takes place in an area of cramped population, severe land scarcity, harsh environmental pollution, and intense and enthusiastic recreational requirements. As a result, the importance of urban farming in combating urban environmental pollution and recreational development for the urbanites is really immense.

Figure 4: Aba Gada Recreation Center, Adama

Source: Photo by the writer (June 2009)

It is, therefore, believed that urban agriculture has special importance and requires special consideration in environmental greening, recreational service development and urban micro-climatic improvement for the towns like Adama. This is because Adama, owing to its location, is one of the moderately dry and hot areas in the country; and it is a town most frequently visited by both domestic and foreign tourists. Because of the attractiveness and the ability of the crops/plants to adjust the micro-climatic condition of an environment,

developing intensive urban arable farming in every tiny unoccupied space benefits the town a lot in this regard. This could be done not only by planting seasonal crops but also by growing perennial trees and grasses so as to make impressive to look at, provide some sort of material benefit to the people and moderate the micro-climatic conditions of the town.

The establishment of Aba Gada Recreation Center at the heart of the town and the efforts made by the limited number of small-scale commercial nurserypersons alongside major roads in Adama are worth mentioning in this regard. An encouragement to establish and sustain more and more of such public parks and nurseries is worthwhile in environmental greening, maintaining the micro-climatic conditions, job creation, bringing-forth fruits, vegetables and flowers for consumption or commerce, and urban waste recycling.

URBAN ON-ROOF FARMING AND VERTICAL GREENING

The theoretical model of an on-roof and vertical urban farming envisions buildings that contain small animals (eg. fish and egg-laying chickens) and plants/crops like vegetables and herbs upward and on top of buildings. The vertical garden greens the buildings and provides food items to the restaurants and supermarkets on the buildings. In addition to this, farms like on-roof fishponds and pot-flowers could be lucrative businesses and valuable tourist attractions where the shoppers and other visitors rest and refresh. Moreover, similar to other forms of urban farming, vertical urban plantation is assumed to mitigate the micro-climatic condition of the town by moderating the greenhouse gases being pumped into the atmosphere from the use of fuels and other related sources.

Nonetheless, there is no attempt of vertical farming across or on top of the buildings in Adama town so far. Only limited number of potted-plants is found up or down buildings during the observation for this study.

CONCLUDING REMARKS

The results and discussions of the study indicate that urban agriculture in the town of Adama is found to have multifaceted importance. The analysis of the study reveals that its role in food security attainment is crucial. About 43 percent of the small-scale producers have been found to attain the minimum nationally set dietary energy requirement, 2100 kcal/person/day, from their urban food grain production alone. Some of them even supply their products to the local consumers and vendors. The sector has been found contributing greatly to environmental greening, job creation and urban waste management.

However, urban agriculture seems one of the most neglected sectors in the town of Adama nowadays. At its current situation it is entirely rain-fed, resource-poor and subsistence. It is also prone to lack of credit, extension and veterinary services, and absence of structural organization in the administrative structure of the town.

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 secured, environmentally friendly, green, attractive and livable town of Adama. One of the vitally important immediate future actions of Adama City Administration must be the organization of a well-staffed and equipped urban agricultural development bureau in the administrative structure of the town. This bureau will have the responsibility of identification, registration, organization and administration of full and part-time urban agricultural producers. It may also provide technical supports to the farmers and facilitate ways to have access to credit, extension and veterinary services. The urban agricultural development bureau could also be entrusted with the responsibility of informing all about urban farming to the urbanites and the reutilization of urban organic wastes for soil fertilization.

The bureau will also have the responsibility to identify and establish intensive specific agricultural production zones such as urban dairy zones, vegetable zones along rivers/streams, fattening zones, green or recreation zones and poultry zones. The bureau can also aware all the urbanites all about the techniques and importance of urban farming and encourage them to take part in planting and taking care of plants along roadsides, railway-sides, outdoors, balconies and even on the roofs of their houses/buildings. Moreover, the bureau will have the responsibility to initiate and encourage concerned bodies such as engineers, urban planners and architects to give appropriate attention to urban farming whilst they plan for, design and construct urban physical landscapes such as roads, railways, residential areas, buildings, recreation areas and stadiums.

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