



**ASSESSMENT OF URBAN AND PERI - URBAN AGRICULTURE AND
FORESTRY FOR CLIMATE CHANGE ADAPTATION AND
MITIGATION MECHANISM: THE CASE OF YEKA SUB CITY IN
ADDIS ABABA, ETHIOPIA**

MA Thesis

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DEVELOPMENT STUDIES

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By

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DEDICATION

This thesis is dedicated to my parents: I specially dedicate this thesis manuscript to my beloved Mother **Bekelech Nigussie**, who devoted her life in nursing and educating me with affection and love which played great role in the success of my life and to my beloved Father **Dressie Amare** for his sincere love, commitment and who has stood by me and encouraged me throughout the entire period of my study.

STATEMENT OF THE AUTHOR

By my signature below, I declare and confirm that this thesis is my own work. I have followed all ethical principles of research in the preparation, data collection, data analysis and completion of this thesis. All academic matter that is included in the thesis has been given recognition through citation. I affirm that I have cited and referenced all sources used in this document. Every serious effort has been made to avoid any plagiarism in the preparation of this thesis.

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ABBREVIATIONS AND ACRONYMS

ADLI	Agricultural Development Led Industrialization
FAO	Food and Agricultural Organization
FEWSNET	Famine Early Warning System Network
GDP	Gross Domestic Product
GHGs	Greenhouse gas
GTP	Growth and transformation plan
IPCC	Intergovernmental Panel on Climate Change
MDGs	Millennium Development Goals
NFPAs	National Forest Priority Area's
NMA	National Meteorology Agency
Mo FED	Ministry of Finance and Economic Development
NGOs	Non-Governmental Organizations
PASDEP	Plan for Accelerated and Sustainable Development to End Poverty
SDPRP	Sustainable Development and Poverty Reduction Program
SPSS	Statistical package for social science
UN	United Nations
UNDP	United Nation Development Program
UNFCCC	United Nation Framework on Climate Change
UPA	Urban and Peri- Urban Agriculture
UPAF	Urban and Peri urban Agriculture and Forestry
WFP	World Food Program

BIOGRAPHICAL SKETCH

The author was born from his father Ato Dressie Amare and his mother W/o Bekelech Nigussie in January, 1972 in Ataye Efratana Gidim District, North Showa Zone of Amhara Regional State. He attended His elementary school at Abalo Feres Elementary School from 1981 to 1984 and secondary school at Ataye Senior Secondary School from 1985 to 1992. He then joined Combolcha Agricultural training center in 1996 and completed with Certificate in the field of agriculture and natural resources development. Then he graduated from Alage Agricultural Technical Vocational Education and Training College with Diploma in natural resources in 2004. Then he joined Bahir Dar University college of Agriculture and environmental science in 2007 and graduated with Bachelor of Science Degree in the field of Natural Resource Management in October 2011.

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ABSTRACT

Ethiopia is the second most populous country in Africa next to Nigeria with a population estimated at 99.39 million out of which over 20.4% live in urban and peri-urban areas. Ethiopian agriculture is characterized by low productivity. As a result, the country has been a scene of poverty and persistent food insecurity. To solve this problem assessing urban and peri urban agriculture and forestry for climate change adaptation and mitigation mechanism play important role in the livelihoods of urban and peri urban farmers in particular and the society at large. It helps to realize the relevance of the sector in urban and peri urban poverty alleviation. The main inspirations of urban and peri urban agriculture and forestry studies were the need to investigate and understand the forces that drive food insecurity and food self-reliance. Therefore, this study was conducted in Yeka Sub City of Addis Ababa during the production season of 2019/20 to assessing urban and peri urban agriculture and forestry for climate change adaptation and mitigation mechanism and identify socio-economic factors affecting the urban and peri urban agriculture of the households. A three-stage sampling technique was employed to select 148 households which participated in urban and peri urban agriculture and forestry. Both primary and secondary data have been used to generate the required information. Descriptive statistics tools were employed to analyzed the statistical data such as percentage, mean, and the like are used in describing the final result. The objectives of the study were to assess the implication of urban and peri- urban agriculture and forestry for climate change adaptation and mitigation mechanism in Yeka sub City, and their roles in livelihoods of urban and peri urban farmer households and urban poverty alleviation, and to provide empirical evidences on the level of urban and peri urban farmers awareness on climate change in relation to their farming system. The results of the study indicated that urban and peri urban agriculture in Yeka sub city has significant influence on the livelihoods of urban and peri urban households. On the other hand, this research discusses also the cultivating vegetable crops and cereal crops are the most common agricultural activities produced by the urban and peri urban farmers. The existing condition of the forest cover in Yeka sub city is exposed to over clear cutting, deforestation of land for cultivation and settlement. This study recommends that government should take immediate steps to establish the institutional setup to facilitate the urban and peri urban forestry and greening programs

Key words: Urban, Peri urban, Forestry, Climate change, adaptation and Mitigation

CHAPTER ONE

1. INTRODUCTION

In this part of the thesis, background, statement of the problem, objectives, research questions, significance of the study, scope and limitation of the study of the thesis were discussed briefly.

1.1. Background

The world population is becoming highly urbanized rapidly, with half of the world's population now living in cities and urban poverty growing at a higher pace in the developing world. Food and fuel absorb a large share of urban poor household incomes, and household food insecurity has been worsening in recent years Didit Okta Pribadi and Stephan Pauleit, (2016). Hence, at a time of increasing urbanization, dwindling agricultural resources, increased food insecurity and an accelerating deterioration in the quality of life for those living in urban areas, it is absolutely vital to be considerate of the existing and urban and peri-urban agriculture and forestry (UPAF) activities Halloran A and Magid J, (2013).

Urban and peri-urban agriculture and forestry (UPAF) is increasingly being practiced around the world as a livelihood strategy for poor city dwellers Conway D and Schipper L., (2011). According to (FAO, (2013) reports, there were 800 million people working in urban agriculture in 1996, a majority of whom were minimum wage earners in developing countries. The contribution of urban and peri-urban agriculture and forestry (UPAF) to food security and healthy nutrition is probably its most important asset. Urban and peri-urban agriculture and forestry (UPAF) supplies food to the city and income to those who farm. Above all, urban and peri-urban agriculture and forestry (UPAF) make an important contribution to food security for those who do not have easy access.

In Africa for decades, poverty, food insecurity and malnutrition were viewed as largely rural problems African Climate Change Resilience Alliance, (ACCRA). (2014): however, the population of many African countries is becoming more urbanite. The urban population in Africa grew from 27 percent to 38percent between 1980 and 2000, and is expected to reach nearly 50 percent by 2030 La Rosa, D. *et al.*, (2014). People tend to move to cities in order to improve their lives, find better jobs and have access to goods and services that are not

available in rural areas FAO, (2011). Hence, urbanization is most likely to be one of the major problems of human kind in the near future Kwasi Addo, (2010).

Ethiopia is the second most populous country in Africa next to Nigeria with a population estimated at 99.39 million out of which over 20.4% live in urban and peri-urban areas CSA, (2016). In Ethiopia, urban and peri-urban agriculture and forestry (UPAF) can play a strong role in enhancing food security for the urban poor, greening the city and improving the urban climate, while stimulating the productive reuse of urban organic wastes and reducing the urban energy footprint, reducing the incidence and impacts of floods and landslides on the urban poor, enhancing access to nutritious food and diversifying food sources and thereby reducing the impacts of disturbances in food supply from rural areas or imports and increases in food prices, diversifying their income, creation of “green jobs safety net in times of economic crisis, enhancing community building. Rearing cattle and chickens, or growing rain-fed crops such as vegetables on plots found adjacent to their houses and away along river sides are a traditional urban and peri-urban agriculture and forestry (UPAF) farming practices in Ethiopia Achamyelch, (2014).

Urban and peri-urban agriculture and forestry (UPAF) has been proposed as an important urban element to deal with the challenges of increasing poverty, food insecurity, and environmental degradation as particularly found in rapidly expanding cities of Ethiopia. However, farming in the urban and peri-urban agriculture and forestry is under strong pressure from urbanization. The economic and social roles of farming need to be better understood in order to integrate urban and peri-urban agriculture and forestry Federal Democratic Republic of Ethiopia, (2016). Urban and peri-urban agriculture and forestry (UPAF) may improve both food intake (improved access to a cheap source of proteins) and the quality of the food may improve (poor urban families involved in farming eat more fresh vegetables than other families in the same income category. Despite the fact that, urban and peri-urban agriculture and forestry (UPAF) does not match with the available land size, yet the threat of climate change on urban and peri-urban agriculture and forestry (UPAF) settings has not been given much attention in Ethiopia Fekadu, (2015).

In Addis Ababa, the capital of Ethiopia, where 35% of the population is estimated to be below poverty line EDRI, (2015), urban and peri-urban agriculture and forestry (UPAF) has played significant role in food security and generating household income. In Addis Ababa alone, the livelihood of over 11,716 households is associated with farming in the city. Moreover, the spatial coverage of UPAF in Addis Ababa is estimated to be over 8300

hectares /of which about 300 hectares are under irrigation/ (Zenebe 2010). The ability of urban and peri-urban agriculture and forestry (UPAF) to continuously supply food for the urban poor depends on better planning based on accurate agro-ecological information, which is also a means to enhance sustainability of the system. urban and peri-urban agriculture and forestry (UPAF)'s ability to do so in general and its sustainability in particular, however, is being threatened by population increase due to natural and rural-urban migration, coupled with urban straggling and infrastructure developments that are competing with urban farming for available space and scarce resources UN, (2012).

Over the last few years, Urban and peri-urban agriculture and forestry (UPAF) has increased in popularity due to concerns about climate change and sustaining food security in Addis Ababa. The effects of climate change have induced crop reductions and affected optimal environmental growing conditions through rising temperatures and changes in rainfall patterns. Although, agriculture contributes to 30% of anthropocentric greenhouse gas (GHG) emissions, presence of vegetation in urban areas can lower temperatures and GHG emissions Woldegerima, *et al.*, (2017).

Mitigation measures include initiatives to reduce emission and/or enhance the sinks of greenhouse gases such as carbon dioxide, methane, nitrous oxides and chlorofluorocarbons IPCC, (2013). These measures include sustainable forest management and Land Fill Gas Methane Recovery. On the other hand, adaptation refers to human adjustment in response to climate change in order to moderate harm or exploit their beneficial opportunities. Adaptation measures include: food security issues, introducing drought and saline resistant crops, developing local food banks, improving farming systems and non-farming options such as economic diversification. Therefore, adaptation helps households to adjust their livelihood in the changing climate situation Solomon, (2014).

This study therefore aims to provide evidence-based information to conducting a research in Yeka sub-city of Addis Ababa. Urban and peri-urban agriculture and forestry activity is an important for poor urban and peri-urban households. Urban and peri-urban agriculture and forestry may improve household nutrition as it provides a source of fresh. Locally grown crops and vegetables that increase the micronutrients in poor households' diets (Maxwell. 2001). To solve this problem assessing urban and peri urban agriculture and forestry for climate change adaptation and mitigation mechanism in Yeka sub-city play important role in the livelihoods of urban and peri urban household.

1.2. Statement of the Problem

The main inspirations of urban and pre urban agriculture and forestry studies were the need to investigate and understand the forces that drive food self-reliance and food insecurity. Ethiopia is a country where subsistence agriculture of low productivity predominates and there has been an acute deficit in food supply and hence food self-sufficiency is a primary issue in the national agricultural development policy Nigussie, (2010). Rural agriculture is not in a position to supply food both for the rural and the urban population. Hence, urban and peri-urban agriculture and forestry activities have been carried out in cities supplementing rural agriculture. Although urban and peri-urban agriculture and forestry plays a significant role in producing food and generating employment and income for the urban dwellers, it has been given less emphasis. Whether the future prospects of any potential agricultural policy are concerned with a sustainable or a more intensive agricultural production, the study of individual household urban and pre urban agriculture and forestry is essential in order to maximize the anticipated benefits World Bank, (2015).

Urban and peri-urban agriculture and forestry activity is widely practiced as an informal economic sector in Ethiopia USAID, (2011). Even though urban and peri-urban agriculture and forestry is a viable activity to complement food supplies from rural areas to urbans and is a means of income for many urban and peri-urban agriculture poor, its contribution has been underestimated World Bank, (2013). Urban and peri-urban agriculture and forestry producers are also often discouraged and ignored by the policy reforms. According to Kedir, (2010) planners tend to think that urban food growing is messy business and have little understanding of peoples' need to grow food in cities. This is mainly because national governments, international organizations, and researchers have no substantial experiences with characteristics of urban and peri-urban agriculture and forestry livelihoods, unlike rural areas in Ethiopia Georgis, *et al.*, (2010).

According to Environmental Protection Authority (EPA), (2011) research on the role that urban and peri-urban agriculture and forestry activity plays in livelihoods of urban and peri urban people, therefore, helpful for better understanding of the urban and peri-urban poor livelihood strategies and realizing its contribution in urban and peri-urban agriculture poverty alleviation. For instance, EDRI, (2015) reported that the poverty gap between the urban and peri-urban and rural Ethiopia is narrowing, not because the poverty in the rural Ethiopia is reducing down to poverty levels in the urban and peri-urban areas, but it is because of the rise in the number of urban and peri-urban people below the poverty line (based on the country's

standard) over time. The report also emphasized the unsatisfactory nation's urban and peri-urban development policies as major reasons for rise in the urban and peri-urban poverty.

The situation is not different in Addis Ababa (economic capital and which accounts for over 30% of the total urban population) Ambaye, (2012). stated that the livelihoods of many urban citizens are heavily dependent on urban and peri-urban farming, but urban and peri-urban policy makers fail to give due attention to urban and peri-urban agriculture and forestry during urban and peri-urban agriculture planning policy reforms. According to the Abdissa, and Degefa, (2011) report, there are a large number of households whose livelihoods are associated with farming in Addis Ababa city. Thus, understanding the role that urban and peri-urban agriculture and forestry plays in livelihoods of urban and peri-urban agriculture poor people will definitely help urban and peri-urban agriculture policy makers to design better urban and peri-urban agriculture development policies. According to a report by CSA, (2015) employment survey, agriculture employed 1.5% of the labor force in the city.

The lack of proper attention from policy makers, urban planners and local authorities, stemmed from the shortage of information that substantiate urban and peri urban agriculture and forestry importance in the city sustainability is also causing problem for urban and peri-urban climate change and mitigation. In addition to that, there is a lack of information with regard to the urban and peri-urban agriculture and forestry activities for climate change adaptation and mitigation. In Addis Ababa alone, the livelihood of over 11,716 households is associated with farming in the city Achamyeleh, (2014). Moreover, there are about 2722 individuals engaged in related micro-enterprise in Addis Ababa. The spatial coverage of UPAF in Addis Ababa is estimated to be over 8300 hectares /of which about 300 hectares are under irrigation/ (Zenebe, 2010). Add to this, the lack of reliable data on the extent of urban and peri-urban agriculture and forestry for climate change adaptation and mitigation is also not well-developed sustainable policies to manage urban and peri-urban agriculture farming in the city Solomon, (2014).

In the study area, it supports the livelihood of many urban and peri-urban low-income families. There are significant number of urban and pre urban agriculture and forestry households are engaged in urban and peri-urban agriculture and forestry activities in Yeka sub city. Furthermore, most urban and peri-urban agriculture farmers are low-income men and women who grow food largely for self-consumption, on small plots which they do not own, with little if any support or protection Abdissa, and Degefa, (2011). Moreover, this

urban and peri urban agriculture and forestry can bring important environmental benefits, such as retention of water. Urban and peri urban agriculture and forestry also plays a vital role in reducing the negative environmental impacts of urban and peri urban agriculture growth and also contributes towards the improvement of the urban and pre urban environment Alebachew, (2011). According to the DFID, (2011) report, urban and peri-urban agriculture and forestry is an important activity that utilizes scarce resources such as land. Therefore, urban and peri-urban agriculture and forestry is making considerable contribution towards satisfying the basic needs of the city population dwelling in the sub-city.

Therefore, from the discussion it is apparent that the emphasis given to the sector by the local government bodies in Yeka sub city is not enough due to minimal effort and there is a lack of information with regard to the urban and peri-urban agriculture and forestry activities for climate change adaptation and mitigation. As a result, the study could be considered as a one-step forward towards bridging emphasis given to the urban and peri-urban agriculture sector by the local government bodies in Yeka sub city and the existing information gap. Furthermore, in the study area there was lack of related research on urban and peri-urban agriculture and forestry activities for climate change adaptation and mitigation and investigate the problems faced by household.

1.3. Objectives of the Study

The **general objective of the study** was to assess urban and peri- urban agriculture and forestry for climate change adaptation and mitigation mechanism in Addis Ababa yeka sub city.

Specific objectives of the study were:

1. To asses status, trends and prospective of urban and peri - urban agriculture and forestry
2. To identifying socio and ecological factors that affect the urban and peri urban agriculture and forestry and
3. To assess the climate change adaptation and mitigation mechanism practiced by urban and peri urban farmers

1.4. Research Questions of the Study

The study set out to answer the following questions:

- (1) What is the status, trends and prospective of urban and peri - urban agriculture and forestry?
- (2) What are the socio and ecological factors that affect the urban and peri urban agriculture and forestry?
- (3) What are the climate change adaptation and mitigation mechanism practiced by urban and peri urban farmers? These were important questions that guided the study in identifying the demographic and socio-economic variables influencing the urban and peri- urban agriculture and forestry for climate change adaptation and mitigation mechanism in the study area.

1.5. Significance of the Study

A study of urban and peri- urban agriculture and forestry for climate change adaptation and mitigation mechanism plays a significant role in providing useful information regarding to food self-reliance and helps to identify those factors, which are associated with urban and peri- urban agriculture that may exist. This research will be useful for the other researchers who study in the other area of the problem. It also significant for society through solving problems and giving satisfaction. It also can be very important for planners and policy makers to provide adequate information about the sector, in such a way that they cannot address the needs and constraints of urban and peri-urban agriculture and forestry. Thus, the findings of this research will give benefit to local authorities, urban planners and policy makers in Yeka sub city to have good understanding on the role of urban and peri-urban agriculture and forestry for implication of climate change. It also gives due consideration to incorporate the sector in the future town's sustainable development plan.

Therefore, results of this study generated adequate information on the issues which helps to designing different policies and interventions for improvement of urban and peri- urban agriculture and the identification of the factors associated, mitigate the problem of food insecurity, used as a reference and initiate other researchers who are interested in conducting different research works from different perspectives on the field which will improve the performance of urban and peri- urban agriculture. Conducting this study in the targeted area would give tremendous timely technical contribution to indicate the way out to improving urban and peri- urban agriculture.

1.6. Scope and Limitation of the Study

The study was conducted in Yeka sub city, Addis Ababa, Ethiopia. The study was undertaken to assess the urban and peri urban agriculture and forestry for climate change adaptation and mitigation mechanisms and identify factors that causes urban and peri urban farmers towards the climate change adaptation and mitigation strategies during 2019/20 year. The study used cross-sectional data obtained from 148 sample households using semi structured interview schedule. Yeka sub city was selected for the study based on the potentiality of area in Addis Ababa city. The results of the study were based on a sample of households from two woreda out of thirteen woreda and which may not necessarily be representative of the entire households due to a shortage of budget, time and facilities. The study was also conducted using cross-sectional data. This may be affected by the specific climate of the year in the study area. Agriculture is dependent on weather condition. Thus, the results of cross-sectional data do not show the change over time. Therefore, households survey by itself was difficult and to get reliable data especially on household's land holding, volume of production as well as other variables which have socio-economic implications may not always be free from error since households can only recall the most recent information.

1.7. Organization of the Thesis

Since the aim of this study was to assess urban and peri- urban agriculture and forestry for climate change adaptation and mitigation mechanism in Addis Ababa Yeka sub city, the study was structured as follows: Chapter two literature reviews, chapter three discusses the methodology, including methods of data collection and analytical techniques used to analyze the data. Chapter four presents the socio-economic characteristics of the survey households. Chapter five presents summary, conclusion and recommendations of the study.

CHAPTER TWO

2. LITERATURE REVIEW

In this part of the thesis, definition of terms and concepts, development and trends in Ethiopia, present status and characteristics, UPAF contributions to environment, climate change adaptation and mitigation mechanism in Ethiopia, impacts and contributions of urban and peri urban agriculture and forestry livelihoods enhancement, greening and climatic regulation, factors that affect that of UPAF in Ethiopia and conceptual frameworks of urban and peri-urban agriculture and forestry were discussed briefly.

2.1. Definition of Terms and Concepts

Some of the definition that could help for further understanding of the concept as follows:

Urban (as opposite to rural) refers to areas characterized by denser population settlement per-unit of land, higher heterogeneity of inhabitants (in terms of ethnic background, religious adherence, livelihood strategies and sources, educational levels etc...), greater organizational complexities as well as higher formal social control FAO, (2015).

Agriculture is the human activity that is most vulnerable to climate change meaning that the greatest percentage of livelihoods depend on agriculture and will inevitably be affected by climate change Drechsel and Dongus, (2010). The main climate vulnerabilities in the agricultural sector are related to seasonal weather changes, increased precipitation and temperatures, and extreme weather events, leading to decreases in crop yields and disease and death among livestock which indirectly can have an impact on market prices and farmers' incomes Berga *et al.*, (2014).

Urban agriculture: This term comprises of two parts which defines an urban as a place-based characteristic that incorporates elements of population density, social and economic organization, and the transformation of natural environment into a built-up environment Brian H.*et al.*, (2014). Urban agriculture addresses “the land in and around areas of intensive human influence, ranging from small communities to dense urban centers, that is occupied or potentially occupied by trees and associated natural resources” Pearson LJ *et al.*, (2011).

Urban agriculture is defined as agricultural practices of urban settlements achieved by ancient civilizations, for the production of food, feed and fodder; fuel, building, shade, fencing, wind-break trees, ornamental and medicinal plants and livestock for food, transport Simon D,

(2012). The early cities of hunters required food storage and these led to the selective domestication of animals and to the regeneration of seed stock (Jacobs 1970, in Smith 1994). The need for food and non-food supplies explains the coincidence of ancient city sites for farming. Those cities provided the incentive and testing grounds for innovations and more intensive and productive farming systems. In fact, agricultural goods produced in cities can be the cornerstones of many urban economies Russo.P.*et al.*, (2014).

Urban and Peri-urban Agriculture (UPA) have been defined as agriculture in and around cities, which compete for resources (land, water, energy, labor) that could also serve to satisfy other requirements of the urban population. Important sectors of UPA include horticulture~ (vegetables and root crops) livestock, fodder and milk production, aquaculture and forestry Pribadi, D.O. and Pauleit, S., (2015).

According to Lwasa S, *et al.*, (2014) urban and peri-urban agriculture (UPA) defines agriculture may take place in locations inside the cities (intra-urban) or in the peri-urban areas. The activities may take place on the homestead (on-plot) or on land away from the residence (off-plot), on private land (owned, leased) or on public lands (parks, conservation areas, along roads, streams and railways), or semi-public land (school yards, grounds of schools and hospitals), or peri-urban farming where owners of plots which were formerly classified as rural, but after the extension of towns are now within the municipality or town administrative boundaries.

Urban and Peri-urban Agriculture and Forestry (UPAF) can be defined as networks or systems comprising all woodlands, groups of trees, and individual trees located in urban and peri-urban areas; they include, therefore, forests, street trees, trees in parks and gardens, and trees in derelict corners. Urban forests are the backbone of the green infrastructure, bridging rural and urban areas and ameliorating a city's environmental footprint. Urban and peri-urban agriculture and forestry include all trees and related vegetation in and around places where people live IPCC, (2013).

Urban and peri-urban agriculture and forestry is the practice of managing urban forests to ensure their optimal contributions to the physiological, sociological and economic well-being of urban societies. UPF is an integrated, interdisciplinary, participatory and strategic approach to planning and managing forests and trees in and around cities Environmental Protection Authority, (2011). It involves the assessment, planning,

planting, maintenance, preservation and monitoring of urban forests, and it can operate at scales ranging from single trees to landscapes FAO, (2015).

Urban and peri-urban agriculture and forestry defines urban and peri-urban forestry as an integrated approach, where the planting, care and management of trees in urban and peri-urban areas is undertaken in order to secure economic, environmental and social benefits for urban and peri-urban dwellers Smith, P., & Gregory, P. J., (2013).

Climate Change: The most universal definition of climate change is a change in the statistical properties of the climate system over periods of decades or longer, regardless of cause World Bank. (2011). The term sometimes is used to refer specifically to climate change caused by human activity. For example, the United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods Simon D, (2012).

Adaptation to (human-induced) climate change: Lwasa S, *et al.*, (2014) defines adaptation to climate change as an adjustment in natural or human (ecological, social, or economic) systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Actions to reduce the vulnerability of a system (e.g. a city), population (e.g. a vulnerable population in a city) or individual to the adverse impacts of anticipated climate change due to emission of greenhouse gases.

Adaptation is a process by which strategies to moderate, cope with and take advantage of the Consequences of climatic events are enhanced, developed, and implemented USAID, (2011). IPCC, (2013) also defined adaptation as the process or outcome of a process that leads to a reduction in harm or risk of harm, or realization of benefits associated with climate variability and climate change.

Mitigation: defined as activities that help to reduce the rate or magnitude of climate change by reducing human generated greenhouse gas emissions or land use practices that contribute to climate change, such as deforestation Berga, H. *et al.*, (2014). Or defined mitigation as a process of curbing greenhouse gas emissions from human activities, for example emissions from fossil fuels as well as deforestation, with a view to stabilizing greenhouse gas concentration at a safe level ACCRA, (2014).

2.2. Development and Trends of Urban and Peri-Urban Agriculture and Forestry

Urban and peri-urban agriculture and forestry (UPAF) green areas, like urban parks, vegetated areas, woodlands, even forest in most cities of the developed countries have traditionally been viewed principally as recreational amenities. In poorer and developing countries urban forestry must first pay attention on assisting in fulfilling basic necessities Drechsel, P. and Dongus, S., (2010). Thus, UPAF comes from the recognition that such urban green areas can and should be used in an integrated, holistic manner for many other environmental and social benefits beyond recreational use and aesthetics in developing countries. These include improving basic sanitation, providing potable water, controlling floodwaters, treating sewage, reducing air pollution, disposing of solid wastes, moderating both macro- and microclimates, increasing biodiversity and alleviating poverty Halloran A. and Magid J, (2013).

2.2.1. Intra-Urban Agriculture Takes Place within the inner city

Most cities and towns have vacant and under-utilized land areas that are or can be used for UA, including areas not suited for building (along streams, close to airports, etc.), public or private lands not being used (lands waiting for construction) that can have an interim use, community lands and household areas. Various types of UPAF can be observed; community gardens (formal and informal), home gardens, institutional gardens (managed by schools, hospitals, pensions, factories), nurseries, roof top gardening, cultivation in cellars and barns (e.g. mushrooms, earthworms). Research data seem to indicate that intra-urban agriculture tends to be more small-scale and more subsistence-oriented than peri-urban agriculture, although exceptions can regularly be found (e.g. vegetable production and production of mushroom or ornamental plants) Simon D, (2012)

2.2 .2. Peri-Urban Agriculture

Takes place in the urban periphery. Peri-urban areas tend to undergo dramatic changes over a given period of time, there is an influx of people from both rural and urban areas, population density increases, land prices tend to go up and multiple land use emerges. Such changes affect the agricultural production systems, which tend to become smaller scale with more intensive production, and shift from staple crops towards more perishable crops and animal production (meat, eggs, milk) Pribadi, D.O. and Pauleit, S., (2015). The peri-urban is characterized by strong urban influences and demands, easy access to markets, services, and

other inputs, but relative to shortage of land and from risk of pollution and urban growth Kwasi Addo, (2010).

2.2.3. Constraints on Urban and Peri-urban Agriculture and Forestry

Some of the literatures reviewed indicate that, like many other sectors, UPAF also constrained by different problems. Urban and Peri urban agriculture and forestry may contaminate local water sources if large amounts of chemical fertilizers and pesticides are used. Also, the excessive use of nitrate-rich manure, such as chicken or pig manure can contaminate groundwater. In particular, wastewater discharge from intensive poultry farms can carry heavy loads of micro-organisms and may contaminate drinking water supplies FAO, (2011).

Further, under certain situations, inappropriate farming practices may lead to reduction of vegetation and siltation of water bodies Conway D, and Schipper L., (2011). Because of the undervaluation of UPAF and staff competition for land, UPAF is often pushed back to marginal areas within the city, such as wetlands and hill slopes, where it may harm the fragile ecosystems if not properly guided. Many of these problems can be prevented by introducing agro-ecological farming practices and integrated pest management control. In general, EDRI, (2015) summarized the major urban agriculture problems in the following three aspects:

Physical constraint and potential: This include lack of land, shortage of water, poor soil condition (physical and chemical composition), lack of inputs and the potential for pollution. Institutional and legal framework: This includes absence of legal status of crop cultivation, tree growing and animal husbandry in urban centers, less attention to extension services for urban farmers, and urban related technical knowledge of these services, research institution and NGOs with less interest to support urban farming and with less capacity to become involved in urban farming respectively. Less attention of urban councils and urban government bodies to urban agriculture, lack of incentives and disincentives for farming such as subsidies, provision of allotment, rules and regulation, taxes, etc.

Socio economic situations: this includes limited knowledge of the dwellers on farming practices, lack of detailed knowledge of sources of livelihoods and the relative importance of urban agriculture, inadequate study in the contribution of urban farming to family nutrition, pattern of food availability from urban farming, impact of urban agriculture to the urban environment, organizational capacity and initiative taken by local groups with respect to urban farming.

According to the UN, (2012) it is predicted that by 2030, the number of city dwellers will reach 60% of the world's population. Globally, as urban centers expand, they often engulf villages or formerly referred to as rural. Third world countries have been experiencing an accelerated urban growth since the last 20th century. According to Kedir, (2010) mega cities and large urban centers, especially in the third world, are experiencing unprecedented population increases. Urban population growth will be most significant in low income countries, notably in Africa and Asia. East Africa will experience total and urban population growth rates significantly higher than the African average DFID, (2011).

2.3. The Present Status and Characteristics of Urban and Peri-Urban Agriculture and Forestry in Ethiopia

Urban and peri-urban agriculture and forestry (UPAF) practitioners in Ethiopia are the most part resource-poor, subsistence, and urban poor growing vegetables and raising animals within and/or around city boundaries in uncoordinated manner. The outputs are mostly meant for subsistence purposes, making the sector unable to play a significant role in poverty alleviation, urban greening and waste recycling endeavors Zenebe, (2010). In the current Ethiopian situation, UPAF has not yet been embedded in the urban planning and developmental strategies though various researchers have recommended for it to be an integral part of the urban system. It has not yet fully engaged the jobless urban residents as laborers, and has not made use of typical urban resources (like organic wastes and urban wastewater) to the required extent. It also faces marketing and delivery challenges owing to lack of legal and policy frameworks Achamyaleh, (2014).

Most of the individuals engaged in UPAF in the briefly surveyed towns (Addis Ababa, Burayu, Galan and Sabata) in Ethiopia. Women constitute an important part of UPAF farmers in these towns. For instance, the data from Urban Agriculture Core Process Owner Bureau /UACPOB/ of AACA indicates that over 40 percent of the overall UPAF farmers in Addis Ababa are female-headed households. Similarly, female-headed households practicing home-gardening and poultry account for 60 percent and 50 percent, respectively, in Addis Ababa. This may be because UPAF and related processing and selling activities, among others, may often be more easily combined with their household chores Alebachew, (2011).

UPAF in these towns has been managed, so far, haphazardly almost in every corner of cities/towns in uncoordinated way. Most individual urban farmers do not have legal license

nor do they pay income taxes to the municipalities. Some practices (such as home-based dairy production and poultry) seem to pose health risks as wastes are found haphazardly spread out everywhere FAO, (2013). In Addis Ababa for instance, it is common to see livestock producers in residential or business areas. Agricultural wastes (such as straw, chaff, husks, discarded offal and other residues) are also disposed of along rivers, lakesides and public areas chaotically owing to lack of legal frameworks and by-laws for the sector. An important part of urban agricultural production in Ethiopia is limited to self-consumption purposes. However, limited private companies (like MIDROC-Ethiopia) are engaged in the production of market-oriented UPAF outputs in larger cities such as Addis Ababa Federal Democratic Republic of Ethiopia (FDRE), (2015a).

A little over 5000 ha of land is covered by urban forest in Addis Ababa. The forests are mostly dominated by species of Eucalyptus and found on the mountains in the northern part of the city. Eucalyptus species have been introduced to the city in 1985 for satisfying the growing demand of wood as source of fuel and construction material and to reduce the pressure on the remaining natural vegetation Georgis *et al.*, (2010). The urban forests of Addis Ababa which are considered as the lungs of the city by the city residents have been affected by anthropogenic activities, mostly by tree cutting for construction and fuel wood and settlement, resulting in a reduced species composition and diversity. Soil erosion by rainwater is a crucial problem in the Ethiopian highlands. Addis Ababa, part of the Ethiopian highlands with rugged steep topographic conditions, has suffered by erosion hazards. This has been exacerbated by the degradation of the urban forests on the mountains of the city, possibly affecting the various ecosystem services provision potential of the forests Nigussie, (2010).

2.4. UPAF and Its Contributions to Urban and Peri-urban Environment

Urban agriculture is part of the urban environmental system and can play an important role in the urban environmental management system Solomon, (2014). UPAF helps cities to become more resilient through: Reducing the vulnerability of the most vulnerable urban groups and strengthening community- based adaptive management by diversifying urban food sources, enhancing access to nutritious food, reducing the dependency on imported and rural food supply; diversifying income opportunities and functioning as a safety net in times of economic crisis; and being a source of innovation and learning about new technologies for high land and water efficient food production. Maintaining green open spaces and enhancing vegetation cover the city with important adaptive and some mitigation benefits by reducing

impacts of high rainfall by storage of excess water, increased and increased infiltration in green open spaces; and maintaining biodiversity in the city, thus protecting a wider base of plant (and animal) genetic diversity Woldegerima, *et al.*, (2017). Urban forestry may also positively impact on the greening of the city, improve the urban microclimate (wind breaks, dust and noise reduction, shade) and maintain biodiversity USAID, (2011).

2.5. Urban and Peri Urban Agriculture and Forestry for Climate Change Adaptation and Mitigation Mechanism in Ethiopia

Ethiopia's climate is strongly influenced by its topography. It is a mountainous country covering over 1,104,300 square kilo meters, with 45% of its land mass made up of high plateaus with mountain ranges divided by the East African Rift Valley. The majority of the population is concentrated in highland regions with elevations greater than 1,500 meters above sea level. The lowlands are more sparsely populated, mainly with nomadic and semi-nomadic pastoralist communities CSA, (2016). Ethiopia's drylands are located in the south, east, and north of the country, with arid and semi-arid regions covering 63% of the territory (Few et al., 2015). Ethiopia has eight main climatic zones at different altitudes, ranging from warm and semi-arid to cold and moist. Mean annual temperatures are around 15°C to 20°C in the highlands, while the lowlands experience average temperatures of 25°C to 30°C World Bank. (2011).

Urban agriculture is part of the urban ecological system and can play an important role in the urban environmental management system UPAF helps cities to become more resilient through: Reducing the vulnerability of the most vulnerable urban groups and strengthening community- based adaptive management by diversifying urban food sources, enhancing access to nutritious food, reducing the dependency on imported and rural food supply; (diversifying income opportunities and functioning as a safety net in times of economic crisis; and being a source of innovation and learning about new technologies for high land and water efficient food production World Bank, (2015).

Maintaining green open spaces and enhancing vegetation cover in the city with important adaptive (and some mitigation) benefits by reducing impacts of high rainfall by storage of excess water and increased infiltration in green open spaces; and maintaining biodiversity in the city, thus protecting a wider base of plant (and animal) genetic diversity Moges *et al.*, (2010). Reducing energy use and greenhouse gas emissions by producing fresh food close to the city (less transport, cooling, storage, processing and packaging), UA and urban forestry

may also positively impact on the greening of the city, improve the urban microclimate (wind breaks, dust and noise reduction, shade) and maintain biodiversity Smith, P., & Gregory, P. J., (2013).

Ethiopia is not only biophysically, but also socio-economically vulnerable to climate change. Rapid population growth and expansion of agriculture in a potentially drier and certainly warmer climate could dramatically increase the number of people at risk. Just as the country is heterogeneous in topography and climate regime, it is also heterogeneous in social, cultural and economic factors IPCC, (2013). Climate change will have significant economic effects on the Ethiopian economy, and on the agricultural sector in particular. It has been estimated that climate change will affect the country's GDP growth by 0.5–2.5 percent per annum in the near future. Not only does it increase poverty and hunger through its adverse effect on food security and economic development; poverty and hunger also decrease people's resilience and their adaptive capacity to the effects of climate change FDRE, (2015a).

Ethiopia's long-term goal is to ensure that adaptation to climate change is fully mainstreamed into development activities. This will reduce vulnerability and contribute to an economic growth path that is resilient to climate change and extreme weather events. Because climate change will affect all geographic areas of the country, its solution requires the participation of the entire population, especially farmers and pastoralists EPA, (2011), Parallel to this, Ethiopia's response to climate change aims to integrate actions that improve the status of women and the welfare of children. The forest sector is enhancing ecosystem health through ecological farming, sustainable land management practices and improved livestock production practices in order to reverse soil erosion, restore water balance and increase vegetation cover, including drought-tolerant vegetation. Furthermore, Ethiopia has designed comprehensive policies and strategies related to forest development and environmental protections at the federal and regional levels ACCRA, (2014).

The mitigation actions see climate change as a cross-cutting issue that requires an integrated approach. In this respect, several sectors are considered in mitigation, including agriculture (livestock and soil), forestry, transport, electric power, industry (including mining) and buildings (including waste and Green Cities). They hinge on four pillars: improving crop and livestock production practices for greater food security and higher farmer incomes while reducing emissions; protecting and re-establishing forests for their economic and ecosystem services, while sequestering significant amounts of CO₂ and increasing the carbon stocks on landscapes; expanding electric power generation from renewable energy; and leapfrogging to

modern, energy-efficient technologies in the transport, industry and building sectors. In the forestry sector, it is important to protect and re-establish forests for their economic and ecosystem services, while sequestering significant amounts of CO₂ and increasing the carbon stocks on landscapes Federal Democratic Republic of Ethiopia, (2015a).

2.6. Impacts in Urban and Peri Urban Agriculture and Forestry

Urbanization is estimated to result in 6 billion urban dwellers by 2050. Cities will be exposed to climate change from greenhouse gas induced radioactive forcing, and localized effects from urbanization such as the urban heat. Climate change may influence most of the urban environment including health and urban biodiversity EPA, (2011), According to IPCC, (2013). Increases in the frequency and severity of floods and droughts as well as declines in water qualities stored in glaciers and snow cover are also expected. The rapid economic development and the concurrent urbanization of poorer countries mean that developing-country cities will be both vulnerable to health hazards from climate change and, simultaneously, an increasing contributor to the problem.

Urban residents are exposed to higher heat stress risk than rural residents due to the Urban Heat, i.e urban areas being warmer than surrounding rural areas. Urbanization reduces green space, increases impervious surfaces compared to rural surfaces FAO, (2013). The geographic focus of climate research mainly the impact of climate change on cities focus on such as Africa and South America. Future research should aim to incorporate urban growth into climate change simulations, and focus on regions that will be most affected by heat stress Abdissa and Degefa, (2011). Climate change is likely to cost developing countries up to 19% of their GDP by 2030 (Nelson et al. 2009). Some studies carried out to determine the magnitude and direction of impacts of climate change on Ethiopian agriculture show that climate change poses a statistically significant impact on agricultural production. Using simulation models, predicted the loss of US \$214 million of agricultural production as compared to the baseline scenario of no climate change of the 1990s CSA, (2016). DFID, (2011) analyzed the potential challenges that climate change presents to Ethiopia's economy. Their findings indicate that the major impact of climate change on Ethiopia's economy will result from more frequent occurrences of extreme hydrologic events, which cause losses in the agricultural and non-agricultural sectors. Here are the following in urban and peri urban agriculture and forestry impacts:

2.6.1. The Socio-economic impacts of Urban and Peri Urban Agriculture and Forestry in Ethiopia

Growing your own food saves household expenditures on food; poor people in poor countries generally spend a substantial of their income (50 - 70%) on food. Growing the relatively expensive vegetables therefore saves money as well as on bartering of produce. Selling produce (fresh or processed) brings in cash. Besides the economic benefits for the urban agricultural producers, urban agriculture stimulates the development of related micro-enterprises: the production of necessary agricultural inputs and the processing, packaging and marketing of outputs. Input production and delivery may include activities like the collection and composting of urban wastes, production of organic pesticides, fabrication of tools, delivery of water, buying and bringing of chemical fertilizers, etc.) Transformation of foodstuffs may include the making of yoghurt from milk, or the frying of plantains or yams, chicken or eggs, etc. This might be done at the household level, to sell at the farm gate or in a local shop or market, and larger units to sell in supermarkets or even for export DFID, (2011).

According to the World Bank. (2011), Food production, processing and marketing also contributes to generating income and employment for many poor urban households. Intensive peri-urban horticultural and livestock rearing are extremely fast-growing sectors that employ many workers and produce high value-added products that yield reasonable incomes and returns. Urban farming can also be a good source of income for the urban poor, if it is especially practiced as a formal sector. The report also confirmed “in Addis Ababa, above-normal profits are earned by even the smallest-scale backyard producers with very low capital.”

According to FAO, (2013), 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. 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 regulation, unlike the rural-based farming practices. This is because it takes place in an area of cramped population, severe land scarcity, harsh environmental pollution and intense and enthusiastic recreational requirements.

2.7. Contributions of Urban and Peri Urban Agriculture and Forestry for Livelihoods Enhancement, Greening and Climatic Regulation

Urban and Peri Urban Agriculture and Forestry seems imperative in livelihoods enhancement, job creation, urban greening and micro-climatic adjustment in Ethiopia. It has the capacity to enable the urbanites to have access to fresh food items in closer proximity than the rural agriculture does. In Ethiopian, this seems even more important as about 35.10 percent of the urbanites in the country are below the poverty line requiring low-priced food items in close proximity. The importance of UPAF in recreational development, combating urban environmental pollution, waste recycling and urban greening is immense in Ethiopia. The sector has special importance in urban micro-climatic regulation for cities/towns. As argued in urban heat principle, cities/towns are significantly warmer than their surrounding rural areas Woldegerima, *et al.*, (2017).

Therefore, the ability of the crops/plants to regulate micro-climatic condition of an environment, developing intensive urban arable farming in every tiny and unoccupied corner benefits cities/towns a lot. It has particular importance for warmer Ethiopian towns located in the Rift Valley System such as Adama and Bishoftu. This could be done not only by planting seasonal crops but also by growing perennial trees and grasses in collaboration with municipal agendas and strategies. The other, often unrecognized, benefit of UPAF is the greening of the cities/towns. Planting trees, and growing fruits and vegetables enhance the aesthetic value of the urban environments all year-round Moges, *et al.*, (2010).

As such, the system can also act as a ‘lung’ for the cities in breathing and cleaning up the polluted air. A case in point is Aba Gada Recreation Center at the heart of the town of Adama and the efforts made by a limited number of small-scale commercial nurserypersons alongside major roads in Adama and Bishhoftu towns. In Addis Ababa alone, the livelihood of over 11,716 households is associated with farming in the city. Moreover, there are about 2,722 individuals engaged in related micro-enterprise in Addis Ababa. The spatial coverage of UPAF in Addis Ababa is estimated to be over 8,300 hectares /of which about 300 hectares are under irrigation/ Zenebe, (2010).

2.8. Factors that affect in Urban and Peri urban Agriculture and Forestry in Ethiopia

Ethiopia is not only biophysically, but also socio-economically vulnerable to climate change. Rapid population growth and expansion of agriculture in a potentially drier and certainly warmer climate could dramatically increase the number of people at risk. Just as the country is heterogeneous in topography and climate regime, it is also heterogeneous in social, cultural and economic factors. Maintaining green open spaces and enhancing vegetation cover in the city with important benefits by reducing impacts of high rainfall by storage of excess water and increased infiltration in green open spaces; and maintaining biodiversity in the city, thus protecting a wider base of plant (and animal) genetic diversity Alebachew, (2011).

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2.8.1. Climate Change

In Ethiopia, the impact of climate change is studied largely at country level in different sectors mainly emphasizing on the impacts of agricultural productivity and water sectors. These studies reveal that climate change and variability severely affect economic conditions livelihoods and agricultural production and food security, water resources and health CSA, (2016).

Ethiopia's climate is strongly influenced by its topography. It is a mountainous country covering over 1,104,300 square kilometers with 45% of its land mass made up of high plateaus with mountain ranges divided by the East African Rift Valley. Ethiopia has eight main climatic zones at different altitudes, ranging from warm and semi-arid to cold and moist. Mean annual temperatures are around 15°C to 20°C in the highlands, while the lowlands experience average temperatures of 25°C to 30°C World Bank. (2011). Climate change will have significant economic effects on the Ethiopian economy, and on the agricultural sector in particular. It has been estimated that climate change will affect the

country's GDP growth by 0.5–2.5 percent per annum in the near future. Not only does it increase poverty and hunger through its adverse effect on food security and economic development; poverty and hunger also decrease people's resilience and their adaptive capacity to the effects of climate change Solomon, (2014).

Ethiopia is one of the most vulnerable countries to climate variability and changes due, its high dependence on rain-fed agriculture and natural resources. The country is indeed rated as among the most vulnerable to climate change as a result of its low adaptive capacity. The country has frequently experienced extreme climate events like droughts and floods, and other climate related hazards. The variability of rainfall and the increasing temperature are blamed for the frequent droughts at that time leads to famine, adversely impacting on the people's livelihood. Since the early 1980s, the country has suffered seven major droughts, five of which led to famines in addition to dozens of local droughts. At the national level, climate change may reduce Ethiopia's GDP compared to a baseline scenario by 2-6 percent by 2015, and by up to 10 percent by 2045 IPCC, (2013).

Ethiopia's extreme vulnerability to the impacts of climate change is also driven by social, economic and environmental factors; and in particular, very high dependence on rain fed agriculture which is very sensitive to climate variability and change, under-development of water resources, low health service coverage, high population growth rate, low economic development level, low adaptive capacity, inadequate road infrastructure in drought prone areas, weak institutions, low levels of awareness on climate change. Past assessments have shown agriculture, water and human health as the most vulnerable sectors. Currently climate change and variability is already impose significant challenge to Ethiopia by affecting food security, water, health, poverty reduction and sustainable development efforts FDRE, (2015a).

Few studies conducted on climate change impacts in Addis Ababa indicate the climate change affects the day to day life styles of urban dwellers. Studies by Billi et al., 2015, at Dire Dawa and Addis Ababa indicate cities in Ethiopia are vulnerable to climate change and hence, require considerable and applicable resilience plans. In general, in a big city like Addis Ababa, integrating all the concepts of climate change and preparing considerable resilience plan to reduce the effect of future climate change is highly important Federal Democratic Republic of Ethiopia, (2016).

2.8.2 Population growth

Ethiopia is the second most populous country in Africa at the rate of 2.9% next to Nigeria with a population estimated at 99.39 million out of which over 20.4% live in urban and peri-urban areas CSA, (2014). Addis Ababa is growing rapidly beyond its legal and municipal boundaries, with attendant negative impacts on socio-economic conditions and the city's physical environment. Lack of good governance, unemployment, chronic shortages of housing and infrastructure, and poor environmental quality are priority issues expressed in the Addis Ababa five-year strategic plan. Governance within the city has suffered from corruption, lack of accountability, and the misuse and abuse of financial resources Addis Ababa City Administration, (2011).

Addis Ababa city is facing critical environmental problems emanating from rapid population growth and unrestricted economic activities. Such environmental challenges include poor green-area management, inappropriate solid waste disposal, deforestation, adverse land-use change in flood-prone areas, and severe pollution of streams and rivers. The city master plan, which is currently under revision, provides a general development guideline. Within its development framework, there are many area-specific local development plans. At present, most of the local plans are implemented in the form of urban redevelopment and renewal in the inner city. As a result, many households have been relocated to Addis Ababa's periphery, which is expanding both formally and informally, with no proper physical and social infrastructure in place. This rapid expansion has significant negative implications for biodiversity conservation and the preservation of prime agricultural land. From its current population of more than 3 million, the population of Addis Ababa is projected to reach 3.3 million in 2015 and 4.7 million by 2025. However, these figures are contested as being highly conservative. The current annual growth rate of the city is 2.1 per cent Abdissa and Degefa, (2011).

2.8.3. Urban and Peri Urban Agriculture and Forestry expansion/ growth

Rapid and unplanned urban growth is the major environmental challenges of the Addis Ababa city, both now and in the future, are strongly linked to rapid population growth, inappropriate land-use management and uncontrolled physical expansion outpacing infrastructure development. Integrated infrastructure and housing development approaches are not common and, as a result, in most areas the provision for basic social and environmental infrastructure is either lacking or inadequate. Unplanned growth exacerbates

existing environmental problems associated with poor solid waste management, inadequate sewerage systems and chronic surface water pollution. Moreover, many of the preconditions for successful environmental policy implementation, are weak at best USAID, (2011).

Urban and peri urban agriculture and forestry may function as an important strategy for poverty alleviation and social integration. Several examples exist of municipalities or NGOs that have initiated urban agriculture projects that involve disadvantaged groups such as orphans, disabled people, women, recent immigrants without jobs, or elderly people, with the aim to integrate them more strongly into the urban network and to provide them with a decent livelihood. The participants in the project may feel by the possibility of working constructively, building their community, working together and in addition producing food and other products for consumption and for sale. UPAF provides a good buffer against political or economic shocks, thus providing a good social safety net World Bank, (2015).

In periods of crisis, households can start this activity with relatively few barriers and thereby provide additional food or income for the household. Many city governments have realized that UPAF provides opportunities to involve specific vulnerable groups in the socio-economic life (social inclusion) and an important strategy for poverty alleviation. They have therefore started UPAF projects, including the provision of access to municipal land, training, technical assistance and investment and marketing support for agricultural production and processing enterprises Nigussie, (2010).

2.8.4. Health and Environmental Impacts of Urban and Peri Urban Agriculture and Forestry

Urban and Peri urban agriculture and forestry may contaminate local water sources if large amounts of chemical fertilizers and pesticides are used. Also, the excessive use of nitrate-rich manure, such as chicken or pig manure can contaminate groundwater. In particular, wastewater discharge from intensive poultry farms can carry heavy loads of micro-organisms and may contaminate drinking water supplies. Further, under certain situations, inappropriate farming practices may lead to reduction of vegetation and siltation of water bodies Simon (2012). Because of the undervaluation of UPAF and staff competition for land, UPAF is often pushed back to marginal areas within the city, such as wetlands and hill slopes, where it may harm the fragile ecosystems if not properly guided. Many of these problems can be prevented by introducing agro-ecological farming practices and integrated pest management control IPCC, (2013).

2.9. Conceptual Framework of Urban and Peri- urban Agriculture and Forestry for Climate change adaptation and Mitigation mechanism

The framework depicts the effect of the interaction of various external (institutional and environmental factors) and internal (farmer and farm characteristics) variables for further reforms. It indicates whether the interventions or changed practices have impacts in the households. According to Lwasa S. *et al.*, (2014). the outcome effects of urban and peri-urban agriculture and forestry for climate change adaptation benefits the HHs directly through enhancing the available food through own production, Income generation at HHs level can be directly when part of the produce is sold, Employment creation at household level concerns the labor carried out by the household members as well the opportunity these households to hire other people to work in their farm and keeping Urban environmental balance in the area Achamyelah, (2014). The following conceptual framework has been developed to show the role of urban and peri urban population in job creation, income generation, enhancing food security condition at HH level.

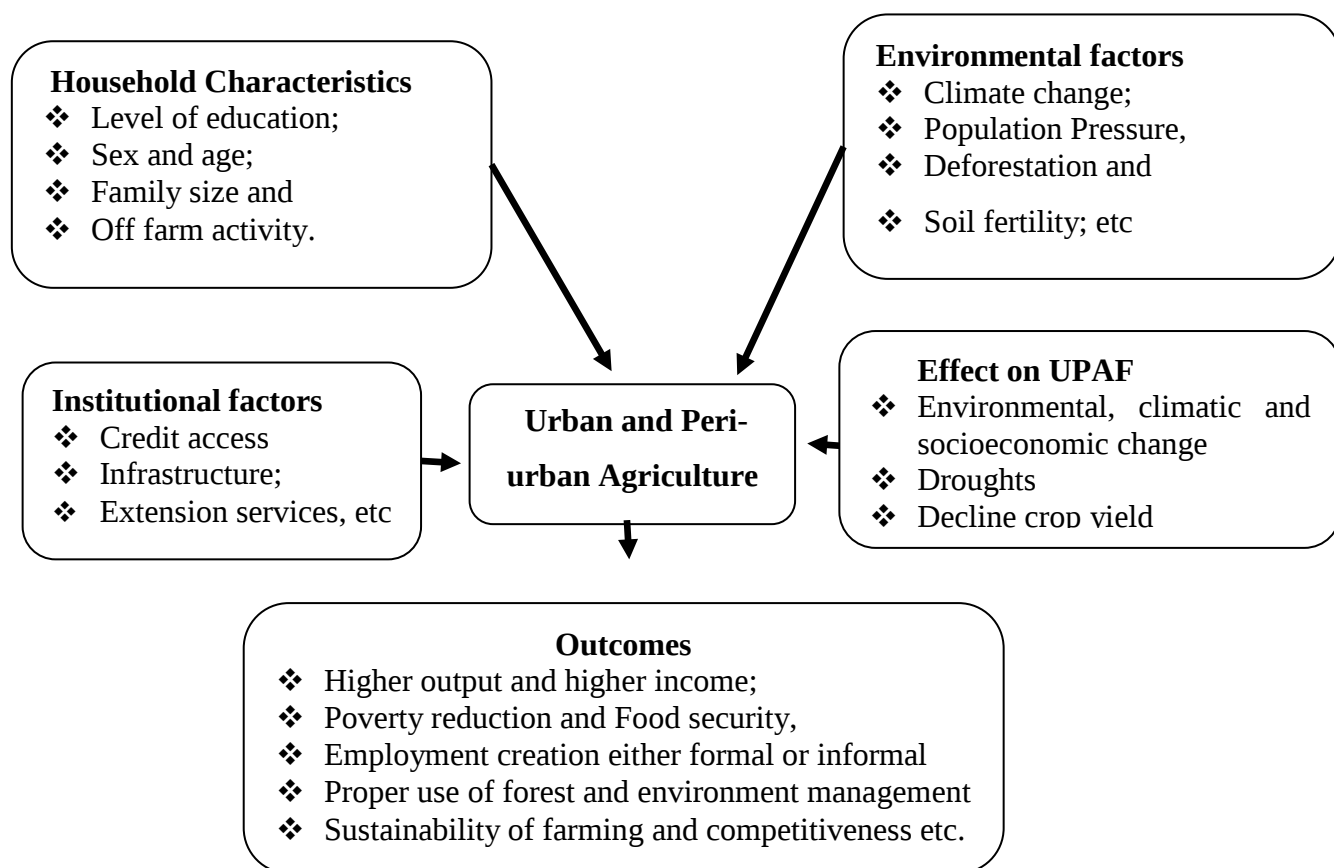


Figure 1: Conceptual framework of Urban and Peri- urban Agriculture and Forestry

Source: Own conceptualization

CHAPTER THREE

3. RESEARCH METHODOLOGY

In this part of the thesis, study area description, status, trends and prospective of urban and peri - urban agriculture and forestry, research design and approach, sampling technique and sample size determination, data collection method, key informant interview, focus group discussions and field observation and data analysis method were discussed briefly.

3.1. Description of the Study Area

This study was conducted in Addis Ababa, the capital city of the government of Federal Democratic Republic of Ethiopia. Addis Ababa is located at 09' 02' Latitude and 38' 44' Longitude with an average elevation of 2,408 meters above sea level having an average minimum temperature of 5C⁰, maximum temperature 27C⁰, and average annual rain fall of 1188.27millimeter CSA, (2010) and Addis Ababa City Administration, (2011). Administratively, the city is a chartered city having three layers of government: city government, sub-city administrations, and Woreda administrations.

The total area of the city is about 527 km² and the total human population, as of July 2010, was estimated to be 2,917,295 (CSA, 2010). Of these females accounted for 52.4% and male 47.6%. On average the city population is growing at 2.1% annually. The city serves as social, economic and political center for the country. In Addis Ababa alone, the livelihood of over 11,716 households is associated with farming in the city. Moreover, there are about 2,722 individuals engaged in related micro-enterprise in Addis Ababa. The spatial coverage of UPAF in Addis Ababa is estimated to be over 8,300 hectares /of which about 300 hectares are under irrigation/ Zenebe (2010).

About 65% of industries of the country are located in the city. The city accounts for one-fifth of the urban GDP in the country CSA, (2014). It is a seat for African Union, United Nations Economic Commission for Africa, and other international organizations. The current annual growth rate of the city is 2.1 per cent Abdissa and Degefa, (2011).

The city is bordered by Special Zone of the Oromiya National Regional State. It is administered by a city council or Mayor and made up of 10 sub-cities, namely Addis Ketema, Akaki-Kality, Arada, Bole, kirkos, Gullele, Kolfe Keranio, Lideta, Nefas Silk Lafto, and Yeka and 116 weredas. According to Central Statistics Agency of Ethiopia CSA, (2014) the

city of Addis Ababa has about 3,548,769 inhabitants of whom 1,690,655 were men and 1,858,113 were women; with the growth rate of 3.7% and density of 7,271 persons per square kilometer which decreases towards the periphery of the city.

Urban farming in Addis Ababa city can generally be divided into two categories: the first category is farming on back yard and open spaces around houses, low-lying areas and along river sides in the city core areas; and the second category is found in peri-urban areas within commuting distance, that is, as far as public and private city transport in Addis Ababa can take the farmer. In the study, both category was considered as urban and peri urban area because it is mainly occupied by residential houses, offices and other facilities with and without space for farming Fekadu, (2015).

Yeka Sub-City is one of the ten sub cities of Addis Ababa city Administration, which covers a total area of 122.08 km². As of July 2010, the total population of the sub-city was 328,900 CSA, (2010). The altitude ranged from 3,025 to 2,314 meters above mean sea level which has a range of 711 meters. The Sub City covers 8,213.11 hectares, constitutes 15.8 % of the total land area of the city which makes it 3rd huge Sub City from the ten Sub Cities of Addis Ababa. The sub-city has a considerable number of agricultural communities and it is one of a rapidly expansion zone of built up areas. It is situated in northeastern part of the city, bounded from south by Bole Sub City, from west by two Sub Cities called Gullele and Arada, from south-west by Kirkos Sub City and from north and east special zone of the Oromia National Regional state UN, (2012).

Map of the Study Area

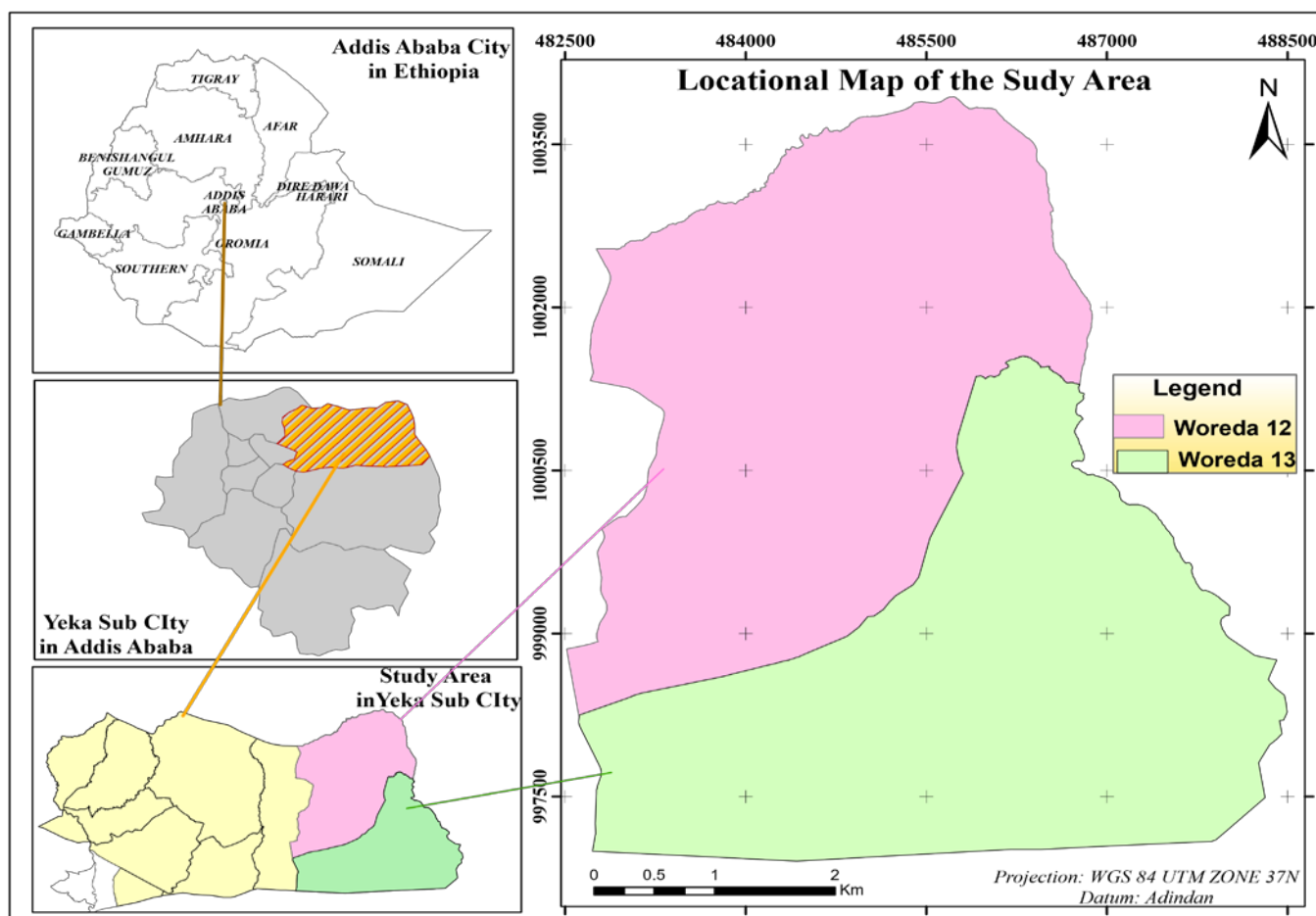


Figure 2: Map of the Study Area

Source: Yeka Sub City plan commission office

3.2. Status, Trends and Prospective of Urban and Peri - Urban Agriculture and Forestry

Overall, the foregoing discussion shows there is a high level of awareness and willingness from agents who play a leading role in climate change at federal, city and local community levels.

3.2.1 Status trends and prospects of agriculture in Yeka sub city

Agriculture production in the Yeka sub city is characterized by a very diverse range of production systems mainly related to the country's diverse agro-ecological conditions. The total cultivated land is about 1920.89ha digitalized from Google earth but the actual currently cultivated land is 395ha. Major cereal crops include teff, wheat, maize, barley, and pulses include peas, beans, fruits and other cultivated include vegetables (onion, tomato, carrot, and cabbage), roots and tubers CSA, (2014).

Table 1 presents production figures of major crops grown in Yeka sub city. About, more than 1920.89 hectares of land were planted during the period 2014 - 2019. About 84.48% of the area was allocated to cereals (teff, maize, barley, and wheat), while vegetables were allocated about 15.52%. The productivity of most crops has been steadily increasing as shown in the table below FAO, (2011).

Table 1: Trends of Agriculture in Yeka sub city

Crop	Parameter	2014/15	2015/16	2016/17	2017/18	2018/19
Cereals	Area (ha)	1391	1511	1640	1678	1817
	Production	23647	25097.71	26461.38	26699.2	27588
	Productivity	15.2	15.71	16.28	16.61	17.00
Vegetables	Area (ha)	40	55	70	94	105
	Production	392.4	492.8	595.7	719.1	704.55
	Productivity	6.71	7.65	8.51	8.96	9.81

Source; Yeka Sub City Government Administration Office

3.2.2. States Trends and prospects of forest in Yeka sub city

Forests play a vital role in regulating environmental shocks and improving livelihoods and make an enormous contribution to the overall development of a nation. The increasing loss of natural forests and woodlands is becoming a concern for the Yeka sub city Government administration and people. Despite significant efforts of local, regional and federal administrations to stop further decline of forest resources, the rate of deforestation continues to increase time to time due to less awareness of the community. In Yeka sub city 1674.48 hectare of land is covered by forest. The trends of past forest resources management were not well-maintained and that was exposed to different problems. There was forest resource exploration in such way that over grazing, clearing the forest to intensify agriculture and settlement purpose and other infrastructures EDRI, (2015).

The driving forces for the rapid decline of the Yeka sub city forests are extensive clear-cutting for cultivation and settlement. Also, there is remarkable demand or market because of densely populated UPAF dwellers, continues demand of settlements, access of big towns and industries; and hence there was no need to conserve the forests. All these points of view are continuing and cannot save forests from further degradation, but rather aggravate destruction of forests in Yeka sub city. The present status of the forest in Yeka sub city is not good. As a result, great attention needs by government body, by different religious institution, by urban

greening program and other development sectors. All these stakeholders, take part in participating on tree plantation program to boost afforestation in Yeka sub city EPA, (2011).

There is need to address the frequently raised issue of institutional setup. Because of the absence of a mandated institution, the profitability of forest resources is not fully exploited and the country's imports of forest and wood products are increasing. For an Agrarian country like Ethiopia with good climatic and soil conditions that permit high forest Production, importing wood products can be avoided. Therefore, the current forest Management system in Yeka sub city should be changed into a system that permits profitability of Forest FAO, (2011).

3.3 Research design and approach

The research design for this study was cross sectional. This is a kind of research design in which the data are collected at a single point in time from a sample to represent a large population. The design is suitable in descriptive study and for determination of relationship between and among variables. The method of research for this study was survey research design. The reason for this researcher chooses this design was that it enabled to describe the intended study to assess urban and peri- urban agriculture and forestry adaptation and mitigation in Yeka sub city community. In order to address the stated objectives, the researcher was using both qualitative and quantitative types. This is because the proposed study needs the collection of statistical (numerical) data for the quantitative approach. Qualitative method applied to describe the existing conditions of expansion of the town and by using qualitative data, options that are hold and processes that are going on regarding to the urban and peri- urban agriculture and forestry to periphery of in Yeka sub city.

3.4. Sampling Technique and Sample Size Determination

In this study, three stage sampling technique were employed to select 148 sample households. All households practicing urban and peri urban agriculture in the study area constituted a sampling frame for the study. Yeka Sub-city consists of 13 Woredas Administrations. In the first stage, out of the total 13 Woredas that participated in urban and peri- urban agriculture production of 2018/19 season, 6 Woredas were selected using purposive sampling technique which were urban and peri-urban agriculture production was carried extensively. In the second stage, 2 Woreda namely Woreda 12 and Woreda 13 were selected using simple random sampling technique. In the third stage, based on a complete list of names of all urban and peri urban agriculture and forestry activity obtained from Yeka Subcity, 66 and 82

sample household were selected from Woreda 12 and Woreda 13, respectively using probability proportional to size (PPS) technique. The study applied a simplified formula provided by Yamane, (1969) to determine the required sample size at 95% confidence level, degree of variability 0.5 and level of precision 8% are recommended in order to get a sample size which is represent a true population.

$$n = \frac{N}{1+N(e)^2} = \frac{2885}{1+2885 (0.08)^2} \approx 148 \quad (1)$$

Where ‘n’ is the required sample size, ‘N’ is total number of household in the selected Woreda (2885) and ‘e’ is the level of precision/sometimes called sampling error (0.08). The above formula gave 148 sample sizes for the study area. Table 2 shows the list of Woredas, number of households that urban and peri urban agriculture and forestry activity in each Woredas and sample household taken from each Woredas.

Table 2: Distribution of Urban and Peri Urban Agriculture and Forestry Activity Household by Sample Woredas

Woredas	urban and peri urban agriculture	Sample size	Percent
Woreda 12	1296	66	44.59
Woreda 13	1589	82	55.41
Total	2885	148	100

Source: Source; Yeka Sub City Government Administration Office, (2019/20)

3.5. Data Collection Method

Primary and secondary data was collected. To collect primary data from the sample household, semi structured interview schedule was employed. A face to face interview with the targeted area head or the person who is directly responsible for the urban agriculture activity was carried out. To facilitate the task of data collection, enumerators was recruited from the study areas and was trained. Interview schedule was pretested with the enumerators for one day to ensure that wording and coding matched field situation.

The data pertaining to output obtained and quantity of various urban and peri urban agriculture activity was collected. That is to say, each sample household was interviewed to get information on household demographic characteristics, socio-economic and institutional data, and contribution of urban agriculture to food supply. Income and employment generation, and some environmental issues related to urban agriculture.

Secondary data related to urban and pre urban agriculture and forestry activity was collected to clarify and support analysis and interpretation of primary data. In addition, secondary data was also obtained from reports of similar studies and information's documented at various office levels of Yeka Sub-city office. An important literature on urban and pre urban agriculture and forestry activity was also accessed from the internet and Addis Ababa university library.

3.6. Key informant interview, Focus group discussions and Field observation

The researcher prepared an interview guides for urban and peri urban agriculture and forestry, experts of the Yeka sub city, Woreda administration and elders of the community. Because experts and office head who are directly working on the issue believed to have rich data than the others. In addition, it helps to get required information from community elders could describe changes resulted over time than other existing young people. Hence, purposive sampling was used to select participants for key informant interviews. Finally, 11 people participated in the key informants' interviews. More specifically, two from Yeka sub city, three from Office of Management of Woreda administration and six from Community elders.

Focus group discussions have been made with two different UPAF farmer groups who have a good knowledge in urban and peri-urban agricultural and forestry activities in the town of Yeka sub city. Each of the group consisted of three members and sex ratio was considered. Out of the first group, two may be male and one member may also female, and from the second group, one be male and two member's female. For this purpose of discussion, a check list was used so as to collect the necessary information on the opinions, perceptions, attitudes and prospects in terms of expansion of UPA, availability of land and town development.

Ground truth data on the field were collected by direct observation on the selected area for this study. The researcher observed and collected the necessary visual information from the existence of urban and peri urban agriculture and forestry. Observation used by the researcher in order to get more information to accurate the information gets from the other tools. Observation checklist was used by researcher to conduct field survey systematically.

3.7. Methods of Data Presentation and Analysis

The primary data obtained from interview, from government office experts and elder person community members selected in the urban and peri urban agriculture and forestry activity

was analyzed qualitatively. With regard to the data gathered from household survey, field supervisor checks every completed questionnaire, the pre-coded questionnaires were processed, managed and analyzed by using the Statistical Package for Social Sciences (SPSS) computer software version 16.0 and Micro-soft excel program. Variables such as, sex, age, households' size, education status, their attitude on the urban and peri urban agriculture and forestry activity on their farmland and livelihood were analyzed using descriptive statistic mainly percentage and mean as well as graphs. The acquired land use statistics data were presented and analyzed by using tables, figures, charts and reports.

CHAPTER FOUR

4. RESULTS AND DISCUSSION

This chapter presents the main findings of the study concerning urban and peri urban agriculture and forestry and its effect for climate change adaptation and mitigation mechanism. In this chapter of the thesis, deals with the results of descriptive analysis pertaining to socio-economics, demographic characteristics and various urban and peri urban agriculture and forestry activities undertaken by household were discussed briefly.

The descriptive statistics presented in this section was comprised of various sub section. The discussion was categorized as demographic and socio-economic characteristics; occupational status of the heads of households; agriculture mechanisms, land use and agricultural activities; reasons for engaging in urban and peri urban agriculture; effects of agriculture and forest on their livelihood; effect of change in forest cover on human and financial resource; implications level of climate change adaptation and mitigation; effect of climate change on agriculture and forest and constraints facing urban crop producers of household in the study area were discussed briefly.

4.1. Demographic and socio-economic characteristics of UPAF household

Under this part, family size, age structure, level of education, sex and marital status of household were discussed as follows.

Socio-economic and demographic characteristics were assessed to reveal the baseline information of the characteristics of interest of the study population. Urban and peri urban household farmer family size and its structure has decisive role in the urban and peri urban agriculture economy. It determines the amount of resource availability and economic status of household farm family. An attempt was made to study urban and peri urban household farmer family size and its structure. The survey result (Table 3) showed that average household farmer family size of sample household was 6.42 persons. The largest urban and peri urban household farmer family size was being 6 persons while the smallest size was 1 person per urban and peri urban household farmer. In terms of sex, 85.14% of the respondents were males and while the remaining 14.86% were females.

Age of household farmer is important to study such a long period phenomenon, related with the farm. All these contribute in determination of individual farm activity. The age range of urban and peri urban household farmer was between 23 years to a maximum of 72 years. The survey result (Table 3) showed that 23%, 61.48% and 15.54% found less than 16, 17 up to 60 and greater than 60 respectively and the mean age was 37.33 indicating that majority of the household farmers were more energetic and that they are likely to devote to more time on farming besides other economic activities. Dependency ratio was 0.49, which shows roughly equal number of dependents and productive members within a household. Based on the findings, UPAF is more practiced by middle age people and with secondary education level.

Level of education upgrades the ability and changes the attitude of person in a given society. An attempt was made to assess the level educational status of the sample household farmers who had informal and formal education. The study indicated that 12.8% of the sample household farmers were cannot write and read. In contrast, 87.2% were able to read and write. Of all the respondents, 25% indicated that they had completed primary education, 48% had secondary education while less than 14.2% had tertiary, certificates and university attained upon completion. Regarding marital status of the households, 81.75% were married, while 10.81%, 4.73% and 2.7% of the households were single, widowed and divorced respectively (Table 3).

Table 3: Demographic characteristics of the sample smallholder farmers

Characteristics	Frequency	Percent	
Educational level of household farmers			
cannot read and write	19	12.8	
Primary education	37	25	
Secondary education	71	48	
Tertiary college and university	21	14.2	
Sex of household farmers			
Male	126	85.14	
Female	22	14.86	
Age of household Years			
<16	34	23	
17-60	91	61.48	
>60	23	15.54	
Marital status of household farmers			
Married	121	81.75	
Single	16	10.81	
Widowed	7	4.73	
Divorced	4	2.70	
Total	148	100	
Characteristic	Unit	Mean	Std. Dev.
Family size members	Numbers	6.42	1.75

Source: Computed from Field Survey Data, 2019/20

4.2. Occupational Status of the Heads of Households

The heads of households were asked to tell whether they have formal employment or not doing commercial activities in addition to farming. In terms of occupation as per the results in Figure 3, 44.59% had permanent employment in either public or private sector, 14.19% had self-employment that included business, provision of services such as catering, health, and transport services. Others were self-employed engaging themselves in vocational activities such as carpentry, tailoring and masonry. 10.81% had no formal employment, which means that they depended on urban agriculture only to sustain their livelihood. 9.46% had temporary employment and 4.73% were retired employees in either public or private sector. 16.22% of

the respondents could not clearly state whether they are employed or not. This finding was in agreement with that of (Solomon, 2014 and Fekadu, 2015).

According to the findings, it is clear that urban and peri urban agriculture is practiced by people from all socio-demographic groups. However, the majority of urban and peri urban agriculture farmers in the study area were those with permanent employment. Again, the reason for this may be the fact that a more paying agricultural activity is capital intensive. It is easier for people with permanent formal or self-employment to raise startup capital from their employment income than those without employment.

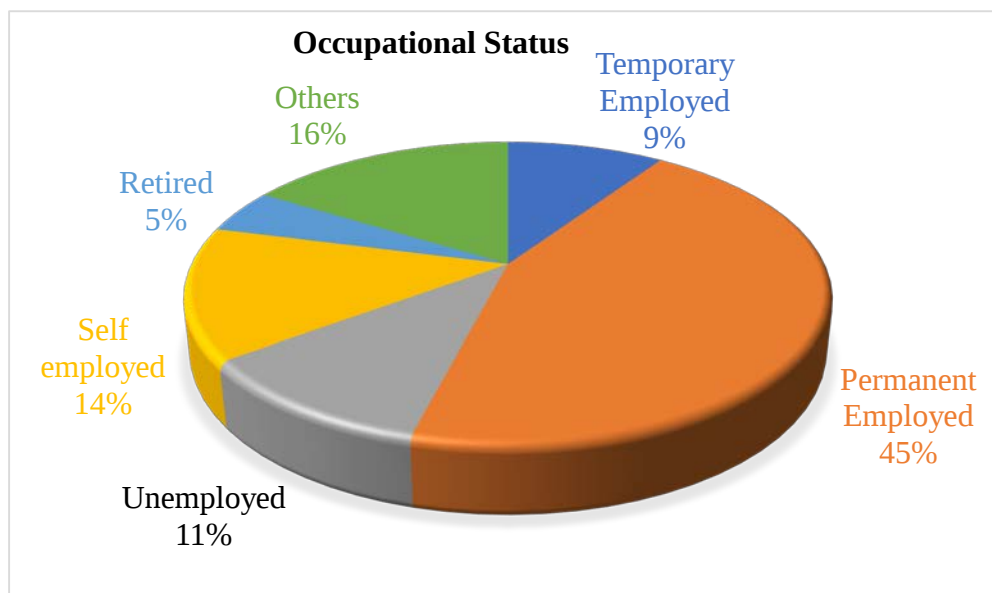


Figure 3: Occupational Status of the Heads of Households

Source: Computed from Field Survey Data, 2019/20

4.3. Agriculture Mechanisms, Land Use and Agricultural Activities Practiced in the Study Area

In tackling the land fertility problems, different measures that have an immediate and long run effects were undertaken. The efforts include soil and water conservation such as terracing, use of commercial fertilizer, compost, manure, and crop rotation. Of all the respondents, 77.7% indicated that they were said fertile soil and 22.3% were said not fertile (Table 4). Regarding to compost use is currently highly promoted by the government. Household farmers explained the problem in this regard, and thus little use of the technology in the area due to compost availability as a result 91.77% were used compost and the remaining 18.23% not used. This result is in full agreement with (Kedir, 2010 and Georgis *et al.*, 2010).

The tendency of chemical fertilizer application in the area was very high due to the enough supply. Urban and peri urban household farmers used technology such as fertilizer, improved seeds, herbicides fertilizers 82.43% and the remain 17.57% not applied fertilizer (Table 4). Of all the respondents, 45.95 indicated that they were practice urban and peri-urban on-plot farmers and 18.24%, 10.14%,10.81%, 8.78%,6.08% were practice Vegetable producer, Home gardeners, Dairy farmers, Poultry producers and Fatteners respectively. Urban farmers used cultivating vegetables on different open spaces around their home, around their fence, on the wall etc. and they didn't use fertilizer due to small plot of lands. But peri urban farmers use their cultivated land and mostly they sow cereal crops. They used fertilizer due to having enough fertilizer and plot of lands. This result was consistent with the findings of Ambaye, (2012).

Land is the indispensable livelihood means or resource base for the rural community and plays typical role in farming. About 87.16% of the respondents owned land and about 11.84% either rented or were permitted by land owners to use for farming. Similar results had been reported by Moges, (2010) and Nigussie, (2010).

Table 4: Agriculture Mechanisms, Land Use and Agricultural Activities Practiced in the Study Area

Characteristics	Frequency	Percent
Soil fertility		
Fertile	115	77.7
Not fertile	33	22.3
Compost availability		
Yes	121	81.77
No	27	18.23
Used technology such as fertilizer, I improved seeds, herbicides		
Yes	122	82.43
No	26	17.57
Types of UPA practitioners		
Urban and Peri-urban on-plot farmers	68	45.95
On-plot vegetable producers	27	18.24
Home gardeners	15	10.14
Dairy farmers	16	10.81
Poultry producers	13	8.78
Fatteners	9	6.08
Land Use		
Owned land	129	87.16
Rented land	19	12.84
Total	148	100

Source: Computed from Field Survey Data, 2019/20

4.4. Mechanisms of Agriculture on Urban and Peri-urban Area

As indicated in Table 5 the sample survey of household revealed that 35.89% of them are undertaking technology used on their own land of urban area and on peri-urban 64.29% of them are carrying out of technology used on their own land. With regard to ways of farming were 66.67, 52.56, 34.62, 61.54, 32.05 plough, sowing, weeding, harvesting, storing used respectively in urban area while in the peri-urban area 84.28, 87.14, 85.71, 81.13, 34.29 plough, sowing, weeding, harvesting, storing were respectively. Therefore, according to the above data most of the respondents less plough, sowing, weeding, and harvesting in urban area than peri-urban area. So, in Yeka sub city agriculture farming activity mostly used storing in urban area. Urban farmers used cultivating vegetables on different open spaces around their home, around their fence, on the wall etc and they didn't use fertilizer due to small plot of lands. But peri urban farmers used on their cultivated land and mostly they sow cereal crops. They used fertilizer due to having enough plot of lands.

Table 5: Mechanisms of Agriculture on Urban and Peri-urban Area

Ways of Farming	Participants	Percent	Non- Participants	Percent
Urban Agriculture				
Plough	52	66.67	26	33.3
Sowing	41	52.56	37	47.44
Weeding	27	34.62	51	65.38
Harvesting	48	61.54	30	38.46
Storing	25	32.05	53	67.95
Peri-Urban Agriculture				
Plough	59	84.28	11	15.71
Sowing	61	87.14	9	12.86
Weeding	60	85.71	10	14.29
Harvesting	57	81.43	13	18.57
Storing	24	34.29	46	65.71
Improved Technology				
Urban Area	28	35.89	50	64.10
Peri-Urban Area	45	64.29	25	35.71

Source: Computed from Field Survey Data, 2019/20

4.5. Reasons for Engaging in Urban and Peri urban Agriculture and Forestry

The study found out that the urban and peri urban farmers engage themselves in urban and peri urban agriculture for a variety of reasons. The most important reasons identified were Figure 4, to get food for home consumption 47.98 %, to get income 36.49 % and to diversify income 10.14%. About 2.03% said they did agriculture as a hobby and about 3.38 % engaged in agriculture because of tradition. This was in agreement with the findings of Solomon (2014).

Table 10: Reasons for engaging in urban and peri urban agriculture and forestry

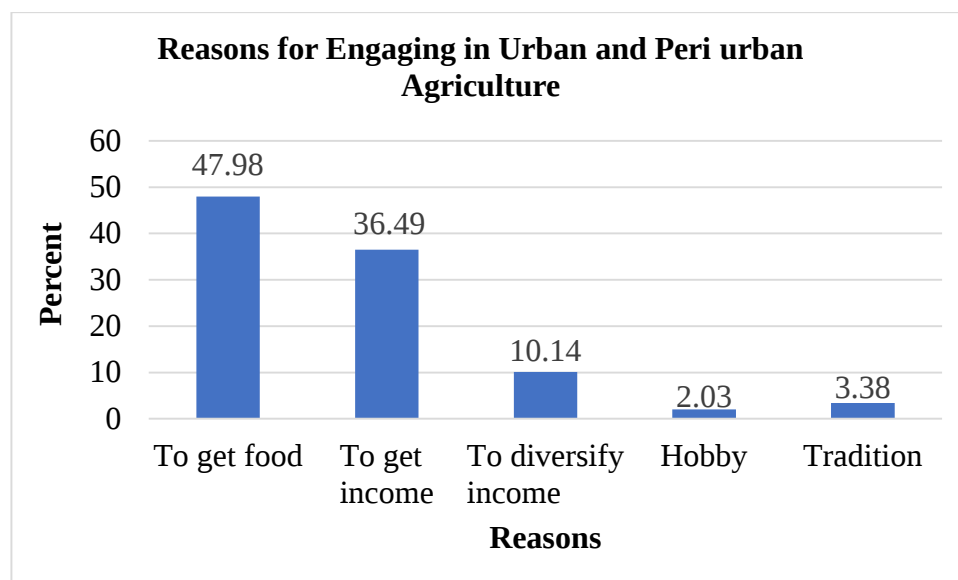


Figure 4: Reasons for Engaging in Urban and Peri urban Agriculture and Forestry

Source: Computed from Field Survey Data, 2019/20

4.6. Effects of Agriculture and Forest on their Livelihood

There are several effects of agriculture on their livelihood in the study area. As indicated in the Table 6 below 92.57% of the respondents mentioned that there is high effect of agriculture on livelihood positively, while other 7.43% of the respondent's response that there is less effect of agriculture on livelihood that means it doesn't matter on their life whether there is agricultural activity or not. Therefor agriculture is the most important elements to on their livelihoods of urban and peri urban farmers in Yeka sub city. These positive effect goes to health, education, transport and also high effect on water resources too. The contribution of urban and peri-urban agriculture to food security, healthy nutrition and livelihoods for the urban and peri-urban population is probably its most important asset in a ways of combination; providing for family self-consumption, thus contributing to healthy diet and

allowing for saving on food expenditures; providing a source of income, through sale of surplus commercial oriented production systems; improving the supply of local markets with fresh foods; ensuring tree cover through landscape management and use of agroforestry systems. It is therefore, it is essential that appropriate strategies should be put in the study area to ensure availability and affordability of safe and healthy foods, promoting the production of foods in urban and peri-urban areas, thus enhancing livelihoods of farmers. This result is supported by the findings of Woldegerima, (2017).

The result from focus group discussions revealed that on Table 6, 91.22% of the respondents responded that there is high effect of forest on their livelihood positively, while the remaining 8.78% of the respondent's respond that there is less effect of forest on their livelihood. Inappropriate forest management changes affect their natural ecological functions and lead to a decline in farm productivity and loss of biodiversity. Because tree planting (reforestation) does not a common activity in the study areas due to less awareness of the community and they used the existing forest stand for many purposes, such as firewood and charcoal selling and these cumulative consequences were led to deforestation. Moreover, the focus group discussions were stated that the rate of deforestation due to demographic factors and awareness problem is at an increasing rate. As a result, continued deforestation in the study area has contributed to soil erosion and land degradation which is commonly affected their livelihood strategies of the communities. As a result, it is essential that appropriate strategies should be put in the study area to ensure forest availability management.

Table 6: Effect of Agriculture and Forest on Livelihoods

Characteristics	Frequency	Percent
Agriculture on livelihood		
High effect	137	92.57
Less effect	11	7.43
Effect of forest on livelihood		
High effect	135	91.22
Less effect	13	8.78
Total	148	100

Source: Computed from Field Survey Data, 2019/20

4.7. Effect of Change in Forest Cover on Human and Financial Resource

The current change in forest cover and entire land use for forest activity in urban and peri urban household are affecting human resources that are effects on Human Resource due to climate related factors and wood extraction important to people's livelihoods including education, occupation and human labor. The study revealed that 96% of the respondent response forest highly effect on Human Resource while the remaining 4% are less effect Table 7. Furthermore, this result is congruent to with Zenebe, (2010).

The result from household survey indicated on Table 6 that 89.86% of the respondent response highly effect forest on financial resources while other 10.14% less effect. As a result, all of the urban and peri urban people of their life depends on forest. This is because most of these are directly dependent on climate sensitive natural resources, such as grazing land, farmland and forests; and then their financial resources are strongly impacted by deforestation. Hence, the respondents of the study area seemed to agree that diversification of financial resources and income generating activities This result is in full agreement with Alebachew, (2011).

Table 7: Effect of Change in Forest Cover on Human and Financial Resource

Characteristics	Frequency	Percent
Effect on human resources		
High effect	142	96
Less effect	6	4
Effect on financial resource		
High effect	133	89.86
Less effect	15	10.14
Total	148	100

Source: Computed from Field Survey Data, 2019/20

4.8. Implications Level of Climate Change Adaptation and Mitigation

Adaptation which is the reduction in the vulnerability of people and ecosystems to climatic changes, and mitigation which is about reduction in GHGs. Reducing the level of emission of GHG which contributes to global warming and supporting local communities in dealing with the impacts is key (UNFCCC 2007). Adaptation and mitigation linkages: Mitigation (i.e. the reduction of greenhouse-gas emissions) results in avoiding the adverse impacts of climate

change in the long run (at least the incremental impacts due to the greenhouse gases not emitted), while adaptation can reduce the unavoidable impacts in the near term (but cannot reduce them to zero). Failure to mitigate will lead eventually to failure of adaptation, hence adaptation and mitigation are not alternative strategies but complementary ones that need to be pursued together. But, as this paper discusses, most of the people and places at greatest risk from climate change are not those with large historic or current contributions to greenhouse gases.

The study assessed the level of adoption of mitigation and adaptation in order to ascertain an overview of the farmers initiatives to address climate change in the study area. In terms of mitigation and adaptation measures, the findings reveal on Figure 5 that 53.39% of the respondents had the highest level of adoption, 27.71% had medium level and 18.92% had the lowest level. This indicates that the level of mitigation measures pursued by the households in mediating climate change is reasonably high. This is because most of urban and peri urban farmers use more than one mitigation measure to mediate climate change effects. The community targeted services that can reach the farmers, which contain weather and climate information that can be used by the farmers as a decision support tool for planting, weeding, fertilizer application, and control of plant pests and diseases. The best option would be to reach the farming community through the development agents. This result is in full agreement with Abdissa, and Degefa, (2011).

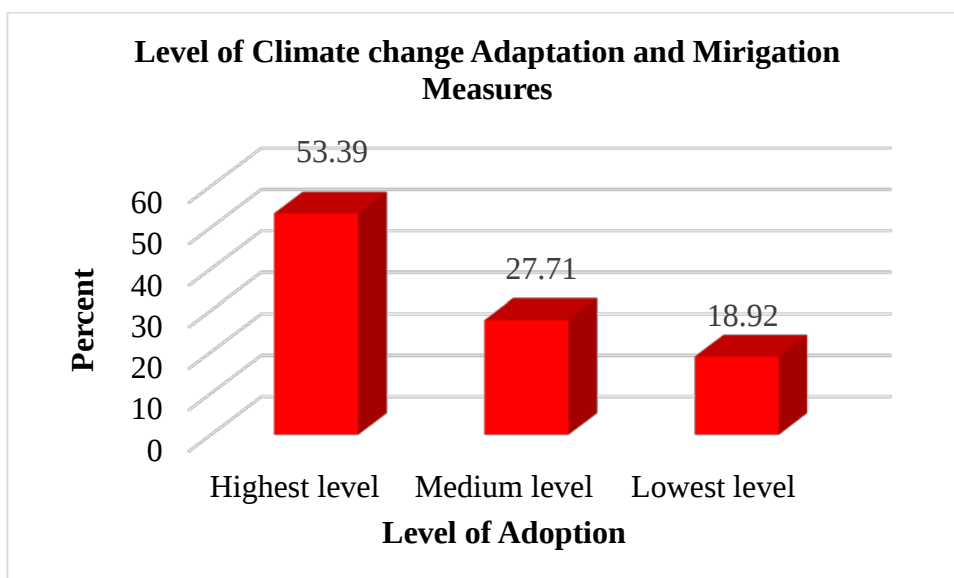


Figure 5: Level of climate change adaptation and mitigation measures

Source: Computed from Field Survey Data, 2019/20

4.9. Effect of Climate Change on Agriculture

The assessment clearly showed that urban and peri-urban effects of climate change on agriculture in the study area has been increased dryness and high temperatures, reduction in primary productivity, land use changes, animal disease, land degradation in some cases, changes in species composition, decreased livestock productivity, income and food security. Increased temperatures, for instance, are to cause additional loss of moisture from the soil, reduced and more intense rainfall and higher frequency and severity of extreme climatic events such as floods and droughts. These factors are already leading to loss of biological and economic productivity and putting dry land populations at risk of short- and long-term food insecurity.

The assessment clearly indicated that urban and peri-urban effects of climate change in the study area were potentially increase. In Yeka sub city, when we are considering the variety of drivers and stressors acting on UPAF, climate change is currently an important factor. Floods and untimely rains were identified as two key climate risks facing UPAF farmers flooding has made vegetable production riskier and more marginal and untimely rains can endanger harvests. Farmers' perceptions are that these risks are increasing though that is not borne out by meteorological station data. However, that does not mean that farmers are incorrect in their perceptions. The increased exposure to these climate risks may be governed more by non-climate factors, for example increased siltation in river beds or changes in where farming is practiced due to urban and peri urban encroachment that increase exposure to flooding. Moreover, systemic factors that reinforce poverty also increase vulnerability to extreme events that disrupt livelihoods that the urban poor derive from UPA and other sources.

Therefore, agricultural sector should be combined mitigation and adaptation activities to minimize the effects of climate change to realize sustainable agriculture or climate-smart agriculture. Likewise, agroforestry has the opportunity to provide food security and income diversification to increase households' adaptive capacities in cases of climate shocks or impacts, as well as achieve significant potential GHG reductions through the planting of trees.

4.10. Effect of Climate Change on Forest

The assessment clearly indicated that the effect of climate change has strong links with forest. Forests supply various livelihoods and ecosystem services for urban and peri urban communities, although these are difficult to quantify in financial terms. In the study area, the respondent said that climate change has high effect on forests in the longer growing seasons and higher atmospheric CO₂ concentrations, decrease productivity, fluctuation of summer rain, changes in suitable habitat, and decrease resource extraction. Forests can provide many benefits for Yeka sub city such as to help mitigate climate change. If the forest sustainably managed, it can play a vital role in increasing societal adaptive capacity to climate change. These benefits include biodiversity conservation including flora and fauna species. In the urban and peri urban, montane forests are unique and highly important ecosystem facing many socio-economic challenges. Forest resources management was no well-maintained and that was exposed to different problems. There was forest resource exploration in the study area such way as clearing the forest to intensify agriculture and settlement purpose and other infrastructures.

Furthermore, the forests provide cultural services for landscape values (aesthetic, spiritual, educational and recreational) and supporting services such as soil formation, water retention and regeneration of degraded lands. Climate adaptation benefits support targeted farmers in adapting to climate change in increasingly degraded landscapes. For example, during the dry seasons and times of drought, forests are often accessed as the last resort for livestock grazing for urban and peri urban communities. The forests also provide climate mitigation benefits which, in the context of urban and peri urban. Agrobiodiversity plays a fundamental role in ecosystems, and its loss could mean fewer opportunities for the growth and innovation needed to boost agriculture at a time when new crop varieties and livestock breeds might be needed. Urban and peri urban area also socio-economically vulnerable to climate change. Facing critical problems emanating from rapid population growth and unrestricted economic activities. Such challenges include expansion of agriculture, poor green-area management, inappropriate solid waste disposal, deforestation, adverse land-use change in flood-prone areas, and severe pollution of streams and rivers. This result is in full agreement with Achamyeleh, (2014).

4.11. Constraints Facing Urban Crop Producers

The respondents were asked to mention the major constraints they encountered in agriculture production. The main problem mentioned by the respondents on Table 8 were poor weather condition which was mentioned by about 35.14 % followed by lack of capital 19.59 %. Through the group discussion with the respondents, they said lack of capital made them unable to meet costs of inputs. In addition, lack of capital hindered them to expand their farm enterprises. Other constraints included pests and diseases 14.87 %, poor seed germination 6.08 %, high inputs costs 8.11 %, low soil fertility 6.75 % and lack of water for irrigation 9.46 % they were said facing constraints. This result is in full agreement with Achamyeleh, (2014).

Table 8: Constraints Facing Urban and Peri urban Agricultural Crop Producers

Constraints	Frequency	Percent
Poor weather condition	52	35.14
Lack of capital	29	19.59
Pests and diseases	22	14.87
Poor seed germination	9	6.08
High inputs costs	12	8.11
Low soil fertility	10	6.75
Lack of water for irrigation	14	9.46
Total	148	100

Source: Computed from Field Survey Data, 2019/20

CHAPTER FIVE

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Summary and Conclusions

The purpose of this study was to provide empirical evidences on the role that urban and peri urban agriculture and forestry and its implication for climate change adaptations and mitigation plays in the livelihoods of urban and peri urban farmer households in Addis Ababa city. The role of urban and peri urban agriculture and forestry in household income and urban and peri urban food self-sufficiency, and socio-economic challenges in relation to urban and peri urban farming were investigated. The urban and peri urban agriculture in Yeka sub city differ in their social backgrounds such as marital status, age, occupation, and levels of education, which might have also implications on their livelihood strategies. In the study area more heads of households depended on urban and peri urban agriculture to earn a living. The urban and peri urban farmers produce a variety of crops and vegetable for home use and/or market. Cultivating vegetable crops is the most common practice for crop producers, and this may be associated with the size of landholdings (being small), and suitability of vegetables for cultivation. Cultivating vegetables on different open spaces around their home, around their fence, on the wall. The most important reasons for engaging in urban and peri urban agriculture included getting income, food and income diversification. The farmers in the study area faced a number of problems in their production activities. The main problems faced crop farmers were poor weather condition, lack of capital which made them unable to meet costs of inputs thereby hindering expansion of farm enterprises. In conclusion, a wood extraction and settlement expansion appear to have been a significant factor that has impacted forest cover of the study area. However, those all factors in combinations were leading to forest cover change and land use land cover changes. Thus, the respondent result shows, change in forest cover and land use land cover were affected different livelihood strategy of the communities like, human resources, forest production, crop production, financial and their social capital resources. Finally, urban agriculture in Yeka sub city is left with a range of policy implications. Despite its dominant contribution to livelihoods of the urban and peri urban farmers, urban and peri urban agriculture and forestry and its implication for climate change adaptations and mitigation is strikingly found to remain as a survival strategy for the urban and peri urban poor and a source of income for the better-off households.

5.2. Recommendations

Based on the above results, knowing the importance of urban and peri urban agriculture and forestry for multiple socio-economic and environmental factors and in view of the ever-increasing urban and peri urban population in the sub city, the following important recommendations have been put forward in order to improve urban and peri urban agriculture and forestry in the study area.

- ❖ Urban and peri urban agriculture and forestry must be recognized as a legitimate urban economic activity. It should be integrated in sustainable urban development policies/strategies, food security improvement, public health enhancement, urban environmental protection, and housing programs. The government should formulate a national urban agriculture policy which would recognize the importance of urban agriculture and encourage it. The government has well established the national agriculture and livestock policy of 1997 but it does not deal with many of the constraints revealed by this study. There is also a need of integrating urban agriculture into urban policies, planning and development and the integration of urban agriculture in environmental policy.
- ❖ The government should provide subsidies to all agricultural inputs and training opportunities and advisory services. If this is done, productivity will raise if farmers switch over from “traditional” to “modern” agriculture in very large numbers, involving the use of high-yielding varieties of seeds, organic manure, chemical fertilizers, insecticides, better implements.
- ❖ Access to land is one of the major obstacles in urban agriculture. So, providing land to urban farmers should be the highest priority. Since land is scarce in most of built-up areas, arrangements may be made fairly to allocate some land for agriculture in peri-urban areas. Such arrangements should be coordinated and supported by the local governments.
- ❖ There also need to be an improved access to agricultural research, extension and credit services, system of input supply and output delivery. Through urban and peri urban agriculture and forestry enhancement, urban and peri urban-rural household linkages and informal sector development must also be facilitated.
- ❖ The government should be given awareness to the study area on the multipurpose use of forest resources and forest ecosystems. Furthermore, natural regeneration of species in the forest can be facilitated through reduced perusing pressure.

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7. APPENDICES

7.1. Appendix I. Interview Schedule

ADDIS ABABA UNIVERSITY

School of Graduate Studies

College of Development Studies

Department of Environment and Sustainable Development Studies

Dear Respondents: This interview schedule is prepared to undertake a study on the entitled *“Assessment of Urban and Peri - Urban Agriculture and Forestry For Climate Change Adaptation and Mitigation Mechanism: The Case of Yeka Sub City in Addis Ababa, Ethiopia.”* The information that you are going to provide based on specific questions was used only for the research purpose (thesis) to qualify the requirement for awarding the Masters of Art degree (M. A) at Addis Ababa University and will not be disclosed for any third party. Dear respondents, you are expected to provide genuine, accurate and balanced information with respect to urban expansion and displacement process. Your accurate information is highly valuable as it determines the success of this study. You were kindly requested to participate in filling the questions.

General information

ID number of the household head_____ Date of interview_____

Enumerator name _____ Signature of the enumerator_____

Socio-demographic Information of the household

1. Kebele _____
2. Name of the household head_____
3. Farming experience_____ years
4. Sex : 1.male 2.female
5. Age in completed year_____
6. Marital status 1. Single 2. Married 3. Widowed 4. Divorced
7. What is your highest level of education? 1.Adult Education 2. No formal education
3. Primary education 4. Secondary education 4.Certificate
- 5.Diploma 6. Degree 7.Others (specify)

8. Religion 1. Orthodox 2. Muslim 3. Protestant 4. Catholic 5. Others
9. Family members of the HHH in No. _____

Sex	Age Category			Remark
	<15	17-50	>50	
Male				
Female				

Land use and possession in 2019/20

10. What is your occupation?

- 1.Official 2.Retired 3.Farmer 4.Self employed 5.Business 6.Others (specify)

The following questions stand about on agriculture and forest

A) Agriculture

1. What is the agriculture area coverage in ha? _____

2. When started agricultural practice? _____

3. What is the Effect of Agriculture on livelihood? _____

4. Is there any effect on human resources? A. yes B .no

If the answer is yes, please specified

5. Is there any effect on finance resources? A. yes B. no

If the answer is yes, Please specify.....

6. Is there any effect on natural resources? A. yes B. no

If the answer is yes, please specified

7.. Is there any effect on physical resources? A. yes B .no

If the answer is yes, Please specify

8. Is there any effect on Transport? A. yes B .no

If the answer is yes, Please specify

9. is there any effect on Health ? A. yes B. no

10. Is there any effect on Soil resources? A. yes B .no

If the answer is yes, Please specify

11. Is there any effect on. For water resources? A. yes B. no

If the answer is yes, Please specify

12. Is there any effect on Finance resources?

For Credit.....

For Banking

13. Is there any effect on Labor, Education, and Employment?

A. yes

B. no

If the answer is yes, Please specify

14. Is there technology used like:-

A. fertilizer

B. herbicide

C. other (specify).....

15. What are the way of framings?

A. Plough

B. sowing

C. weeding

D. harvesting

E. storing

16. What type of crops planted and the way of utilization?

A. For consumption (amount,)

B. For marketing

If your choice include B answer the following questions

Explain its distribution channel_____

Amount of money transaction_____

17. Why you engaging in urban and peri urban agriculture and forestry?

A.to get food for home consumption

B.to get income

C. to diversify income

D. as a hobby

E. tradition.

B) Forest

1. What is the forest Area coverage in ha? _____

2. When started forestry practice? _____ -

3. What is the effect of forest on livelihood?

4. For human resources

A. yes

B. no

If the answer is yes, Please specify

5. For finance resources

A. yes

B. no

If the answer is yes, Please specify

6. For natural resources

A. yes

B. no

If the answer is yes, Please specify

7. For Transport

A. yes

B. no

If the answer is yes, Please specify

8. For health

A. yes

B. no

9. For Soil resources

A. yes

B. no

If the answer is yes, Please specify

10. For water resources

A. yes

B. no

If the answer is yes, Please specify

11. Is there any effect on Finance resources?

For Credit.....

For Banking

12. Is there any effect on Labor, Education, and Employment?

The following questions stand about climate change

1. Describe the trends and status of climate-----

2. What is the important indicator of climate change?

- A. Changes in the onset of rain seasons B. Decline in rainfall
C. Rise in temperature D. Increase in rainfall E. Other (mention).....

3. What is the principal implication of climate change in this area?

4. What is the most important cause of climate change?

- A. Deforestation B. Emission from the industries
C. Agricultural malpractices D. Other (mention).....

5. What are the effects of climate change?

- A. Recurrent droughts B. Food shortages C. Diseases E Other (mention).....

6. Finally, if there is any constraints facing urban crop production you want tell me? _____

7.2. Appendix II Interview Checklist for Key Informant's Interviews

1. Name of Warda.....

2. Name of Village.....

3. Name of street.....

4. Position of interviewee.....

5. You might have heard of climate change; how does this apply in your context?

6. How does the climate change apply in urban and peri urban agriculture and forestry?

7. Is there any connection between climate change and urban and peri urban agriculture and forestry? If yes, how does this relate?

8. How climate change is affecting urban and peri urban agriculture and forestry?

9. How urban and peri urban agriculture and forestry mitigate climate change effects?

10. How urban and peri urban agriculture and forestry adapt to climate change?

7.3. Appendix III Discussion Guide for Focus Group Discussions

1. Name of Woreda.....
2. Name of Village/street.....
3. Definition of climate change by local people
4. Indicators of climate change
5. Evidence of climate change in the study area
6. Effects of climate change (positive and negative)
7. Mitigation to climate change in the study area.
8. Adaptation to climate change in the study area.
9. Factors affecting mitigation in the study area.
10. Factors affecting adaptation in the study area
11. any constraints facing urban crop production in the study area
