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Urban Crop Production and Natural Resource Management Practices, Challenges, and Intervention Options in Addis Ababa

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Abstract

The population of Addis Ababa is growing at rapid pace and currently reaches about 5 million. Food shortage, unemployment of youths and women, and increasing prices of major food items are critical constraints. In spite of the efforts to overcome the limitations, information is lacking on urban crop production and natural resource development and management practices to take informed decisions to enhance urban crop production and environmental sustainability. Therefore, this study was undertaken in Addis Ababa to identify and generate information on urban crop production and natural resource management practices, bottlenecks of the practices, and recommend possible intervention options to mitigate the challenges. Quantitative and qualitative secondary and primary data were collected through review of secondary sources and sample survey of urban producers and stakeholders using distinctive checklists. Data were collected through focus group discussions, key informant interviews, and matrix rankings by multidisciplinary research team. The collected data were analyzed using thematic and narrative analyses to achieve objectives of the study. Most of urban producers grow Swiss chard, lettuce, head cabbage, Ethiopian kale (gomen). These crops are selected due to their short life cycle (could be grown three to four times annually), ease of cultivation and low disease incidence. Carrots, beet roots, cauliflower, garlic, onion and potatoes were also grown by some producers. A few producers grew spices and high value crops such as leeks, chives, celery, zukuni, parsley, spinach and spices like coriander. Cereal crops and mushrooms were also produced by limited number of producers. Managing tree seedling nurseries, afforestation and reforestation, and agroforestry practices are carried out to develop and manage natural resources and keep ecological balance. However, shortage of improved technologies, land, and water supply were main constraints in the city. Environmental degradation, inadequate waste disposal and management, limited waste recycling and reuse, and food safety and quality were constraints in Addis Ababa. Overcoming the challenges need involvement of all stakeholders to jointly plan, formulate policy and strategy, and take coordinated and targeted actions.

Keywords: Addis Ababa, urban crop production, natural resource, food safety

Introduction

Addis Ababa is the capital city of Ethiopia and a home for many national and international institutions, with the current population size estimated to be more than 5 million (CSA, 2018; worldometers, 2022). The annual growth rate of city's population is 4.4 percent. It is estimated that 40 percent of Addis Ababa population lives under poverty (World Bank, 2023). In addition, there is inadequate food supply from various parts of the country to feed the growing population of Addis Ababa. In order to bridge the gap and address the growing food demand, urban agriculture has been initiated to ensure food security, create employment opportunities, and generate income for youths and women. The city administration supports and encourages urban dwellers to practice urban agriculture.

Vegetable production has been one of the important components of urban agriculture in Addis Ababa. About 248,536 producers and 1,478 institutions were involved in vegetable production in 2022 in Addis Ababa (Addis Ababa Urban Agri. Commission, unpublished report). Some producers grow different vegetables on a wider area of land greater than 1 ha while majority of the participants grow vegetables either on very small plots of land or on pots. Predominately Swiss chard, lettuce, head cabbage, Ethiopian kale (*gomen*) are grown by farmers. These crops are selected due to their short life cycle (could be grown three to four times annually), ease of cultivation and low disease incidence. In addition, carrot, beet root, cauliflower, garlic, onion and potatoes are also grown to the lesser scale. A few farms grow spices and high value crops such as leeks, chives, celery, zukuni, parsley, spinach and spices like coriander.

Even though, there are crop production activities, Addis Ababa has experienced rapid urbanization which resulted in the conversion of agricultural and natural land into built-up areas. This expansion has led to the loss of vital green spaces, agricultural land, and increased impervious surfaces. Land management in Addis Ababa is a complex task, given the dynamic urban growth and the need to balance development with environmental protection. The city has been working on urban planning and zoning regulations to guide development and prevent unplanned expansion. Sustainable land management practices aim to strike a balance between urban development and the preservation of green spaces and agricultural land.

The other urban agricultural practice is mushrooms production. Mushrooms are often appreciated for their substantial nutritional and medicinal qualities. They are important source of protein that is naturally high in Vitamin D, potassium, magnesium, and many other nutrients. Mushrooms also contain all the essential amino acids. Extracts from common mushrooms are among some of the most

powerful medicines, supporting a healthy immune system, lowering cholesterol, and fighting cancer cell development, among a long list of other medical attributes (Mdachi et al., 2004; De Silva et al., 2012; Rathore et al., 2017). Mushroom cultivation, which can be done in small and repurposed spaces, offers great opportunities for urban individuals and communities to address food security issues.

Urban food production should take food safety and quality into consideration to ensure urban food security. It is believed that there is no food security without food safety. Food safety is an essential part of food security. Only when food is safe can it meet nutritional needs and help people to live an active and healthy life and children to grow and develop (FAO, 2023). Food safety can be affected at different stages of food production, processing, transporting, handling, and marketing. In urban areas especially in Addis Ababa, the first factor that affects food safety especial vegetable production is polluted water since most farms use untreated various streams water flowing in the city. When food safety standards are applied, consumers will be protected by the efforts that have been undertaken in making sure that the food they consume is safer. Food safety standards provide the common basis for understanding and, at the same time, the common basis for joint action to ensure that all of us can benefit from safe food (FAO, 2023).
The challenges facing the city has led Addis Ababa city administration to give due attention to urban agriculture and natural resource management activities. However, there is limited information on urban crop production and natural resource management efforts. Information is needed for urban crop production's and natural resource management's targeted extension activities, to revise existing policies and strategies, and design appropriate technologies and market linkages. Taking these views in to account, this study was carried out in Addis Ababa with the following specific objectives:

- Identify urban crop production and natural resource management practices.
- Identify the challenges in urban crop production and natural resource management endeavors.
- Assess perceptions of producers and consumers on urban waste disposal and food safety
- Suggest recommendations for development, research, extension and policy intervention options that help address the challenges of crop production and environmental sustainability.

Materials and Methods

Research Design

This study used qualitative research method to identify urban crop production and natural resource management practices, and to identify the challenges of the practices. The study was carried out by multidisciplinary research team. The team carried out survey on urban crop production and natural resource management practices and stakeholders to collected data. Data were collected using specifically designed checklists. Data were collected through focus group discussions and key informant interviews. Secondary data were also collected by reviewing secondary sources.

Location of the study

The study was conducted in all eleven sub cities of Addis Ababa. Addis Ababa is located in the central high lands of Ethiopia between 38° 39´2.76´´ and 38° 54´19.4´´ east longitude and 8° 50´13.06´´ to 9° 6´4.62´´ north latitude. The scope of the study was limited to assessing the existing status of urban crop production and natural resource management practices. The following figure shows location of Addis Ababa in Ethiopia, and the elven study sub cities.

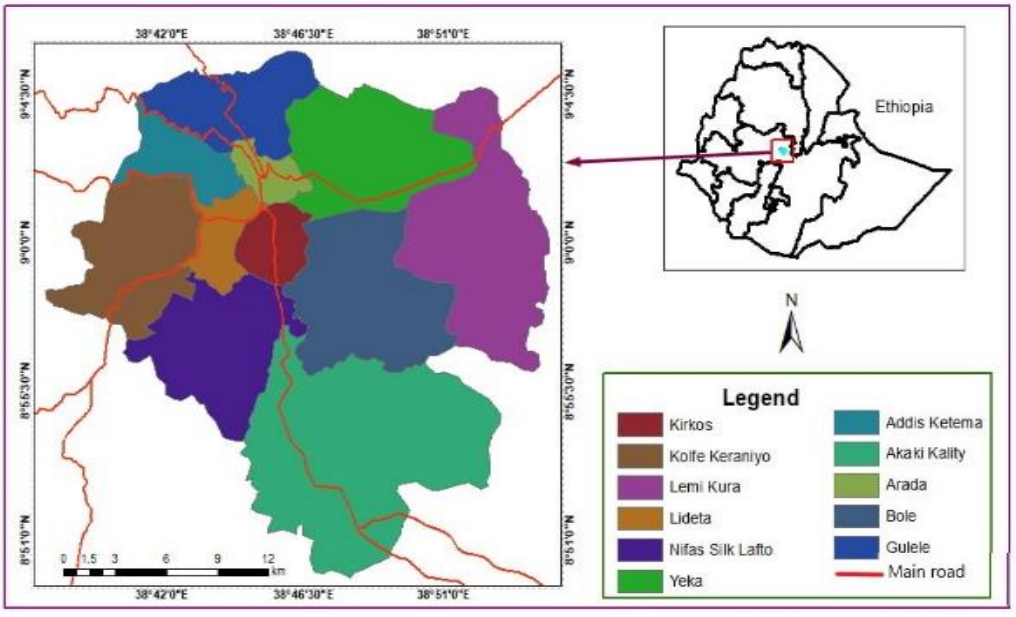

Figure 1. Study location sub cities of Addis Ababa.

Sampling procedure

The sampling frame of the study was the population of urban crop especially vegetable producers, participants in natural resource management and other actors that were engaged either fully or part time in certain types of urban farming and resource management activities. It was assumed that urban producer was the one who was either fully or partially participated in crop production and natural resource management activities for his/her livelihoods. Prior to sample selection, consultative meeting was carried out with city and sub cities' agricultural officers to have better understanding about the potential of districts (*weredas*) that were involved in urban crop production and resource management practices..

Multistage sampling procedure was used to select sample districts and respondents. The first stage was purposive sampling of potential districts that were engaged in urban crop production. The second stage was probability sampling of urban producers and stakeholders along crop and seedling production value chains. Accordingly, 16 districts purposively and 28 producers and other actors in the value chain were randomly selected. Besides, data were collected from 98 agricultural officers or experts found at various levels of urban agricultural office of Addis Ababa. The sample size was determined based on the concept of information saturation which was the point at which no new information was observed in the data from the completion of additional key informant interviews (KII) and focus group discussions (FGD).

Data collection approach

Two standard data collection techniques and approaches were employed. These were desk reviews and qualitative survey techniques. The first stage focused on gathering secondary information while the second stage targeted collecting primary information from target respondents. In the first stage of data collection, secondary information was collected from published and unpublished documents of Addis Ababa city Administrations, Ethiopian Statistical Service (ESS), MoA and other governmental, non-governmental and international institutions. Some of the major sources of published secondary information include journals, books, proceedings, manuals, ESS publications, and unpublished reports. Data were collected using specifically designed checklists by multidisciplinary research team.

In the second stage, qualitative survey methods such as focus group discussions (FGD), key informant interviews (KII) and matrix rankings were adopted to collect primary information from urban producers, offices of agriculture, urban agricultural experts, traders, and consumers. The data were collected from 98 agricultural experts, 25 focus groups discussions, each group with minimum of five members, and 3 traders (supermarkets, retailers and wholesalers). Specific

checklist was designed for each of the target group to collect qualitative information by the multidisciplinary research team. Moreover, in this study, the dynamics of land use land cover (LULC) changes over the past three decades was examined using geospatial technologies. A training dataset for supervised image classification was established. To illustrate, urban farmland was identified by annotating it within the image. Subsequently, additional training locations representing the entire image were progressively included. This process was repeated for each land cover class until representative samples were obtained for all classes. As a result, a signature file containing spectrum data for each training sample was generated. The final step involved performing signature file classification using ERDAS (Earth Resource Data Analysis System) and ArcGIS software.

Data Analysis

Thematic and narrative analysis were used to analyze the collected data. Narrative analysis identifies the basic story which is being told, focusing on the way an account or narrative is constructed, the intention of the teller and the nature of the audience as well as the meaning of the story or 'plot' (Riessman, 1993). On the other hands, thematic analysis is mainly described as a method for identifying, analyzing and reporting patterns (themes) within data (Braun & Clarke, 2006). Thematic moves beyond counting explicit words or phrases and focuses on identifying and describing both implicit and explicit ideas. The analysis focused on investigating urban crop producers' and stakeholders' ideas, values, meanings, beliefs, thoughts, experiences, challenges, and feelings related to his/her crop production and natural resource management practices, technology needs and farm input utilizations, urban agricultural support and service mechanisms, and challenges for crop production and natural resource managements as well as urban vegetable food safety and quality. Preferences and priorities were assessed and prioritized using matrix and ranking tools. Technology and input preferences as well as production and management constraints were assessed and identified.

Results and Discussion

Crop production in Addis Ababa

Vegetables

Small scale vegetable production was carried out in Addis Ababa. Some farms grew different vegetables on a wider area of land greater than 1 ha while majority of the participants grew vegetables either on small plots of land or on pots. Growers accessed land either through inheritance from their parents or from the city administration or institutions which have unutilized land; those who accessed land from the latter were unemployed residents organized as small-scale

enterprises. The Producers were of age from 27 to 62 years, educational background ranged from illiterate to college graduates (most have elementary and high school education). They have an average family size of six, ranging from 3-12 members. The purpose of establishing the farms was mainly to generate income, employment and/or house-hold food security.

Input was an indispensable prerequisite for production and lack of one or more of which renders production difficult and even impossible. Input includes land, source of water for irrigation, seed/plating material, organic and inorganic fertilizers, capital, and agro-chemicals. Owing to the scarcity of lad, most urban dwellers in Addis Ababa grow vegetables on small beds or in pots. Some growers who had own land or youth organized as small-scale enterprise who obtained land from the city government had wider area of land ranging from 0.05 - 3 ha or more. The small-scale enterprises obtained land that belong to friends or family, government (schools) or non-government organizations which own large unutilized marginal lands on river banks, garbage dumping sites or woodlands. Such lands involved high cost of initial land preparation to clear trees and rocks and construct terraces on sloppy river banks. The option of using vertical farming was seen mostly in the promises of sub-cities, not in individual farms. In addition to the scarcity of land, obtaining legal status for long term (sustainable) production was the major problem. The vegetable farms had only temporary permission letter that allows them use the land for unidentified period of time. Lack of long-term security, consequently, led the farms to limit investment on modern technologies (greenhouses, lath-houses, irrigation schemes, etc) and production of permanent fruit crops which intern reduced productivity of the farms and the tendency to remain in the business.

Availability and quality of vegetable seeds was the most important prerequisite for vegetable production. Most growers procure imported commercial vegetable seeds from agro-dealers in Piaza and Gojam Berenda. They complained that the germination quality and varietal purity of seeds procured from the agro-dealers was poor; however, some disagree and claim that the quality of the seeds from these sources was good. Selecting varieties and brands, and establishing reliable relations with the agro-dealers were the means to secure seed quality. A small amount of vegetable seeds was provided from woreda urban agricultural offices; nonetheless, the type and amount of vegetable seeds provided was not based on the needs of growers. A very few of the farmers obtained seed donations from relatives living abroad. Still a few farmers with better information procured seedlings of pepper and tomatoes from commercial vegetable nurseries such as JoyTech. In addition to the problem of quality, shortage of vegetable seeds, seed health that manifested itself during production (pod rotting in pepper) and high price of seeds driven by ever increasing inflation were the major bottlenecks of vegetable production.

Unlike in rural areas, urban vegetable production didn't receive much research attention. Most highland vegetable crops grown in Addis Ababa: Swiss chard, lettuce, head cabbage, Ethiopian kale, cucumber, and carrots were considered as low priority crops in the national research system until recently when Cool Season Vegetable Crops Research Program was established. Consequently, varieties of these crops recommended in the 1960s were commonly used for production. On the other hand, private seed companies introduce and register seeds of vegetable varieties in Ethiopia. These companies avail seeds of registered varieties of aforementioned crops (except for Ethiopia kale) to growers in the rural areas through their own marketing and extension systems. However, urban vegetable production could not benefit from the registered varieties. In addition to using unimproved varieties, agronomic practices and insect pest and disease management systems used in vegetable production in Addis Ababa were traditional. These practices were developed elsewhere and yet were not adapted to soil and environmental conditions of Addis Ababa. Therefore, adopting these varieties and adjusting their management practices with due consideration to intensive utilization of narrow spaces in urban settings is of paramount importance to intensify production and increase productivity.

Increasing production and productivity was the major objective of any farm and could be achieved only through use of appropriate production technologies and management practices. Despite the fact that farmers used traditional production practices, most of them perceived that productivity of their farms was good. They mostly attributed the productivity of their farm to multiple cycles (three cycles of vegetables or two cycles of vegetables followed by one cycle of cereal) production per year. However, most farmers reported that shortage of land, water, fertilizers, improved seeds, diseases, insects, finance and extension service were constraints in crop production in order of their importance. In addition, water logging, heavy rainfall and hail damage during rainy season (June - August) and frost damage in (October –January) were also reported to cause low productivity.

Vegetable production problem emanates from lack of recognition, commitment, and necessary support by responsible institutions. Although vegetable production usually needs relatively wider area of land as compared to other urban businesses, most farms had small plots ranging from 0.05-2 ha. All farms had only temporary permit to use the land. This caused insecurity and lack of enthusiasm prohibiting long term investment on constructing structures, establishing irrigation systems, etc. that could increase production and productivity. Some farms didn't have electricity supply so they were subjected to high cost of fuel for running water pumps and theft of during the night time.

There was urban extension service gap in vegetable production. Most farmers started vegetable production business traditionally as unemployed residents or

inherited from their parents. They had no formal education or sufficient training on agronomy, protection and management of vegetable farms. They also lacked exposure to intensive horticultural farms that could serve as sources of new ideas. Thus, most farms lacked the knowledge and skills necessary to run the farms as profitable businesses leading them to low profitability and disappointment. In addition, the extension advisory service they get from urban agricultural office was inconsistent and some producers consider it as not helpful.

Urban agriculture in general and vegetable production in particular have shortage of land and modern technologies feasible for urban setting to undertake vegetable production. It was very difficult to get land for expansion or start a new farm. Most of the farms were found scattered all-over the city, some located side-by-side with residential areas or unsuitable (sloppy, rocky) sites. Coordinated provision of these resources, extension service, experience exchange, and marketing were difficult under these conditions. Therefore, allocation of land dedicated to clusters of vegetable farms could be important to ensure long term security and success of the farms through building the confidence of farmers to plan long term investment. It also creates suitable conditions to provide the necessary infrastructure, inputs and services. Moreover, modern technologies for urban oriented vegetable productions are lacking or limited, not promoted; and the potential urban vegetable production in Addis Ababa could also include school and institutional gardens, community gardens, vertical farming, rooftop gardening, container gardening, aquaponics and hydroponics, and agroforestry. Therefore, it is essential to develop a clear roadmap with achievable targets and robust extension system involving competent staff capable of designing and leading urban vegetable production.

Cereals

Cereal production in Addis Ababa is a vital component of urban agriculture, contributing significantly to the city's income and employment. Urban residents in Addis Ababa engage in cereal cultivation, primarily focusing on crops like teff, maize, barley, and wheat. Cereal urban farming activity provides income for many households, particularly low-income families, while creating employment opportunities. It was estimated that the total area currently under cereal crops cover was about 3,349 hectares in the city in 2023.

The production and productivity of cereals in Addis Ababa depend on factors like land availability and security, input accessibility, and the use of efficient farming techniques. In this regard, due to the lack of timely input supply and limited use of improved technologies and management practices, productivity of cereal was about 20 quintals per hectare. Urban cereal producers face significant challenges that include land ownership insecurity, which compels them to sell their land due

to the fear of potential dispossession by the city administration or the need to construct family housing and meet basic family requirements. Furthermore, they contend with challenges like the shortage and delayed delivery of essential farm inputs like fertilizers and improved seeds. Moreover, the prices of crucial inputs such as fertilizers and herbicides are increasing from time to time.

Therefore, to enhance cereal production in Addis Ababa, there is a need for on time supply of farm inputs with affordable prices and required quality, technology transfer, training and extension services. Urban land planning should also establish secured land ownership for cereal producers to enhance productivity and sustainability.

Mushrooms

There were limited efforts that involve training on mushrooms production, technical support, and sometimes subsidies to encourage urban dwellers to take up mushroom cultivation as a livelihood option in Addis Ababa. The results of this study show that Addis Ababa's mushroom production has significantly decreased mainly due to limited supply of mycelium, low productivity of the varieties, limited access to training, limited supply and the high price of the substrate (cottonseed), and lack of credit service. For these reasons, only a tiny percentage of producers remain active in this market while a large majority have ceased production. Currently, there are only two active mushroom growers in the city. This report is therefore based on insights gleaned from these two functional farms.

Mushroom cultivation in the city is generally accomplished by both individuals and enterprises, often with a focus on commercial endeavors. However, the currently active growers lean more towards personal consumption rather than mass market distribution. Mushroom production necessitates the availability of both dark rooms for the initial growth phase and well-illuminated spaces to facilitate maturation. Individuals typically engage in this practice on their privately owned land, utilizing their personal finances and family labor. In contrast, enterprises operate on public land, relying on the labor of their members, and often secure loans from financial institutions to support their mushroom cultivation ventures.

Mycelium is the living fungal culture grown onto a substrate. It provides the backbone to any mushroom-growing operation. The producers obtain mycelium from the city’s urban agriculture commission and some private suppliers. The respondents revealed that mycelium from private sources is relatively expensive. Limited access, shortage and low quality of mycelium are challenges related to the input. Sometimes mycelium supplies are affected by bacteria and fungus which then affect the whole farm. Mushrooms also need a substrate to grow, just like plants require soil. The substrate supplies energy, nutrition, and structure needed

by the mycelium, to develop and grow into beautiful mushrooms. The producers use cotton seed, sorghum, sawdust, hay, and straw (tef straw) as a substrate. However, cotton is given priority by producers due to its high nutrient content and reduced productivity from the use of other substrates. Limited access to the market and the high price of cotton is the major challenge in mushroom production. The current price of a quintal of cotton is 2,600 Birr.

Mushroom provides output two to three times in its lifespan. About 60kg of mycelium yields 180 to 300 kg of production based on the quality of the mycelium from the farm of the individual. Enterprises harvested only 20 kg from 100 boxes of production, which was extremely low. The market outlet for the product was hotels. The product reaches hotels through collectors as the producers have no receipt (TIN) to directly sell the product to hotels. Collectors assemble from farms and sell to international hotels. Enterprises sell the product to suppliers of inoculants. The market is not an issue for mushroom products due to high demand. The price of a kilogram of mushroom costs 120 to 150 Birr. They don't know the current market status since the farms are currently not producing for the market. Individuals produce for home consumption while the enterprise supplies the product to the market.

The challenges in mushrooms production included the limited supply of mycelium, low productivity of the varieties, limited access to training, limited supply and the high price of the substrate (cottonseed), and lack of credit service. High market demand for the product, having a relatively short growth cycle, and allowing for multiple harvests throughout the year are opportunities in mushroom production. It is recommended that development and dissemination of improved productive varieties, provision of adequate technical and business training, availing extension and credit services, and enhancing the mushroom value chain, especially input suppliers and producers are essential to enhance its production and productivity.

Natural Resource Management

Land management in Addis Ababa is a complex task, given the dynamic urban growth and the need to balance development with environmental protection. The city has been working on urban planning and zoning regulations to guide development and prevent unplanned expansion. Sustainable land management practices aim to strike a balance between urban development and the preservation of green spaces and agricultural land. These efforts include strategies to protect natural habitats and incorporate green infrastructure into the city's design to enhance its resilience to environmental challenges.

In response to pollution concerns, Addis Ababa has taken steps to manage and mitigate pollution sources. This includes addressing air and water pollution, waste

management, and reducing industrial emissions. Additionally, the Green Legacy Initiative, introduced by the Prime Minister, aims to tackle pollution and environmental degradation by emphasizing afforestation and reforestation efforts across the country, including Addis Ababa. This initiative encourages the planting of millions of trees to combat deforestation, improve air quality, and enhance urban greenery. Many thriving youth and women groups and businesses are actively involved in seedling nurseries, and successfully multiplying millions of seedlings to support the city's afforestation and urban greening endeavors.

The *Green Legacy Initiative* has gained significant momentum in Addis Ababa. The program not only focuses on afforestation but also involves urban greening and the preservation of existing green spaces. Thousands of people in the city have been actively involved in tree planting campaigns, contributing to the re-greening of urban areas and the improvement of air quality. These efforts align with the broader goal of achieving a more sustainable and environmentally friendly future for Addis Ababa, while also inspiring environmental consciousness among its residents.

Accordingly, in 2023, the dominant land cover type was built-up land, encompassing a substantial area of 350.6 square kilometers, representing 66.5% of the total land coverage. Vegetation covered 95.9 square kilometers, accounting for 18.2% of the area, with a minor increase of only 0.6 square kilometers observed between 2013 and 2023. In contrast, there has been a significant decline in the area coverage of urban farming and bare land, now constituting 57.7 square kilometers (10.9%) and 21.4 square kilometers (4.1%), respectively. Additionally, 1.5 sq. km (0.3%), 1.6 sq. km (0.3%), and 1.6 sq. km (0.3%) are all included in the water land cover class. These results are supported by a similar study by Mitiku and Dessalegn (2021) who also examined the land use/land cover change of Addis Ababa over three decades.

In the context of urban agriculture, land-use change in Addis Ababa has emerged as a significant and intricate issue in recent years. The city has witnessed a significant transformation in its landscape as the demand for urban development collides with the need for sustainable food production. This conflict between urbanization and agriculture has led to the conversion of fertile agricultural land into residential and commercial areas, resulting in reduced agricultural productivity and raised potential food security concerns. This dramatic change in land use and vegetation cover in Addis Ababa is clearly indicated by the land use land cover change map (*Figure 2*).

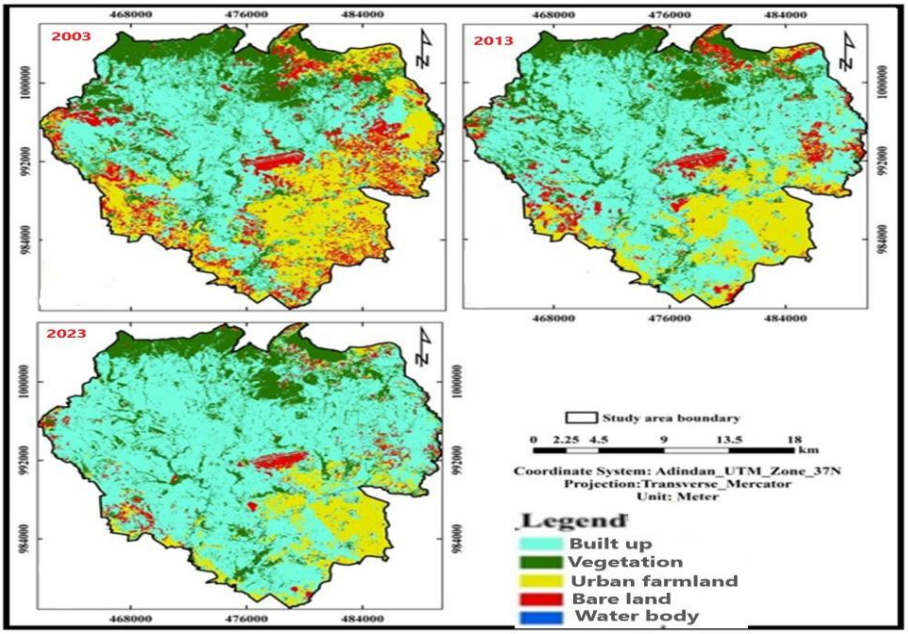

Figure 2. Land use land cover change of Addis Ababa over the last 20 years.

Maintaining the ecological balance of urban agricultural production and reducing environmental pollution need the use of eco-friendly waste disposal techniques like composting and recycling. To guarantee that urban agriculture remains a sustainable and ecologically conscious practice, cooperation among communities, local governments, and urban farmers is crucial. Local producers in the majority of Addis Ababa's sub-cities generally believe that urban agriculture does not present a serious environmental danger in terms of pollution. Some growers efficiently recycle organic resources by making compost out of vegetable and animal leftovers and other farm wastes. However, wastes from industries, households, institutions, and urban farms are contributors to environmental pollution in Addis Ababa.

In general, the use of compost and farm waste as organic fertilizers in urban vegetable and cereal crops production presents both challenges and opportunities for Addis Ababa. While issues such as sourcing quality organic material and managing composting processes require attention, the benefits of sustainable urban agriculture, improved soil health, and economic development make the investment in organic fertilizers a promising avenue for the city's future food security and environmental sustainability. Addressing these challenges and seizing the opportunities will be pivotal in ensuring the success of sustainable agricultural production in Addis Ababa.

Urban Food Safety and Quality

Studies show that discharge of untreated effluent from industries, solid wastes and wastewater from households and institutions are the major sources of pollution of the rivers flowing through Addis Ababa. We observed that most urban vegetable producers use polluted river and stream water for vegetable production. Vegetable productions using polluted water could be a factor affecting food safety and quality. Shortage of tap and ground water make producers use polluted rivers' water for production of various vegetable crops in the city. Different studies show that urban agricultural products produced using polluted or contaminated water are unsafe and do not meet safety and quality criteria. Water pollution is a critical challenge to food safety since most Addis Ababa urban producers use polluted and unsafe water for production activities. The urban food products produced using polluted water could not meet food safety and quality standards.

Potentially toxic elements or heavy metals and pesticides residues are major factors affecting food safety in urban food productions (Buscaroli et al., 2021). Heavy metals and pesticides residues affect human health. Vegetable producers in Addis Ababa mainly use river water and pesticides. This production practice is one of the main routes of heavy metals entry into human body. Agricultural products produced by polluted water could have toxic elements or heavy metals that can greatly affect human health. Vegetable outputs from Addis Ababa urban agriculture could not be free from contamination by heavy metals and pesticide residues since most urban producers use polluted water and pesticides in their vegetable productions.

Generally, unsafe food affects the realization of the right to adequate food in the context of national food security and reduces efforts to guarantee health and wellbeing. Safe food is also a prerequisite for achieving healthy diets, increasing market access and economic development. Unsafe food causes an estimated 600 million cases of food-borne diseases (FBDs) every year, as well as 420 000 annual deaths globally; and Children under the age of five account for 143 000 of those fatalities (WHO, 2015). Human illnesses due to unsafe food are estimated to cause yearly productivity losses equating to USD 95 billion for low- and middle-income countries (LMICs) (Jaffee et al., 2019).

The challenges in vegetable production include limited knowledge or lack of awareness among the majority of urban vegetable producers, supporters, consumers, and policy makers on food safety risks of urban agricultural products. The main objectives of urban agriculture are to ensure food security, generate income and employment opportunities. We perceived that most consumers did not know the source and production practices of vegetables bought from market; and focus on urban food safety was limited or non-existent.

There are several evidences of food safety hazards related to urban food production practices. Studies carried out in different parts of the world indicate that foodborne pathogens and micro-organisms, potentially toxic elements (PTEs), pesticides residues, nitrate and nitrite are common hazard categories for urban food production systems (Buscaroli et al., 2021). Producers in Addis Ababa use unsafe production practices, and food products could not be free from these problems. Further quantitative studies and laboratory analysis are needed to substantiate this fact.

Therefore, growing food to ensure food security in Addis Ababa requires responsibility for the safety of food products. Urban producers must have guidelines and recommendations to improve the safety and quality of agricultural products. The guidelines and recommendations on good urban agricultural practices enhance the safety and quality of agricultural products by preventing microbial contamination from soil, water, hands, and surfaces throughout production, processing, and marketing stages.

Conclusion and Recommendation

The assessment of crop production in Addis Ababa reveals that there are productions involving vegetables, cereal crops, mushrooms, and seedling nurseries. Vegetable and cereal productions have relatively higher income generations and employment opportunities. In addition to vegetable production, there are various urban agricultural practices that can be explored and implemented to enhance urban food security, promote sustainability, and contribute to the well-being of urban dwellers. The possible potential urban agricultural practices in Addis Ababa could also include school and institutional gardens, community gardens, vertical farming, rooftop gardening, container gardening, aquaponics and hydroponics, and agroforestry.

Even though urban crop production has huge potential to ensure food security and generate employment opportunities, however, it has been constrained by various challenges. The challenges affect production, productivity, and consumption of urban agricultural commodities. These challenges are related to availability or limited supply of infrastructures (land, water, and electricity), shortage of improved technologies (plant seeds, seedlings, production & management practices, tools and implements), limited availability of quality farm inputs with affordable prices (fertilizers, and agrochemicals), shortage or unavailability of basic services and supports (urban agricultural extension, training, credit, policy and regulatory frameworks), limited urban waste disposal and management mechanisms, and urban food safety and quality.

The challenges are diverse and interrelated. Solving the challenges require collaborative approach involving various stakeholders for strategic interventions. Some of the key strategic actions need to be taken to overcome the challenges and enhance urban crop production, natural resource management, and food safety and quality in Addis Ababa include:

- Establish and implement urban crop production and natural resource management policies related to land use planning, water management, infrastructure, waste disposal and environmental pollution, and food safety and quality.
- Implement policies that provide secure land tenure for urban producers that promotes long-term production and sustainability.
- Develop efficient irrigation systems, ground water and rainwater harvesting, and water recycling initiatives.
- Develop mechanisms to ensure reliable and affordable access to improved agricultural technologies and inputs, and financial support mechanisms.
- Implement training and awareness creation programs, workshops, and extension services.
- Develop and strengthen urban- rural input and output market linkages.
- Enhance research and research funding on urban crop production, natural resource management, and food safety and quality.

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