

Assessment of Causes and Consequences of Urban Expansion: The Case  
Study of Adama City.



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December, 2024

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Assessment of Causes and Consequences of Urban Expansion: the Case  
Study of Adama City.

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Thesis Submitted to the department of Urban Planning and design  
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Adama, Ethiopia

## **DECLARATION**

I declare here by this research thesis entitled “Causes and Consequences of Urban Expansion: the Case Study of Adama City.” is my own work and has not been submitted to any university for similar purpose. The reference used in this Thesis is dully recognized by proper citations.

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## **Abstract**

*This study investigates the causes and consequences of urban expansion in Adama City, Ethiopia, focusing on changes in land use patterns and the factors contributing to the city's rapid growth. It uses a mixed-methods approach, combining quantitative and qualitative data collection methods. The quantitative and qualitative data was collected from a survey of 364 respondents, and 20 focus group discussion informant respectively. GIS and remote sensing were used to analyze the transformation Land using the supervised classification algorithm from 1991 to 2022; the study reveals significant transformations landscape, dramatic increase in built-up areas (813%) and a decrease in agricultural land (23%) within these years, reflecting rapid urbanization. The study also presents an accuracy assessment of LULC classification, with overall accuracy rates exceeding 85%, confirming the reliability of the data. Key factors driving urban expansion include population growth, economic Opportunities, infrastructure accessibility, rural-to-urban migration, topography, land speculation and weak planning regulation enforcement. Population growth (42.9%) of respondents is the primary driver, contributing to increased demand for housing and infrastructure. Economic opportunities and infrastructure development also plays a significant role, with 34.2% and 30.4% of respondents, respectively citing it as a key factor. Based on the finding, the most prominent consequences include increased demand for housing and infrastructure, the loss of agricultural land, and environmental degradation, Strain on public services, social displacement, and the pressures on natural resources. Furthermore, traffic congestion and pollution, along with economic opportunities and challenges, are notable consequences of rapid urbanization. The study highlights the need for strategic planning and sustainable development to manage and mitigate its environmental and social impacts.*

**Keywords:** Urban Expansion; Land Use Change; GIS and Remote Sensing; Population Growth; Sustainable Development

# Chapter One

## Introduction

### *1.1 Background of the study*

Urban expansion is a significant phenomenon globally, fueled by rapid urbanization, economic growth, and population increase. According to the United Nations (2018), over 55% of the world's population resides in urban areas, with projections indicating this will rise to 68% by 2050. Urban expansion has been a defining feature of cities, particularly in developing nations, where unplanned growth is common. Rapid urbanization in cities like Lagos, Kinshasa, and Mumbai has led to challenges such as environmental degradation, loss of agricultural land, and displacement of local communities. Uncontrolled expansion often stems from rural-to-urban migration, industrialization, and speculative real estate development, significantly altering urban systems and the socio-economic fabric of cities (World Bank, 2020).

Urban expansion has been managed differently across regions, with developed countries implementing zoning regulations, urban growth boundaries, and infrastructure planning. Conversely, cities in developing nations often face challenges such as informal settlements and inadequate infrastructure, as noted by the UN-Habitat (2003).

The physical expansion of towns is a dynamic and continuous process that alters the spatial dimensions of urban areas, whether vertically or horizontally. However, when this expansion occurs in an unplanned and uncoordinated manner, it disrupts the physical balance of urban areas, leading to challenges in maintaining functional urban systems. As noted by Ingam (2006), many small and intermediate cities in developing countries tend to grow beyond their planned boundaries, often resulting in incompatible land use patterns that exacerbate urban problems such as congestion, inefficiency in service delivery, and environmental degradation.

Unplanned urban expansion is one of the most critical challenges faced by towns in developing countries. This phenomenon is driven by a variety of factors, including rapid population growth, rural-to-urban migration, weak urban governance, and a lack of

comprehensive urban planning frameworks (Angel et al., 2011). As a result, unregulated growth imposes significant socio-economic and environmental burdens on urban dwellers, such as inadequate housing, increased pollution, and the loss of green spaces and agricultural land (UN-Habitat, 2020).

To address these issues, it is essential to guide and control the physical growth of cities by considering key parameters that influence urban expansion. Growth management involves intentional governmental programs and policies aimed at shaping the rate, size, type, direction, and quality of future urban development (Kelly, 1993). These programs are typically implemented through a combination of urban planning, land use regulations, zoning laws, and environmental protection measures. Growth management strategies should aim not only to accommodate development but also to ensure the long-term sustainability and quality of urban communities (Ravallion et al., 2007).

Moreover, integrated urban planning and growth management can help mitigate the adverse effects of unplanned urbanization, such as spatial inequalities and infrastructure deficits. For instance, the incorporation of green infrastructure and mixed land-use planning can enhance urban resilience while promoting environmental sustainability (Wu, 2014). Effective governance mechanisms and public participation are also critical to ensuring that urban expansion aligns with broader social, economic, and environmental goals (World Bank, 2022).

In Sub-Saharan Africa, urban expansion is occurring at an unprecedented pace. The region's urban population growth rate, averaging 4% annually, is one of the highest globally (UN-Habitat, 2014). Urbanization here is driven by rural poverty, economic opportunities in cities, and high natural population growth rates. This rapid expansion has exacerbated issues such as land-use conflicts, informal settlements, and environmental degradation. Cities like Nairobi, Kampala, and Addis Ababa have seen their outskirts transformed, often at the expense of agricultural land and natural ecosystems.

In Ethiopia, urban expansion reflects broader regional trends. The Ethiopian population is rapidly urbanizing, with urban centers expanding into rural hinterlands. However,

unplanned expansion often leads to socio-economic challenges, including inadequate infrastructure, environmental degradation, and the displacement of rural communities (Tegegne, 1999). For instance, Addis Ababa's expansion into surrounding Oromia regions has led to land disputes and tensions between urban and rural communities.

Adama, one of Ethiopia's rapidly growing towns, is a prime example of urban expansion challenges. Located strategically within the East Shewa Zone and part of the Great Rift Valley, Adama's location along major trade routes has made it an attractive destination for migration and investment. Its proximity to the capital, Addis Ababa, and its role as a transit hub have contributed to its rapid physical and population growth. The city has expanded from 32,000 hectares to accommodate growing residential, commercial, and industrial demands (Adama Structural Plan, 2010).

This study investigates the causes and consequences of urban expansion in Adama's Bole Sub-City. It aims to identify the factors driving this expansion, explore policy gaps in community participation, and assess the socio-economic and environmental impacts on displaced communities. The findings are expected to inform urban policy and planning in Adama and similar contexts, ensuring sustainable and inclusive urban development.

## ***1.2 Statement of the problem***

Urbanization is the process of people moving from rural areas to urban areas, resulting in an increase in the number of people living in towns and cities. This process has been ongoing for centuries, but it has accelerated in recent decades due to a number of factors, including economic development, technological advances, and climate change. According to the United Nations Department of Economic and Social Affairs (UNDESA), (2014) the world's urban population is expected to reach 6.74 billion by 2050. This means that two-thirds of the world's population will be living in urban areas by that time.

The urbanization process in the developed world has almost come to an end. However, urbanization is still a major issue in developing countries, where the majority of the population still lives in rural areas. In the developing world, the percentage of the population living in cities has increased from 17.8% in the mid-20th century to over 40% today. By 2030, it is estimated that this number will reach 60%. Most of this urban growth will occur in Asia, Africa, and Latin America. These regions will account for

54%, 32.5%, and 6.8% of the total urban population growth, respectively. This rapid urbanization is putting a strain on resources in developing countries. Cities need more infrastructures, such as roads, water, and sanitation, to accommodate their growing populations. They also need to create jobs and provide affordable housing (Jedwab, et.al. 2014).

Urban expansion is one of the most pressing challenges faced by rapidly growing cities in Ethiopia, driven by factors such as population growth, rural-to-urban migration, economic development, and weak urban governance. However, unplanned and poorly managed urban expansion often leads to severe consequences, particularly in peri-urban areas where the livelihoods of communities are deeply intertwined with agricultural and natural resources.

Adama City, one of the largest and fastest-growing cities in the Oromia Regional State, is witnessing significant urban expansion, especially in its Bole Sub-City. Similar to other Ethiopian cities, this expansion is largely unregulated, characterized by the uncontrolled conversion of agricultural and forest lands into residential, commercial, and industrial uses. The lack of effective urban planning and enforcement has led to the loss of prime agricultural lands, displacement of farmers, and disruption of local livelihoods, as well as environmental degradation. Farmers in peri-urban areas, who rely heavily on their land for sustenance and income, face social and economic challenges as they are forced to abandon their traditional way of life due to urban sprawl.

This rapid urbanization in Bole Sub-City has also resulted in various environmental consequences, including deforestation, loss of biodiversity, soil erosion, and increased pollution levels. The uncontrolled expansion places immense pressure on existing urban infrastructure and services, leading to overcrowding, inadequate waste management, and limited access to water and sanitation. Furthermore, the lack of coordinated land use planning has given rise to informal settlements and irregular land distribution, exacerbating socio-economic inequalities within the city.

Despite the evident challenges posed by urban expansion in Adama City, limited research has been conducted to comprehensively examine the causes and consequences of this phenomenon. Existing studies have often focused on broader urbanization trends

in Ethiopia, overlooking the specific drivers of expansion in Adama City and the unique impacts. Key issues such as the socio-economic displacement of the community, the loss of livelihoods, and environmental degradation remain underexplored. Therefore, this study aims to fill these critical knowledge gaps by investigating the causes and consequences of urban expansion in Adama City, with a specific focus on Bole Sub-City. The study has employed a mixed-methods approach, integrating field surveys with, questioner, interviews, and focus group discussions to provide a holistic understanding of the issue and inform sustainable urban planning strategies.

### ***1.3. Objectives of the study***

#### **1.3.1 General Objective**

The general objective of the study is to investigate the causes and consequences of urban expansion in Adama City, with a specific focus on Bole Sub-City, and provide insights to guide sustainable urban planning and management practices.

#### **1.3.2 Specific Objectives**

The specific objectives of the study are:

1. To analyze the impact of urban expansion on land use patterns in Adama City from 1991 to 2022
2. To assess the driving forces for the urban expansion of the study area.
3. To examines the consequences of urban expansion in the study area.
4. To suggest possible solutions to mitigate the consequences of urban expansion in the study area.

### ***1.4 Research question***

In light of the above problem statement and objectives, the study has the following questions.

1. What is the impact of urban expansion on land use patterns in Adama City from 1991 to 2022?
2. What are the major causes that have induced urban expansion in Adama City during the study period?

3. What are the consequences of urban expansion in Adama City?
4. What possible solutions can be suggested to mitigate the consequences of urban expansion in Adama City?

### ***1.5 Significant of the study***

The study on the "Causes and Consequences of Urban Expansion: A Case Study of Adama City" is significant for several reasons, contributing to the body of knowledge on urbanization processes in Ethiopia and offering practical insights for policymakers, urban planners, and local communities.

### ***1.6 Scope of the study***

The thesis scope encompasses spatial and thematic dimensions. Thematically, the study focuses on examining the causes and consequences of urban expansion within Adama City, specifically in Bole Sub-City. It addresses how the expansion of urban areas affects various aspects of community life, including social, economic, environmental, and political consequences for communities in the expanded areas. The emphasis is on the impacts on livelihoods, housing, infrastructure, and local resources. Additionally, the research explores the drivers of urban expansion, including demographic trends, economic factors, and policy decisions. The study also identifies strategies to mitigate the adverse effects of urban growth on affected communities. Spatially, the study concentrates on specific areas within Bole Sub-City, particularly communities directly impacted by urban expansion.

### ***1.7 Limitation of the study***

All research studies face limitations throughout their lifecycle. This study also had some limitations during its conduct. The first limitation was a lack of secondary data sources, specifically the inefficient provision of information by the urban municipality. In addition, the researcher faced some other challenges related to respondent behavior during interviews and questionnaire completion. These challenges included respondents failing to answer questions fully and correctly, and not attending focus group discussions when invited.

## ***1.8. Operational Definition***

- ✧ **Urban expansion:** The process by which urban areas expand into surrounding rural areas. This can be measured by the rate of increase in urban land area, the number of new buildings constructed, or the population growth of urban areas.
- ✧ **Livelihood:** The means by which people meet their basic needs for food, shelter, clothing, healthcare, and education. Livelihoods can be based on a variety of activities, including farming, fishing, trade, and employment in the formal and informal sectors.
- ✧ **Impact:** The effect of urban expansion on the livelihoods of peri-urban communities. This can be measured by changes in income, employment, access to land and resources, and food security.
- ✧ **Socioeconomic impacts:** The social and economic effects of urban expansion on peri-urban communities. These impacts can be positive or negative, and can include changes in income, employment, education, health, and social networks.
- ✧ **Environmental impacts:** The physical and ecological effects of urban expansion on peri-urban communities. These impacts can be positive or negative, and can include changes in air quality, water quality, biodiversity, and land use.
- ✧ **Adaptive capacity:** The ability of peri-urban communities to make changes to their livelihood practices in response to the challenges and opportunities of urban expansion. This can be influenced by a variety of factors, such as access to credit, land, and resources.
- ✧ **Causes of Urban Expansion:** The causes of urban expansion in this context refer to the various factors that drive the expansion of urban areas. These can include economic factors such as industrial growth, job creation, and improved infrastructure; demographic factors such as population growth and rural-to-urban migration; political factors such as land policies and urban planning; and social factors such as the demand for housing and amenities. These drivers will

be assessed based on local government policies, regional development plans, population trends, and economic activities in Adama City.

- ✧ **Consequences of Urban Expansion:** Consequences of urban expansion refer to the social, economic, environmental, and political impacts that the growth of the urban area has on the surrounding community. This includes changes in land use, displacement of residents, loss of agricultural land, environmental degradation, and social challenges (including disruptions to livelihoods, changes in community structure, and access to services). The consequences also extend to governance challenges such as inadequate public services and infrastructure.

### **1.9 Organization of paper**

This research is divided into five chapters. The first chapter is introduction, which includes the background of the study, statement of the problem, research questions and objectives, scope of the study, significance of the study, limitation of the study and organization of the paper.

The second chapter examines review of related literature that focuses on the basic concepts of urban expansion, drivers of urban expansion, positive and adverse effects of urban expansion on the communities, and possible solutions for the consequence of urban expansion. Furthermore, it reviewed empirical literatures related with the topic including the research gap and conceptual framework of the study.

The third chapter briefly presents description of the research design and methodology used in the study while the fourth chapter contains data analysis, presentation, and interpretation (research result and discussion). The fifth chapter is conclusion, recommendation, and direction for future research.

## **Chapter two**

### **Literature Review**

#### ***2.1. Theories of Urban Expansion***

Urban expansion is the physical extension of the geographical footprints of towns, cities, and metropolitan areas into the surrounding countryside. It is a global phenomenon, driven by population growth, economic development, and technological change (Angel, 2023). There are a variety of different theories, each with its own strengths and weaknesses.

One of the most influential theories of urban expansion is the concentric zone model, developed by sociologist Ernest Burgess in the early 1920s. This model suggests that cities grow in a series of concentric rings, with the central business district (CBD) at the core and different types of land uses radiating outward. The innermost ring is typically characterized by high-density commercial and industrial activity, followed by a ring of mixed-use residential and commercial areas, then a ring of low-density residential areas, and finally a suburban ring of agricultural and undeveloped land (Reiffenstein, 2017).

Another important theory of urban expansion is the sector model, developed by economist Homer Hoyt in the 1930s. This model suggests that cities grow in a series of wedges radiating outward from the CBD. Each wedge is characterized by a different type of land use, such as high-income residential areas, industrial areas, or transportation corridors (Fujita, 2013).

The concentric zone model and sector model were both developed in the early 20th century, and they have been updated and refined over the years to reflect changing trends in urban growth. However, both models remain influential in the field of urban planning today.

In addition to the concentric zone model and sector model, there are a number of other theories that have been used to explain urban expansion. Some of these theories focus

on the economic factors that drive urban growth, such as the agglomeration economies that businesses can achieve by clustering together in cities. Other theories focus on the social and cultural factors that influence where people choose to live, such as the desire for access to jobs, schools, and other amenities (Abdullahi, et.al. 2017).

In recent years, there has been a growing interest in the spatial interaction models of urban expansion. These models use complex mathematical equations to simulate the movement of people and businesses within and between cities. Spatial interaction models can be used to predict how urban areas will grow and change in the future, and they can be used to evaluate the impacts of different planning policies (Li, & Gong, 2016).

Urban expansion is a complex phenomenon, and there is no single theory that can fully explain it. However, the theories discussed above provide a useful framework for understanding the patterns and drivers of urban growth, as well as the consequences of this growth for cities and their surrounding regions.

## ***2.2. Concept of Urbanization and Urban Expansion***

Urbanization is a major topic of discussion in the development sector. Some people believe that urbanization is a positive change for people, while others believe that it has negative consequences. The United Nations (UN) and Gollin et al. (2013) argue that urbanization can lead to economic growth and improved living standards for people living in both urban and peri-urban areas. They point to the fact that cities are often centers of innovation and economic activity. However, Mondal (2010) argue that urbanization can have negative consequences, such as increased pollution, poverty, and crime. They also argue that urbanization can lead to the displacement of farmers and the loss of agricultural land. To better understand the debate on urbanization, it is important to define what urbanization is and what drives it. Urbanization is the process of increasing urban population, the growth of urban areas, and the increasing proportion of people living in urban areas. It is a form of metropolitan growth that is a response to a variety of economic, social, political, and environmental factors (Cohen, 2006)..

Urban expansion is the physical expansion of the built-up area of cities and towns into the surrounding countryside. It is a complex process that is driven by a variety of factors, including population growth, economic development, and government policies. Recent studies of urban expansion (e.g., Angel et al. 2012) have shown that this process is often fragmented and can leapfrog over vacant open spaces. However, these vacant spaces eventually fill in as urban expansion continues. Urban expansion also tends to occur at lower densities on the urban periphery than in central cities. This is because land on the urban periphery is typically cheaper than land in city centres (Brody, 2013).

The term "urban expansion" indicates the spatial or physical enlargement of built-up areas. Urban land expansion is one of the main indicators to measure the intensity of urbanization. Urban expansion is the most easily identifiable characteristic of the process in the spatial dimension. Bloch et al., (2015) defined that as the process of land conversion from non-built-up land use categories into built-up developed land over time. It is possible for a city to experience urban growth without expansion if this growth is absorbed within existing settlement boundaries. Conversely, expansion can occur without growth where new developments are created to facilitate lower population densities for an existing community. Recent studies have shown that urban land consumption per capita has been increasing over time. This is due to a number of factors, including economic development, cheaper transportation, and the desire for more space (Seto et al. 2011).

Urban expansion is a complex issue that is often resisted by citizens groups and municipalities. This resistance can lead to cities not preparing adequate lands for expansion, which can have negative consequences. A typical claim of those resistant to urban expansion is that urban population growth can be accommodated by the densification of the existing footprints of cities, not requiring any incursion into the rural periphery to convert new lands to urban use (Angel, et.al. 2021). A study by Angel et al. (2023) found that in a global sample of 200 cities, the average share of the increase in population during the period 1990–2014 that was accommodated by the densification of the existing footprints in 1990 was 23%, while the remaining 77% was accommodated in expansion areas built during the same period.

In conclusion, urban expansion is the principal mechanism by which cities accommodate their population growth. It is a complex issue with no easy solutions. However, it is important to understand the factors driving urban expansion and the potential impacts, both positive and negative.

## ***2.2. Drivers of Urban Expansion***

Urban expansion is a complex phenomenon that is influenced by a variety of factors. These factors can vary depending on the specific city or region, and they can also change over time. In Indonesia, for example, global and external economies, local demographic, infrastructural, and natural elements are all driving forces of urban expansion. However, the relative importance of these factors can vary from place to place. In Jakarta city, the core of the megacity, global and external economies are more important than local factors. This is because Jakarta is a major economic and financial center, and it is closely connected to the global economy. Outside the core of the megacity, local factors such as demographics and infrastructure are more important. This is because these areas are less developed, and they have less access to global markets. In many developing countries, the core driving forces of urbanization and urban expansion are political, economic, social, educational, natural population increase and lack of urban planning (Pravitasari et al. 2015).

### **2.2.1. Demographic factors**

According to a study by Kassahun and Tegegne (2018), two of the most important factors driving urban expansion are in-migration (both rural-urban and urban-urban) and natural population growth. Urban growth is essentially a combination of two demographic processes. The first is rural-urban migration, which has been a major driver of urban expansion since the beginning of cities. People migrate from rural to urban areas in search of economic opportunities, to escape rural insecurity, or to avoid environmental or economic problems. The second type of growth is natural, which is caused by both rising fertility and falling mortality rates.

Economic, legal, and private sector participation are all forces that drive urban expansion and change in settlement patterns in peri-urban zones. Each of these forces

can have both positive and negative impacts on the livelihoods of farmers in peri-urban areas. The central government's intervention was considered to be the primary factor in the expansion of peri-urban Bangkok (Jonkory, 2009).

### **2.2.2. Political factors**

During times of political unrest, families are often forced to flee their homes in rural areas. They may be displaced by violence, conflict, or the destruction of their homes and livelihoods. These families often migrate to urban areas in search of safety, shelter, food, and employment. When large numbers of people migrate to cities, it can put a strain on the city's resources. The cities may not have enough housing, food, or jobs to support the influx of new arrivals. This can lead to the development of slums, which are informal settlements that lack basic infrastructure and service (Osman, & Abebe2023). Slums are often located on the outskirts of cities, where land is cheap and there is less government oversight. They are typically overcrowded and unsanitary, and they lack access to clean water, sanitation, and healthcare. The residents of slums are often marginalized and discriminated against, and they may face high levels of crime and violence. The problem of slums is a major challenge for cities around the world. It is a complex issue with no easy solutions. However, there are a number of things that can be done to address the problem, such as providing affordable housing, creating jobs, and improving infrastructure and services in slums. The studies by Abraha and Samson (2016), Teketel (2015), and Pravitasari et al. (2015) all found that political unrest can lead to the development of slums in cities.

### **2.2.3. Economic factors**

Economic factors cause urban expansion by creating opportunities for people to earn a living and improve their quality of life. Cities offer a wider range of jobs, higher wages, and better access to education, healthcare, and other amenities than rural areas. As a result, people are drawn to cities in search of better economic opportunities cities (Zhang, Xie, 2019). One of the most important economic factors that drives urban expansion is industrialization. When industries move to cities, they create new jobs and attract workers from rural areas. This is because industries need access to a large pool of

labor, transportation networks, and other infrastructure that are more readily available in cities (United Nations, 2017).

Another important economic factor is economic development. As cities grow and develop, they become more attractive to businesses and investors. This is because cities offer a larger market for goods and services, and they provide a more educated and skilled workforce. As a result, businesses and investors are willing to invest in cities, which further drive urban expansion (Choe, & Roberts, 2011). Economic factors can also lead to urban expansion through suburbanization. Suburbanization is the process by which people move from central cities to the surrounding suburbs. This is often driven by the desire to find more affordable housing, larger homes, and better schools. Suburbanization can lead to the expansion of urban areas, as new housing developments and commercial centers are built in the suburbs (Nechyba, & Walsh, 2002).

#### **2.2.4. Social factors**

Social factors are key drivers of urban expansion, influencing the movement of people and businesses to cities and their peripheries (Yiran et.al. 2020). These factors include:

**Rural-to-urban migration:** This is a major contributor to urban expansion, as people from rural areas move to cities in search of better job opportunities, education, and healthcare. Rural-to-urban migration is often driven by poverty, lack of land, and environmental degradation in rural areas (Lall, & Selod, 2006).

**Changing social norms and aspirations:** People are increasingly choosing to live in cities because they offer a variety of social and cultural amenities, such as restaurants, cafes, museums, and theaters. Cities are also seen as places of opportunity and excitement, where people can pursue their dreams and aspirations (Sassen, 2001).

**Government policies:** Government policies can also play a role in urban expansion. For example, government investments in transportation infrastructure can make it easier for people to live in suburbs and commute to work in the city. Tax breaks and other incentives for businesses can also attract businesses to move to suburban areas (Gordon, & Vining, 1991).

### **2.2.5. Lack of urban planning**

Urban expansion is the outward growth of urban areas into surrounding rural areas. It is caused by a number of factors, including population growth, economic development, and technological change. However, lack of urban planning is a major driver of urban expansion (Basu, et.al. 2023).

Urban planning is the process of designing and managing the development of urban areas. It involves setting goals for the future growth of a city or town, and developing policies and regulations to achieve those goals. Effective urban planning can help to control urban expansion and create more sustainable and livable cities (Pinson, 2004). However, many cities and towns lack comprehensive urban planning. This can lead to a number of problems, including urban sprawl. Urban sprawl is a type of urban expansion that is characterized by low-density development, single-use zoning, and a reliance on cars (Habibi, & Asadi, 2011).

According to Watson (2009), there are a number of ways in which lack of urban planning can cause urban expansion. For example, if a city does not have a zoning code in place, developers may be free to build anywhere they want. This can lead to development in areas that are not suitable for development, such as floodplains or wetlands. Additionally, if a city does not have a long-term vision for its future growth, it may be more likely to approve development projects that are not in the best interests of the community. For example, a city may approve a new housing development without also planning for the necessary infrastructure, such as roads and schools. Finally, a lack of public participation in urban planning can also lead to urban expansion. If residents do not have a say in how their city or town develops, they are less likely to support projects that are designed to control urban expansion (Ma, 2017).

### ***2.3. Impacts of Urban Expansion***

The impact of urban expansion on rural farming communities in the periphery is complex and multifaceted. There is no single theory that can adequately explain all of the potential effects, both positive and negative (Talema, & Nigusie, 2023). However, modernization theory and dependency theory provide some useful insights.

Modernization theory suggests that urban expansion can lead to economic growth and improved access to services for rural farming communities. However, it also warns that this process can be disruptive and lead to social inequality (Almandoz, 2014). Dependency theory, on the other hand, argues that urban expansion often occurs at the expense of rural communities, which are exploited for their resources and labor (Emeh, 2013).

In the context of developing countries, urban expansion is often associated with unplanned development and a lack of infrastructure. It is also evident that even in planned activity the development of infrastructure usually does not correspond to the large tract of land that develops in a low-density pattern. Thus urban expansion consequently results social, environmental and economic problems to the society (Koroso, et.al, 2021).

### **2.3.1. Social Challenges**

Rapid and unplanned urbanization can lead to urban violence and social unrest for a number of reasons. First, it can lead to widening inequalities. Urban areas tend to be more concentrated with wealth and power, while rural areas are often more impoverished. This can lead to a sense of resentment and frustration among the urban poor. Second, urban areas can be more competitive for scarce resources, such as jobs, housing, and land. This can lead to conflict and tension, especially between different social groups. Third, weak city governance can make it difficult to maintain law and order. This can create a climate of impunity, where criminals believe they can get away with their crimes. Finally, rapid and unplanned urbanization can lead to a breakdown of traditional social networks. This can leave people feeling isolated and vulnerable, which can make them more susceptible to violence (Scott, 2015). The example of San Pedro Sula, Honduras, is a tragic illustration of how these factors can combine to create a very dangerous environment. The city has a long history of poverty, inequality, and violence. In recent years, the city has experienced rapid and unplanned urbanization, which has exacerbated these problems. As a result, San Pedro Sula has one of the highest murder rates in the world (Lehmann, 2015).

One of the negative impacts of urban expansion is that it can lead to displacement, dislocation, and segregation. Displacement occurs when people are forced to leave their homes and communities due to urban development. Dislocation occurs when people are forced to move to a new place, but they are not provided with the resources or support they need to adjust to their new environment. Segregation occurs when different groups of people are separated from each other, often by physical or social barriers (Alamneh, & Abebe, 2023).

Urban expansion can cause displacement, dislocation, and segregation in a number of ways. For example, when land is cleared for new development, people who live in informal settlements may be forced to leave. Additionally, when new roads or infrastructure are built, they can divide communities and make it difficult for people to access essential services (Chettry, 2023).

Displacement, dislocation, and segregation can have a number of negative consequences for individuals and communities. For example, people who are displaced may have difficulty finding new housing and employment. They may also lose their social networks and sense of community. Additionally, segregation can lead to social inequality and discrimination. In the context of extended urban areas, people who live in these areas may still live partly rural lifestyles, but they are not fully integrated into the urban economy or society. They may have difficulty accessing essential services and may not have a say in how their communities are developed (Carter, 1995)

### **2.3.2. Environmental Challenges**

Urban expansion is one of the most significant environmental challenges facing the world today. As cities grow larger and more populous, they consume more resources, produce more waste, and become more vulnerable to the effects of climate change (Li, et.al. 2022).

One of the biggest environmental challenges of urban expansion is the loss of natural habitat. As cities grow, they encroach on forests, wetlands, and other natural areas. This can lead to a loss of biodiversity and ecosystem services. For example, forests play an important role in regulating water flow and air quality. When forests are cleared for

urban development, these services are lost, which can have negative consequences for human health and well-being (Puplampu, & Bofo, 2021).

Another environmental challenge of urban expansion is air and water pollution. Cities are often major sources of air and water pollution. Air pollution can cause respiratory problems and other health problems. Water pollution can contaminate drinking water and make it unsafe to drink (Dodman, 2016).

Urban expansion can also lead to increased flooding. Cities are often located near the sea or natural waterways. As cities grow, they encroach on these areas, which can make them more vulnerable to flooding. Climate change is also increasing the risk of flooding in coastal cities. Migration from rural areas to cities is at least partially driven by the increasing prevalence of extreme weather. Extreme weather events such as droughts, floods, and storms are becoming more common due to climate change. This is driving people to migrate from rural areas to cities in search of safety and better opportunities. However, cities are often more vulnerable to the effects of climate change, so this migration can make people more vulnerable in the long run (Lehmann, 2015).

One of the most significant negative impacts of urban expansion in developing countries is the loss of productive and fertile agricultural farmland and forest (Yuan, et.al. 2022). There are a number of reasons why urban expansion often occurs at the expense of agricultural land and forest in developing countries. One reason is that agricultural land is often located in prime areas that are also attractive for urban development. For example, agricultural land is often located near cities, which makes it convenient for people to live and work. Additionally, agricultural land is often relatively inexpensive, which makes it attractive to developers (Gebre, & Gebremedhin, 2019). Another reason why urban expansion often occurs at the expense of agricultural land and forest in developing countries is that there are often weak land use regulations and planning processes. This can lead to unplanned and uncontrolled urban expansion, which can encroach on agricultural land and forest (Tessema, 2017).

The loss of agricultural land and forest to urban expansion can have a number of negative consequences for developing countries. One consequence is that it can reduce

food security. When agricultural land is lost to urban development, it reduces the amount of land available to produce food. This can lead to higher food prices and increased hunger and malnutrition. Another consequence of the loss of agricultural land and forest to urban expansion is that it can damage the environment. Agricultural land and forest play important roles in regulating the climate, protecting water resources, and providing habitat for wildlife. When agricultural land and forest are lost, it can lead to environmental problems such as soil erosion, water pollution, and biodiversity loss (Minwuyelet, 2005).

### **2.3.3. Economic Challenges**

Urban expansion presents a number of economic challenges, both for cities and for the surrounding rural areas. One of the biggest challenges is the cost of providing infrastructure and services to new urban areas. This can include things like roads, bridges, schools, hospitals, and water and sewer systems. The cost of infrastructure can be especially high in developing countries, where cities are growing rapidly and often in an unplanned way (Kuddus, et.al. 2020).

Another challenge is the loss of farmland and other productive land to urban development. This can lead to higher food prices and reduced food security. Additionally, urban expansion can lead to environmental degradation, such as air and water pollution, which can also have negative economic impacts. Finally, urban expansion can exacerbate social inequality. This is because the benefits of urban growth are often concentrated in the hands of a small number of wealthy people, while the costs are borne by the poor and marginalized. For example, urban expansion can lead to displacement of low-income residents, who are often forced to move to less desirable areas with fewer job opportunities and access to services (Ha, et.al. 2019).

### **2.3.4. Positive Impacts of Urban Expansion**

Rapid urban growth in major cities poses enormous opportunities for the future sustainable development of a country. Large cities are expected to be centers of innovation and wealth creation. They can also be more efficient in terms of resource use than smaller cities. For example, large cities can have more efficient public

transportation systems, which can reduce greenhouse gas emissions and improve air quality. Large cities can also have more concentrated populations, which can make it easier to provide essential services such as education, healthcare, and sanitation (Keno et al, 2019).

Urban expansion has led to economic growth in peri-urban communities by creating new jobs and businesses. This can be particularly beneficial for communities that are located near major transportation corridors or that have access to natural resources that are in demand. (Efrem, 2017) Moreover, urban expansion can also lead to improved access to services such as education, healthcare, and transportation in peri-urban communities. This is because urban areas tend to have a higher concentration of public services and infrastructure. In addition to this, urban expansion can also lead to increased land values in peri-urban communities. This can be beneficial for landowners, who may be able to sell their land for a higher price (Cattaneo et al, 2022). Furthermore, urban expansion can also create new opportunities for development in peri-urban communities. For example, new businesses and industries may be established in these areas, or new housing developments may be built (Amina et.al 2018).

#### ***2.4. World experience in urban expansion***

Urban sprawl first existed when the first city first existed. As long as inner city areas have been overcrowded there has been a tendency for cities to expand their boundaries into neighboring rural lands. One of the earliest documented examples of this was Rome, in the very beginning of the Christian era.

“This great city had an estimated population of 1 million people piled up with city walls that enclosed a little more than six miles. A small group of Romans lived in splendor in spacious palaces that took most of the space within the walls” (Brugmann 23).

This caused the poorer citizens, who were the vast majority of the population, to either live crowded together in the outer sections of the city, or to live just outside the city walls in the lands called ‘suburbia.’ As could be expected, the city would expand into suburbia over time, creating a new suburbia, literally meaning below city limits.

Such expansion cycles can be found in virtually every major metropolitan area. The surprising thing about North American urban sprawl, however, is that unlike the sprawl in Europe, the richer citizens tend to populate the outer edges of the city while the poorer citizens, still always a majority, tend to populate the inner cities. Of course, this leads to even faster expansion since rich citizens have the money and affluence to expand their territory at a quicker rate on the outside of cities than that of earlier European sprawls. However, even in Europe the richest still tend to leave dense city centers eventually; it just takes many centuries, as opposed to a few years when immigration starts in America (Breugmann 29).

In America, urban sprawl began in earnest in the early 1900s (Brugmannn 27). As immigrants could afford to move out of densely packed inner city neighborhoods, so, and cities expanded rapidly. Once World War One ended, this movement out of cities rose exponentially. In many areas, by the end of the 1920s, a majority of families lived in single family, suburban homes. It is in this period that “many of the characteristics that we tend to associate with postwar America (became) evident” (Breugmann 37). This was the true start of the urban sprawl explosion in America.

Since the 1970s, urban sprawl has been as strong as ever. Some areas, such as Atlanta, have doubled in land mass since 1980, and continue to grow. Atlanta currently consumes more than 500 acres of undeveloped land every week (Lmindstrom 275). However, since 1970, there has been a concerted effort among most major cities to attract people back. Urban renewal and neighborhood revitalization effort have attempted to clean up inner cities and attract residents to living in cities again. Ironically, this creates a new problem of people not being able to afford living in the inner city, though, as property values rise, and sprawl continues unfettered, with population decreases remaining constraint in general (Breugmann 57).

Today, urban expansion is more and more becoming a topic of household discussion. Urban expansion is taught in classrooms, around the country. Everyone is familiar with the idea of expanding cities and the words urban sprawl, whether or not they know the truth behind those words not. The connotation is generally a negative one, however,

since it is due mainly to anti-expansion groups of getting the general public aware of the issue.

Urban sprawl creates many problems within a community. The community in question includes rural and urban areas, and the suburban areas that connect them. Sprawl becomes a political problem at these edges where the city expands, and it's not unusual to see politicians including sprawl related items in their platforms, such as no new developing or campaigns to create new jobs. Many people are upset with these problems, living both inside and outside the city limits.

## 2.5. Urbanization and Urban expansion trend in Ethiopia

Urbanization in Ethiopia is a recent phenomenon conditioned by historical factors (Markakish, 1984). Ethiopia is characterized by low level of urbanization even by African standards, where only 16percent of the populations live in urban areas (CSA, 2011) but the rate of growth is one of the highest in the world (UN, 2008). Such high growth rate; nonetheless, is not often accompanied by development in socio-economic services and infrastructure, and economic and employment capacity of the urban centers to support the growing population (Teller and Assefa, 2010). The establishment of many medium-sized towns in Ethiopia are in fact as a result of sociopolitical and military reasons (Markakish, 1984) and some due to the establishment of roads connecting Addis Ababa to different parts of the country and in some cases the construction of Ethio-Djibouti railway; whereby towns like Akaki, Bishoftu, Modjo and Adama were formed as urban-industrial complex (Markakish, 1984).

Urban growth and urbanization process in Ethiopia is characterized by high primate city development (Dejene, 2011); though according to Teller and Assefa (2010), such a pattern is declining due to the emergence and growth of regional capitals. The spatial distribution of urban centers in Ethiopia is unbalanced, and there is a large disparity between the levels of urbanization among the various regions. According to data obtained from different sources, the total number of urban centers in Ethiopia is close to 1,000; and the level of urbanization is a little more than 19%. Despite this low level of urbanization, there is rapid urban growth. According to UN population projection

(2012), the urbanization rate of Ethiopia is 3.6%. With this pace, the level of urbanization will only be 36% in 2050.

For instance, four regions (Oromiya, Amhara, SNNP and Tigray) account for about 70% of the national urban population. On the other hand, the national urban system in terms of sheer number of urban centers is dominated by small urban centers as there are only fifteen urban centers with population size of 100,000 or more: Addis Ababa, Mekele, Adama, Gondar and Dire Dawa are the largest cities with population sizes greater than 250,000; Hawasa, Bahir Dar, Jimma, Dessie, Jijiga, Shashemene, Bishoftu, Harar, Sodo and Arba Minch are medium-sized cities with population ranging from 100,000 to 250,000; while the remaining are small towns (CSA, 2007).

In spite of the low level of urbanization, inadequate housing resulting in homelessness, overcrowded living arrangements, poor sanitation and shortage of health and educational services and employment opportunities are common features of most urban centers in Ethiopia. On the other hand, different study documents indicate that apart from the different forms of urbanization and urban sprawl, urban centers surrounding Finfinne exhibit distinct features of urbanization; almost all urban centers surrounding the capital exhibit common features of high land settlements, resultant decline in agricultural land and production, high rate of squatter settlements and informal land acquisitions, replacement of domestic economic activities, high rates of migration from different parts of the country, and out migration of inhabitants to the periphery are some of the major socio-economic changes.

## ***2.8. Lesson learned***

In recent years cities all over the world have experienced rapid growth because of rapid increase in urban population and irreversible flow of people from rural to rural area. This urban expansion to the periphery is derived mainly from two, from population and urban development. The implication of accelerated rate of global urban expansion and what should be done about it is the basic policy debates about different scholars. At one time there have been those taught to limit the growth of the city at any and all means, on

the other hand as the researcher argue those who welcomed it and actively prepared it for absorbing the oncoming wave of the new migrant.

The causes of urban expansion are considered as population growth, speculation, speculation of land appreciation and lack of comprehensive planning. These conditions which create any urban area to expand create many consequences on three environment and community. To reduce the effect of urban expansion on the environment and community the city administration should plan and experience different managing mechanism based on the condition of the town. the major managing mechanism are managing techniques, regulation, urban growth boundary, development policy, extra purification, promotion of in all area and redevelopment.

## CHAPTER THREE: RESEARCH METHODOLOGY

### 3.1 Descriptive of study area

#### 3.1.1. Geographical Location

Adama is a city in Ethiopia's central Oromia Region (Figure 1), located in the east Shewa Zone 99 kilometers southeast of Addis Abeba. The city is situated between the base of an escarpment to the west and the Great Rift Valley to the east. Encompassing an area of roughly 313.04 km<sup>2</sup> and falling within the latitude range of 8° 26'35" to 8° 38'46"N and the longitude range of 39° 9'20" to 39° 21'30"E. One of the railway urban centers, Adama city was established in 1916 as a depot along the Addis Ababa-Djibouti railway line. The development of the Addis Ababa-Djibouti railway line was a key component in the emergence.

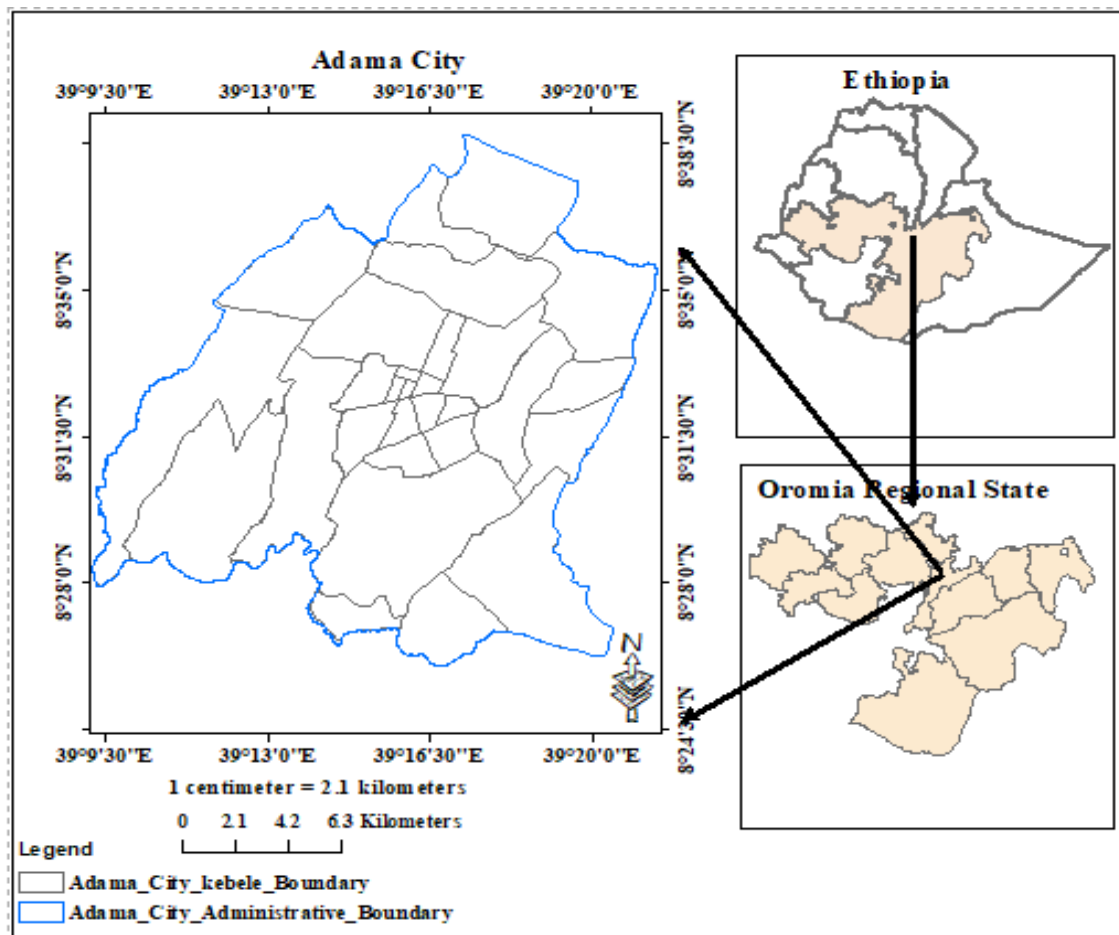


Figure 1 Location Map of study Area

### 3.1.2. Demographic

Adama city is Ethiopia's fourth largest urban center in terms of population size (Central Statistical Authority, 2021). Additionally, it is one of the few cities in the nation with a threshold population of over 300,000 and the largest urban hub in the Oromia Region. Since 1965 G.C., when the first baseline urban demographic survey was carried out in the nation, the city has experienced long-term population survey trends that have been documented by the majority of demographic and housing censuses and surveys (Socio Economic Profile of Adama, 2018). According to the country's past three successive censuses, Adama city showed a significant rise in population in the first Ethiopian population and housing census, which was held in May 1984. The population of Adama was 77,237. In the third base Ethiopian population and housing census, which was held in 2007 (the most recent year for which statistics are available), 220,212 people were inhabited in Adama. The following population and housing census, conducted in 1994, indicated that Adama had a total population of 127,842. According to the Oromia Urban Planning Institution (OUPI), the population of Adama City was 232,152 in 2007 due to the exclusion of four Gandas/kebeles, namely Daka Adi, Dabe Soloke, Boku Shenen, and Melka Adama, with a combined population of around 11,940. According to the revised structural plan, 11 new rural Gandas/kebeles are defined within the city administrative limit based on the projected population of 435,222 (Central Statistical Authority, 2021), with 212,991 men and 222,231 women.

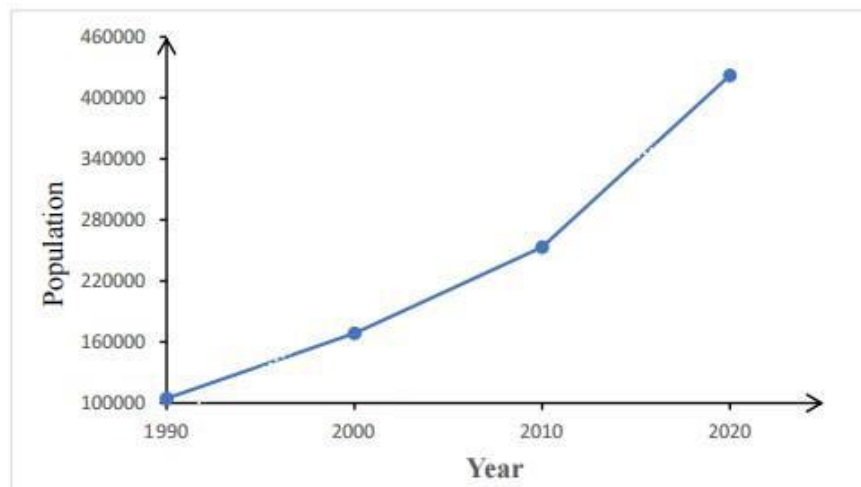


Figure 2 Location Map of study Area

### **3.1.3. Urban Growth**

In terms of population, urban built-up area, and economic function, Adama is one of Ethiopia's fastest-growing cities. According to Tesema & Assefa (2019), the city's population increased by 9% between 2004 and 2016; by 2021, the overall population is expected to be close to 435,222. (Central Statistical Authority,2021). Both naturally occurring urbanization and rural-to-urban migration contribute to the growth of Adama city. In fact, migrants from nearby rural areas, rural areas in other regions, and other cities make up the majority of the city's population. According to the 1984 census, migrants made up 53.7% of the city's population, making Adama one of the regions and countries with a substantial intake of migrants each year. Similar to how the proportion of migrants peaked at 52.9% in the second census of 1994 after a decade, and was expected to have reached 59.2% in the 2007 census (CSA, 1984, 1994, 2007), As was already said, a significant section of the population of Adama city consists of migrants, who are primarily drew to the city in quest of job, demonstrating a city's capacity to pull citizens from other cities or rural regions.

Between 1984 and 2015, Adama City's built-up area increased by 293%. (Sinha et al., 2016) Similar to this, Dejene & Abebe (2019) claimed that from 1995 to 2019, the city's built-up area increased by 22% year, more than doubling. The city of Adama is growing and expanding, and it is making an ever-greater economic contribution to the area and the nation. The top three industries for employment in Adama City are wholesale trade, manufacturing, and construction, which account for 23.2%, 19.0%, and 9.4% of all jobs, respectively. However, the city's economy also greatly benefits from other sectors, such as transportation and storage, the service sector (real estate, hotels, food, and services), retail, and construction (Dube & Mulugeta, 2015). To summarize, Adama City's urban growth over the last few decades can be linked to geological as well as socio-demographic factors.

### **3.1.4. Topography**

The major topographic feature of the Town is part of the Great Rift Valley of East Africa. The existing built up area of Adama that is found between Kechema and Boriticha uplands has flat topography. This topography generally rolls down from

north (Dhaka Adi) to south direction up to the express way that runs from Finfinne to Adama. The western and eastern parts of the built-up area that are at the center like Migira and Irreechaa Anas are affected by flood from the dissected uplands during the rainy season.

The chain of uplands surrounds Adama Town is almost in the northern, western and eastern, The *Lume* chain of upland is found in the western part. It is a ridge that runs from northwest to southeast direction up to Sire Robe that is located north of Koka dam. The top of the two uplands where Adama Town wind farm I and II are located with flat topography that has steep slope toward west and east directions. One of these uplands is the *Kechema* upland that extends from wind farm I to *Ana Irrecha* substation with a general northwest to southeast alignment. This chain of uplands serves as a divide line for southeast and southwest seasonal flood.



The topography of the southern part of Adama Town is also dominated by pockets of uplands which are found here and there within *Torban Oboo* and *Arooret*. These uplands have a north facing aspect that determined the general flow direction of flood during the rainy season. Most of these uplands in *Torban obo* are used to extract construction materials of red ash, pumice and selected materials for construction.



There are deep V-shaped gorges in areas that are susceptible to gully erosion. This includes areas near Koka dam, near the existing abattoir of Adama town exit to *Metehara* to southeast direction and *Dhaka Adi*. These deep V-shaped gorges are also found near asphalted road that do not regard the amount of rainfall that causes flood, bridges and in areas where there are sharp changes in slope.

Gullies are a specific form of severe erosion typically caused by concentrated water flow on erodible soils. Gullies are relatively permanent steep-sided V-course that experience ephemeral flows during rainstorms. Compared with Stable River channels which have relatively smooth long profile, Gullies are characterized by a head cut and various steps or knick-points along this course. These gullies the main features of many Ana like *Dhaka Adi*



### 3.1.5. Climate Condition

Climate is an average long-term synthesis of weather. Climate comprises different elements. These elements have clear urban planning implication and should be considered and used as input for the preparation of the structure plan of Adama town.

#### 3.1.5.1. Temperature

Temperature is an important element of climate. Temperature is directly related to land use block density and theoretically in hot areas sparse block density is advisable than denser blocks that facilitate easy air circulation. As analyzed data source from Adama metrological station of the Adama branch the mean annual temperature of Adama Town is 21.7<sup>0</sup>c. Except minor variation due to different in elevation at Kechema that is located in North western part of the town.

#### 3.1.5.2. Rainfall

Adama Town falls within summer maxima rainfall region of the country. The mean annual rainfall of Adama Town is 923 mm. The two months that acquire maximum rainfall are July and August.

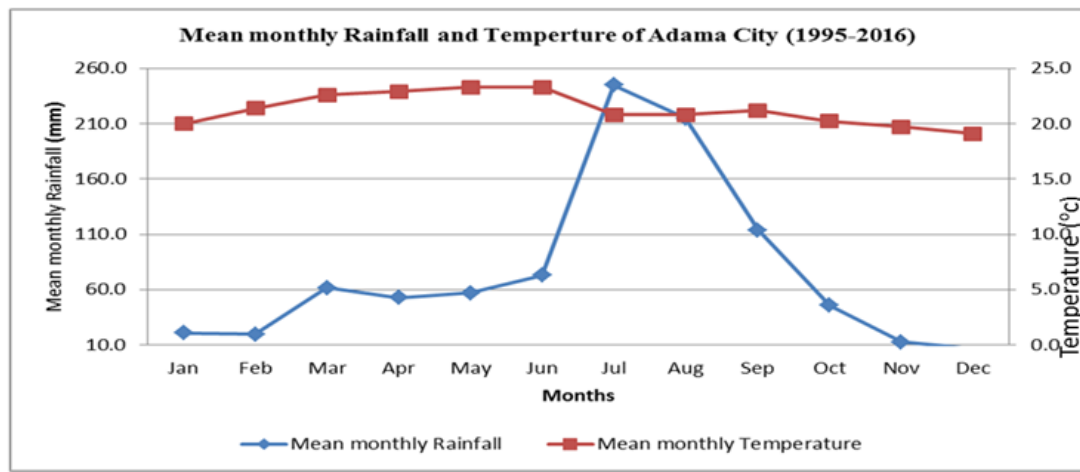


Figure 3 Rainfall and Temperature of Adama city

#### 3.1.5.3. Wind Direction

Wind is the horizontal movement of air. It is caused by the uneven heating of the Earth's surface by radiant energy from the Sun. Wind direction is reported as the

direction from which the wind blows, not the direction toward which the wind moves. A north wind blows from the north toward the south. The analysis of wind direction is very important to determine the location of different pollutant urban activities in terms of smoke, dust, noise, and nuisance smells. These activities should be located against the local wind direction to minimize pollution in settlement.

Accordingly, the wind direction analysis of Adama town indicates that the dominant wind directions are North easterly, South Westerly and Northerly, respectively (Source Adama metrological station).

#### **3.1.5.5. Humidity**

Humidity is a climate variable. It is the amount of water vapour present in the air. Humidity indicates the likelihood of precipitation, dew, or fog. Higher humidity reduces the effectiveness of sweating in cooling the body by reducing the rate of evaporation of moisture from the skin.

### ***3.2. Case Study Area Section***

Adama City, one of the fastest-growing cities in the Oromia region of Ethiopia, is undergoing rapid urban expansion, with various sub-cities experiencing unique challenges and opportunities. Among the six sub-cities of Adama City, Bole Sub-City stands out as an ideal case study for investigating the causes and consequences of urban expansion for several reasons:

1. **Rapid Urbanization and Population Growth:** Bole Sub-City has experienced significant urban growth in recent years due to the increasing population, migration, and industrial development. It is a hub for business, residential areas, and government institutions, making it a focal point for urban expansion. The sub-city's transformation from a primarily agricultural landscape to a highly urbanized area offers an exemplary case for studying the dynamics of urbanization and its consequences.
2. **Diverse Urban Land Use Changes:** The urban expansion in Bole Sub-City has resulted in significant changes in land use patterns. The conversion of

agricultural land to residential, commercial, and industrial zones has been prominent in this sub-city. Studying Bole provides valuable insights into the relationship between urban growth and land use changes, especially in peri-urban areas where agricultural activities are crucial to the livelihoods of many residents.

3. **Economic and Infrastructure Development:** Bole Sub-City has witnessed substantial infrastructure development, including roads, housing, and social services. The growth of the area is not only driven by population increases but also by the development of new economic opportunities, such as small and medium-sized industries, trade, and real estate. This economic expansion is both a cause and consequence of the broader urban growth process, which directly impacts the local community, economy, and environment.
4. **Socio-economic impact on community**

The rapid urban expansion in Bole Sub-City has had significant socio-economic effects, including displacement of residents, changes in local employment, and shifts in community structures. The peri-urban populations are particularly vulnerable to the negative consequences of urban expansion, such as loss of farmland, disruption of traditional livelihoods, and reduced access to resources. Investigating the specific impacts of urban expansion on the community in Bole will contribute to understanding broader challenges faced by other sub-cities in Adama City.

### 3.3 Research Methodology

The research Methodology is the philosophy or general principle which guides the research. It provides the explanation of data sources, data type and data gathering tools, sampling technique data analysis and interpretation. Research methods are tools that the researcher uses to gather data.

### ***3.3.1. Research Design***

The research design for this study was descriptive and exploratory. It aimed to describe the causes and consequences of urban expansion in Bole Sub-City, Adama City, and explored the broader implications of these findings for urban development in similar contexts. The design integrated both qualitative and quantitative methods to provide a comprehensive analysis of the issue at hand. The descriptive component of the study focused on understanding the state of urban expansion in Bole Sub-City, including the factors driving this expansion and its resulting consequences. This involved identifying specific land-use changes, socio-economic shifts, environmental impacts, and policy gaps. Descriptive analysis was used to map the trends and features of urban expansion, providing a clear picture of the situation. The exploratory component investigated the deeper causes behind urban expansion (e.g., population growth, industrialization, migration) and its multifaceted consequences on communities, infrastructure, the economy, and the environment. This helped identify patterns, relationships, and potential drivers of expansion that had not been fully studied or understood.

### ***3.3.2 Research Types***

Descriptive research designs helps to provide answer to the question of who, what, when, where and how associated with particular research problems. Descriptive study cannot conclusively ascertain answer to why. It is used to obtain information concerning the current status of the phenomena and describe “what exist “with the respect to variable or condition in situation.

Descriptive research is often used as a per-cursor to more qualitative research design with general over view of giving some valuable pointer so as to what variable are worth testing quantitatively and can yield rich data leads to important recommendation. Due to this the researcher selects this type.

### ***3.3.3. Research Approach***

The research approach adopted a mixed-methods approach, combining both qualitative and quantitative techniques. This approach allowed for a comprehensive understanding of the issue by triangulating findings from multiple data sources and methods, ensuring the reliability and validity of the research results.

The qualitative approach focused on gathering in-depth information about the socio-economic, environmental, and political consequences of urban expansion in Bole Sub-City. This was achieved through several methods. In-depth interviews were conducted with key informants, including urban planners, government officials, community leaders, and local residents. These interviews explored their perspectives on the causes of urban expansion and its impacts, as well as policy gaps and potential solutions. Focus group discussions (FGDs) were organized with community members in the expanded areas to gain a deeper understanding of how urban expansion affected their livelihoods, land use, social networks, and access to resources. The quantitative approach provided measurable data on the extent of urban expansion. Geospatial data analysis was conducted using GIS (Geographic Information Systems) and remote sensing technologies to analyze changes in land use over time, such as the conversion of agricultural land to residential, commercial, and industrial uses. Structured surveys were administered to a sample of households in peri-urban areas affected by urban expansion.

### ***3.4. Data Type and Sources***

To accomplish the primary objective of the study, a combination of primary and secondary data sources was utilized. Primary data were gathered from local communities, elderly residents, and experts from city and sub-city administrations. The methods employed for primary data collection included field surveys, structured questionnaires, in-depth interviews with key informants, and focus group discussions.

Secondary data were sourced from various materials, such as books, academic journals, official reports, websites, legal documents, aerial photographs, Landsat imagery, and previous research studies.

To conduct a detailed analysis of urban expansion in the study area, Landsat satellite imagery from the years 1991, 2000, 2010, and 2022 was obtained from the United States Geological Survey (USGS) (Table 1). These specific years were strategically selected based on their significance in reflecting key historical, political, and urban development milestones in the study area.

The year 1991 marks a pivotal period of governmental transition in Ethiopia, which introduced significant policy reforms and restructuring of urban governance. The year 2000 represents a period of initial urban planning efforts and structural plan formulation aimed at addressing urbanization challenges. Similarly, 2010 was chosen due to the implementation of urban reforms and infrastructure development initiatives that accelerated urban growth. Finally, 2022 reflects the most recent state of urban expansion, providing up-to-date information on the changes in land use and urban sprawl.

The Landsat data were processed and analyzed to generate historical land use/land cover (LULC) maps of the study area for each selected year. These maps were used to identify patterns, trends, and spatial dynamics of urban expansion over the 31-year period. Additionally, the analysis provided insights into how urban development has influenced and transformed the natural and built environments within the study area. The selected imagery also ensured consistency in data quality and resolution, enabling accurate comparisons across the different time periods.

Table 1: Landsat data used for the LULCs classification

| Landsat type    | Date of acquisition | Map projection | Projection units | UTM zone | WRS Path & row | Resolution/pixel size (m) | Source/origin                                |
|-----------------|---------------------|----------------|------------------|----------|----------------|---------------------------|----------------------------------------------|
| L5_TM           | 1991                | UTM            | Meters           | 37       | 168 / 054      | 30m x 30m                 | Image courtesy of the U.S. Geological Survey |
| L7_ETM          | 2000                | UTM            | Meters           | 37       | 168 / 054      | 30m x 30m                 | Image courtesy of the U.S. Geological Survey |
| L7_ETM          | 2010                | UTM            | Meters           | 37       | 168 / 054      | 30m x 30m                 | Image courtesy of the U.S. Geological Survey |
| LANDSAT_8/L1_TP | 2022                | UTM            | Meters           | 37       | 168 / 054      | 30m x 30m                 | Image courtesy of the USGS                   |

### ***3.5. Sampling techniques and sample size determination***

To achieve the intended objective of the study purposive sampling methods was employed. Purposive sampling method was used to select the sub cities. The usage of the purposive sampling technique in the study was not arbitrary, but based on its strength in helping select key sub city from which detailed information could be obtained to have a better understanding of specific events and activities. Accordingly, Bole sub city were selected from six sub cities found in Adama city. Bole Sub-City was selected for its significant exposure to urban expansion driven by rapid urbanization, population growth, and industrial development. It has experienced extensive horizontal expansion, including the conversion of agricultural land into residential, commercial, and industrial zones. The sub-city has also been a hub for infrastructure development, economic activities, and real estate growth, making it critical for understanding urban growth and land-use changes.

Additionally, Bole Sub-City illustrates the socio-economic impacts of urban expansion, such as displacement, loss of farmland, and disruption of livelihoods in peri-urban

areas. Its selection, in consultation with Municipality and Sub-City Administration experts, ensures the study focuses on a representative and highly affected area, providing insights to address urbanization challenges in Adama City.

### ***3.5.1. Population***

The research population, also known as the target population, refers to the entire group or set of individuals, objects, or events that possess specific characteristics and are of interest to the researcher. It represents the larger population from which a sample is drawn. For this research the population is the community affected by urban expansion in the study area of the town, particularly in bole sub-city. The population of bole-sub-city from which the sample drawn was 34645

### ***3.5.2. Sample frame***

The sample frame is the list of population elements under study .Since the population under study is infinite and cannot be listed listing the samples frame is unnecessarily.

### ***3.5.3. Samples Units***

The samples units for the research are the households reside in the sub city. These samples units include ever households that live in single compound or share the same compound.

The sampling frame for identifying respondents was based on a list of 34,645 households residing in Bole Sub-City. This number represents the total population used to calculate the sample size required for the study.

To determine the appropriate sample size, the study employed a statistical formula developed by Yamane (1967) (Eq. 1). Yamane's formula is widely used in research to calculate sample sizes for a given population, ensuring a representative sample while accounting for a desired level of precision and confidence. The formula is expressed as:

$$n = \frac{N}{1 + N(\alpha)^2} \text{-----Eq.1}$$

Where: n= sample size of the study population

N=Number of households

$\alpha$ =the margin of error, and

1=constant

Thus, actual sample size was calculated as follows:

$$n = \frac{34645}{1 + 34645 \cdot (0.05)^2}$$

$$n = \frac{34645}{87.6125}$$

$$n=395$$

Accordingly, out of 34645 households, 395 sample informants were selected for household surveys. In order to increase the accuracy of the research results, the research operated at a 95 % level of confidence with a margin of error of 5%.

To select the sample households, a purposive sampling technique was employed to select the 395 households. This method was chosen because it allowed the researcher to intentionally target respondents who were most likely to have relevant knowledge and experience regarding the causes and consequences of urban expansion in the study area. Given the limitations in reaching all households particularly since not all residents were well-informed about urban expansion dynamics purposive sampling ensured the inclusion of individuals who could provide meaningful insights for the research.

To implement this, the households were first stratified based on their proximity to areas significantly affected by urban expansion, such as newly developed residential, commercial, and industrial zones, as well as areas where agricultural land had been converted. From these strata, key informants, including long-term residents, community leaders, and households directly impacted by displacement or land-use changes, were purposefully selected for inclusion in the sample. This approach was supplemented by consultation with sub city officials and urban planners to identify specific neighborhoods and groups most affected by urban growth.

By focusing on households with direct experience or knowledge of urban expansion, the purposive sampling method enabled the research to gather detailed and relevant data on the study objectives, ensuring that the findings were both comprehensive and representative of the dynamics in Bole Sub-City.

The study involved interviews with 20 key informants, including officials from the city and sub-city administrations as well as community elders. Additionally, one focus group discussion (FGD) was conducted with at least six participants. The interviews with key informants aimed to gather insights into the causes and consequences of urban expansion on the communities. Meanwhile, the focus group discussion provided a platform to delve deeper into the experiences of these communities, highlighting shared challenges and identifying recurring themes related to urban expansion in Adama City.

### ***3.6. Data Collection Instruments***

#### **3.6.1. Questionnaires**

The researcher employed a carefully designed questionnaire as the primary tool for data collection from respondents within the selected sample. These questionnaires were tailored to investigate the causes and socio-economic consequences of urban expansion in Adama City. To ensure the content was both accessible and accurate, the questionnaire items were initially drafted in English. They were then translated into Oromifa, the local language, to enhance comprehension and encourage meaningful responses from participants. To maintain the reliability of the translation, a back-translation process was performed, wherein the Oromifa version was retranslated into English to verify the fidelity and accuracy of the original content. The questionnaire incorporated a mix of closed-ended and open-ended questions. The closed-ended questions provided structured options, allowing respondents to choose from predefined answers, ensuring consistency and facilitating quantitative analysis. Meanwhile, the open-ended questions offered respondents the opportunity to elaborate on their views, experiences, and insights, enabling the researcher to capture a richer and more nuanced understanding of the issues related to urban expansion in the area. This dual approach

ensured a comprehensive data collection process, combining the benefits of both quantitative and qualitative methods to address the study's objectives effectively.

### **3.6.2. Key Informant Interview**

An interview is essentially a structured conversation that involves a face-to-face verbal exchange between two or more individuals. In this process, the interviewer seeks to obtain information, opinions, or beliefs from the interviewee(s). This method is particularly valuable as it allows for the collection of additional insights while offering a high degree of flexibility to probe deeper into responses as needed.

In this study, the researcher conducted structured, face-to-face personal interviews with a total of 20 participants, including officials and community elders. These interviews were guided by carefully prepared interview questions tailored to address the key objectives of the research. The officials and professionals selected for the interviews were those directly engaged with the subject matter, as they were believed to possess more detailed and relevant data compared to others.

In addition to consulting professionals, community elders were also interviewed. Elders hold a wealth of knowledge and experience, particularly about historical and cultural changes in the study area, making their contributions invaluable. Unlike younger individuals, elders can provide rich, detailed accounts of transformations that have occurred over time, offering unique perspectives that complement the insights from other respondents. This combination of interviews with experts and community members ensured a comprehensive understanding of the research topic.

### **3.6.3. Focus Group Discussion**

Focus group discussions (FGDs) are a qualitative research method that involves collective interviews where participants engage in discussions facilitated by the researcher to generate in-depth insights. Typically consisting of 6-8 participants, focus groups allow for the exploration of participants' opinions, attitudes, values, and expectations about a specific topic. In this study, FGDs was employed to gather data on the urban growth of Adama City and its impacts on the communities.

A total of one focus group discussion was conducted, with 6-8 participants per group. The participants were selected from the communities. These included representatives from the affected the communities, leaders of local social institutions, administrative officials, land management authorities, and experts with relevant experience. The FGDs was structured around open-ended questions that created an open and collaborative environment for participants to share their perspectives. The discussions focused on the historical development of Adama City and its consequences on the way of life for local communities, providing valuable insights into the causes and consequences of urban expansion in the city.

### ***3.7. Data Image Analysis***

#### **3.7.1. Data Image Pre-Processing**

Data pre-processing involves essential steps performed before conducting primary data analysis and extracting meaningful information. To achieve the research objectives, multi-temporal satellite imagery was utilized. This includes:

- Thematic Mapper (TM) (L5TM) for the year 1991,
- Enhanced Thematic Mapper Plus (ETM+) (L5ETM) for the year 2002,
- Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS) from Landsat 8 for the years 2000 and 2022, all with a path of 168 and row 054.

Additionally, a **topographic map** with a scale of **1:100,000** was employed to provide spatial references and assist in identifying data patterns over nearly three decades (30 years).

The raw satellite imagery was subjected to a series of pre-processing steps to prepare it for analysis:

1. **Georeferencing:** Ensuring spatial accuracy by aligning the imagery to a defined coordinate system to match real-world locations.
2. **Clipping:** Extracting the study area's boundaries from the satellite images to isolate relevant data for focused analysis.

These steps ensure that the data is accurate, consistent, and properly aligned for further processing and analysis to address the study's objectives.

### **3.7.2. Data Image Geometric Correction**

For this research, the processing of the Landsat images involved several detailed steps to ensure accuracy and relevance for analysis.

1. **Geometric Rectification:** The Landsat images were geometrically rectified by aligning them with identifiable reference points such as street intersections and stream junctions visible on the satellite images. This process ensured that the spatial positioning of the images matched real-world coordinates.
2. **Use of Reference Maps:** To enhance the accuracy of the rectification process, a 1:100,000 scaled topographic map of the study area was employed. The map provided a reliable spatial framework to validate the alignment and ensure precise georeferencing of the satellite imagery.
3. **Georeferencing:** Once rectified, the Landsat images were georeferenced to assign them accurate geographic coordinates. This step involved registering the satellite images to a specific coordinate system, ensuring that the imagery corresponded accurately to the actual location of the study area.
4. **Clipping of Data:** After georeferencing, the raw Landsat data were clipped using the boundaries of the study area. This process involved extracting only the portion of the satellite imagery that fell within the defined boundaries, eliminating extraneous data outside the area of interest.
5. **Processing in ArcGIS Software:** The clipped and georeferenced images were then imported into ArcGIS software for further processing and analysis. ArcGIS tools were used to conduct tasks such as classification, land use/land cover mapping, and change detection to assess urban expansion in the study area.

These systematic steps ensured that the Landsat imagery was accurately processed and prepared for detailed spatial analysis relevant to the research objectives.

### 3.7.3. Data Image Enhancement

Image enhancement is a crucial process used to improve the visual quality of an image by increasing the apparent contrast between various components within the scene. This technique allows distinctive features of the image to become more prominent, facilitating better analysis, classification, and interpretation. By enhancing the image, the subtle details and unique characteristics are made more visible, aiding researchers in achieving higher analysis accuracy and quality.

One key method of image enhancement involves adjusting the brightness levels of the image. The minimum and maximum brightness values of the image are mapped to the minimum and maximum display values. This adjustment simplifies the interpretation of the visual content by making the details more distinguishable. Specifically, the low dynamic range of the image is stretched to utilize the entire available dynamic range (0 to 256), improving the overall visibility of the image. This process, known as histogram equalization, ensures that the contrast across the image is enhanced, enabling clearer differentiation of features.

Additionally, spatial enhancement techniques were applied to the satellite images corresponding to the selected years. In particular, a high-pass filter with a Kernel size of 5x5 was used for spatial improvement. This filtering technique highlights finer details and edges in the images by suppressing low-frequency components, making high-frequency elements more prominent. These enhancements are essential for improving the precision of visual analysis and ensuring that the resulting data are suitable for categorization and interpretation.

By applying these image enhancement methods, the satellite imagery becomes a more reliable and informative resource for conducting detailed visual and analytical studies.

### 3.7.4. Data Image Classification Analysis

To classify the land use and land cover (LULC) types for each reference year (1991, 2000, 2010, and 2022), a **pixel-based supervised image classification approach** was

employed. The classification process utilized the **maximum likelihood classification algorithm** (Lillesand & Kiefer, 2000), which is widely recognized for its accuracy in analyzing multispectral satellite imagery. This method assigns each pixel to a specific LULC category based on its spectral signature and the probability that it belongs to a particular class.

The classification focused on identifying the following major LULC categories:

1. **Built-up Areas:** Representing areas covered by buildings, roads, and other infrastructure associated with urban development.
2. **Bareland:** Referring to areas with exposed soil, sand, or rocks, which lack significant vegetation cover.
3. **Agriculture:** Encompassing land used for crop cultivation and farming activities.
4. **Vegetation:** Including areas dominated by natural vegetation such as forests, grasslands, and shrubs.

These LULC types were chosen to reflect the key features and land use patterns in the study area, allowing for a comprehensive analysis of land use changes and urban expansion over the study period.

This approach ensured a consistent and reliable classification across all reference years, facilitating the comparison of LULC changes over time and enabling the generation of historical land use/land cover maps for the study area.

Ground truth points from a variety of sources were employed to train and assess the accuracy of land use and land cover (LULC) maps for the years 1991, 2000, 2010, and 2022. For maps of areas smaller than 4000 km<sup>2</sup> with fewer than 12 LULC classes, a minimum of 50 samples per class is recommended for classification accuracy (Lillesand et al., 2008). Given that Adama city spans 311 km<sup>2</sup> and includes four distinct LULC classes, a minimum of 50 random ground truth points was collected for each class.

For the years 1991, 2000, and 2010, ground truth points were obtained from the following sources:

- Google Earth high-resolution imagery: Utilized to visually identify and validate the LULC classes within the city for each reference year.
- The researcher's personal experience: Leveraged the researcher's previous knowledge of the area and its LULC changes over time.
- Local community knowledge: Engaged with local residents to gather information on land use patterns, providing insights into the LULC for the respective years.

For the year 2022, ground truth points were collected through a combination of field visits and visual interpretation of Google Earth high-resolution images. The field visits allowed for direct observation and confirmation of LULC classes, while the images provided supplementary data for validation.

Despite the accuracy of remote sensing imagery, creating a digitally generated land cover map inevitably involves some degree of error. These errors can arise during both the data collection phase and the image processing phase. As such, assessing the accuracy of the classification is a critical step in ensuring that the resulting maps are reliable and reflect true land cover conditions. Accuracy assessment is an essential process in land use/land cover detection, as it helps quantify how well the classification results align with actual real-world conditions. Additionally, it enables accurate estimation of temporal land cover changes.

In this study, the accuracy of the land cover maps for the years 1991, 2000, 2010, and 2022 was evaluated using an error matrix. This method compares the classified image's information with reference site data collected from the ground truth points for multiple sample areas. The evaluation involves calculating several key metrics:

- Overall accuracy: Represents the percentage of correctly classified pixels in the image.

- Producer's accuracy: Reflects the probability that a reference site with a given LULC class was correctly classified.
- User's accuracy: Indicates the probability that a pixel classified into a given class corresponds to that class on the ground.
- Kappa statistic: A statistical measure that assesses the agreement between the reference data and the classified image, adjusted for chance agreement.

The accuracy metrics were calculated for each year by applying the relevant formulas to the error matrix derived from the ground truth points. These formulas allow for a comprehensive evaluation of the classification's effectiveness and help quantify the level of accuracy in the LULC maps for each reference year.

$$\text{Users Accuracy} = \frac{\text{Number of Correctly Classified Pixels in each category}}{\text{Total number of classified pixels in that category (The Row Total)}} * 100$$

$$\text{Producer Accuracy} = \frac{\text{Number of Correctly Classified Pixels in each category}}{\text{Total number of classified pixels in that category (The Column Total)}} * 100$$

$$\text{Kappa Coefficient (T)} = \frac{(TS * TCS) - \sum (\text{Column Total} * \text{Row Total})}{TS^2 - \sum (\text{Column Total} * \text{Row Total})} * 100$$

$$\text{Over Accuracy} = \frac{\text{Total Number of Correctly Classified pixels (Diagonal)}}{\text{Total Number of Reference Pixels}} * 100$$

### ***3.8. Data Analysis of the socioeconomic part***

The study employed a combination of both quantitative and qualitative data for a comprehensive analysis, utilizing a mixed-methods approach to ensure a thorough examination of the research questions. For the quantitative component, all completed questionnaires were carefully collected, edited for accuracy, and subsequently analyzed. The data was processed using descriptive statistical techniques, with a primary focus on calculating key measures such as the mean, frequency distributions, and percentages. In addition, standard deviation was employed to measure the variability or spread of the data points, allowing for a clearer understanding of the data patterns and trends. The qualitative component of the study involved data collected from focus group discussions, key informant interviews, and personal observations. These qualitative data

were systematically documented in notebooks, ensuring that the information was organized and clearly presented. The collected data were then analyzed by reviewing and categorizing the content, which was interpreted and presented in a coherent manner. The narrative data derived from key informant interviews were particularly organized as oral accounts, which were transcribed and analyzed for recurring themes, patterns, and insights. This narrative approach enabled the research team to explore in depth the perspectives and experiences of the participants, enriching the overall analysis and providing a more holistic understanding of the subject under study.

### ***3.9. Ethical Consideration***

During the thesis writing process, it is crucial for researchers to anticipate and address the potential ethical issues that may arise throughout the study. Since research often involves the collection of data from individuals, researchers must prioritize the protection of research participants. This includes building trust with participants, ensuring the integrity of the research, and safeguarding against any misconduct or impropriety that could reflect negatively on both the researcher and the university. Furthermore, researchers must be prepared to navigate emerging ethical challenges, ensuring their approach aligns with established ethical standards (Israel & Hay, 2006).

To maintain ethical standards, the data collected during the study was strictly used for academic purposes. To assure participants of this, an official introduction letter from the university was obtained and provided to each respondent. Additionally, informed consent was obtained from all research participants, ensuring they fully understood the purpose and nature of the study. Throughout the research process, utmost attention was given to maintaining the privacy and confidentiality of participants at every stage of the study, reinforcing the commitment to ethical conduct.

From the questioner distributed to the interviewers collected at different day show almost consistent answer and the interviewed respondents in the same condition responds at the same level of confidence. Due to this my data collection method is reliable for this research.

## **CHAPTER FOUR**

### **RESULT AND DISCUSSION**

As outlined in the previous chapter, this study delves into the causes and consequences of urban expansion, with a particular focus on Adama City. In this chapter, the findings of the research are presented in a structured manner, divided into four key sections: demographic information, changes in land use patterns resulting from urban expansion, the underlying drivers contributing to urban expansion, and the consequences of urban expansion. Each of these sections provides an in-depth analysis of the various facets of urban growth, examining how demographic factors shape expansion trends, how land use patterns have shifted over time, the forces driving the urban sprawl, and the social, environmental, and economic impacts of such expansion. This chapter aims to offer a comprehensive understanding of urban expansion in Adama City, supported by data and insights derived from the study.

#### ***4.1. Response Rate***

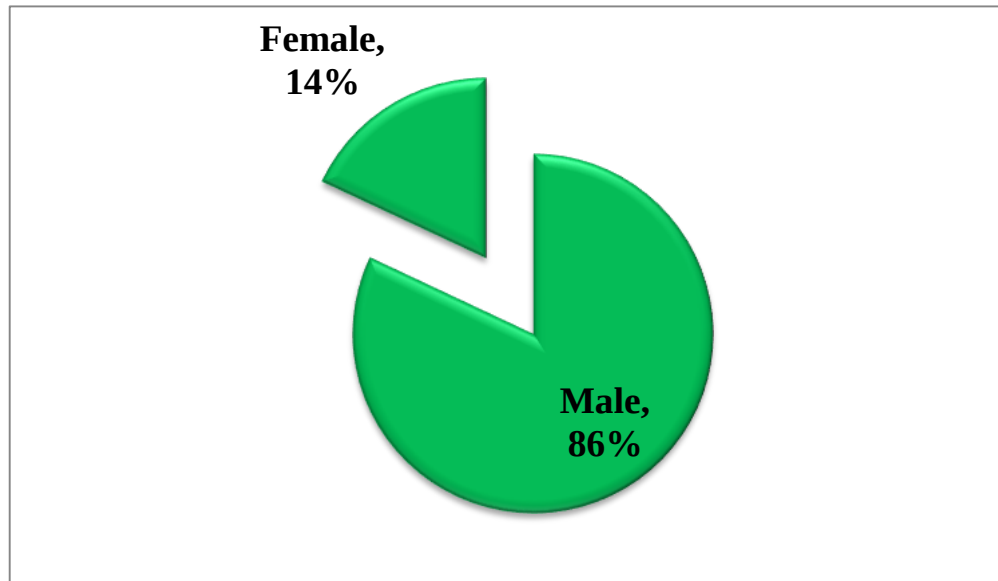
The research employed both structured and unstructured questionnaires to thoroughly investigate the research problem. A total of 395 questionnaires were initially designed, with the intention of distributing them across the study area. The questionnaires were administered to respondents within the study region, ensuring comprehensive data collection. Out of the 395 questionnaires distributed, 364 were returned, which accounts for 92% of the total number distributed. These 364 returned questionnaires were all deemed valid for analysis. Additionally, 20 key informants were purposefully selected from various offices to participate in the study. These individuals were chosen based on their expertise and relevance to the study topic. They were engaged through interview questions designed to gather in-depth qualitative insights related to the research problem. The data analysis for this study relied on two key sources. The first was the quantitative data derived from the 364 completed questionnaires. The second source consisted of qualitative data obtained from the interviews with the 20 key informants, as well as from one focus group discussion that was conducted. This combined approach provided a robust set of data for addressing the research questions and drawing meaningful conclusions.

## ***4.2. Background of the Respondents***

### **4.2.1 Sex Composition of Respondents**

Figure 5 shows that 14% of the respondents to the survey were female and 86% were male. This indicates that participants of both sexes actively participated in the survey. This implies that both gender groups were surveyed for their perceptions of causes and consequences of urban expansion.

In the context of this study, the survey results will be used to understand the diverse experiences of men and women living in Adama City, particularly in areas affected by urban expansion. This distinction is crucial because the impacts of urban expansion are often experienced differently by various groups, including men and women. For instance, women may face greater challenges than men when it comes to displacement, as they are often more dependent on their homes and communities for social and economic support. Furthermore, women may encounter more barriers in accessing employment opportunities in the expanded urban areas due to gender-based inequalities in the labor market. On the other hand, men might be more involved in economic activities linked to the new urban infrastructure but may also face challenges related to changes in their livelihoods and social structures. Understanding these gendered impacts is essential for developing policies and strategies that address the unique needs of both men and women in the face of urban expansion. This approach aligns with the findings of Talema & Nigusie (2023), which emphasize the importance of considering gender in urban development studies.

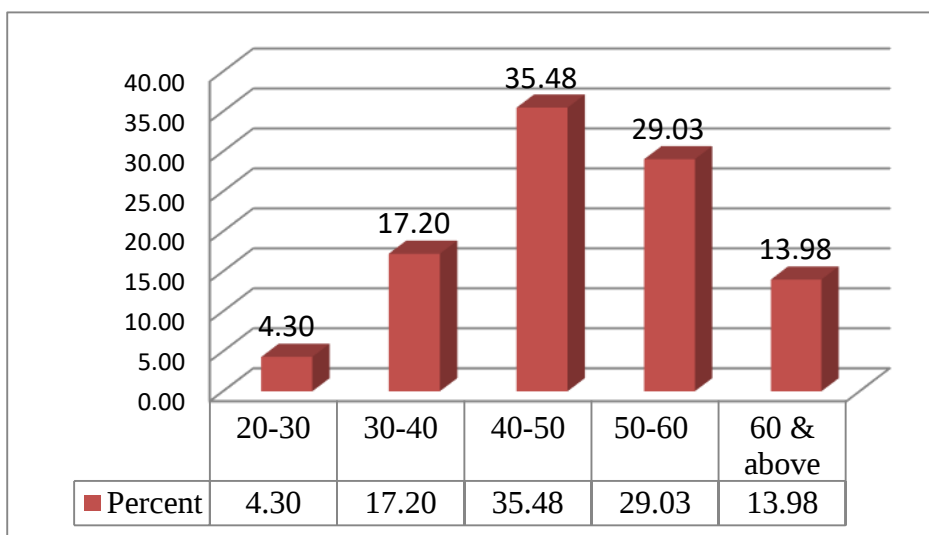


**Figure 4:- Sex Composition of Respondents**

#### **4.2.2 Age Composition of Respondent**

The age distribution of the household heads in the study area was relatively even, with most respondents falling between the ages of 30 and 60 (81.6%). There was a smaller percentage of respondents under the age of 30 (4.3%) and over the age of 60 (13.98%) (Figure 6). This suggests that the majority of respondents are economically productive and have a good understanding of the historical expansion of the study area, as well as causes and consequences of the urban expansion.

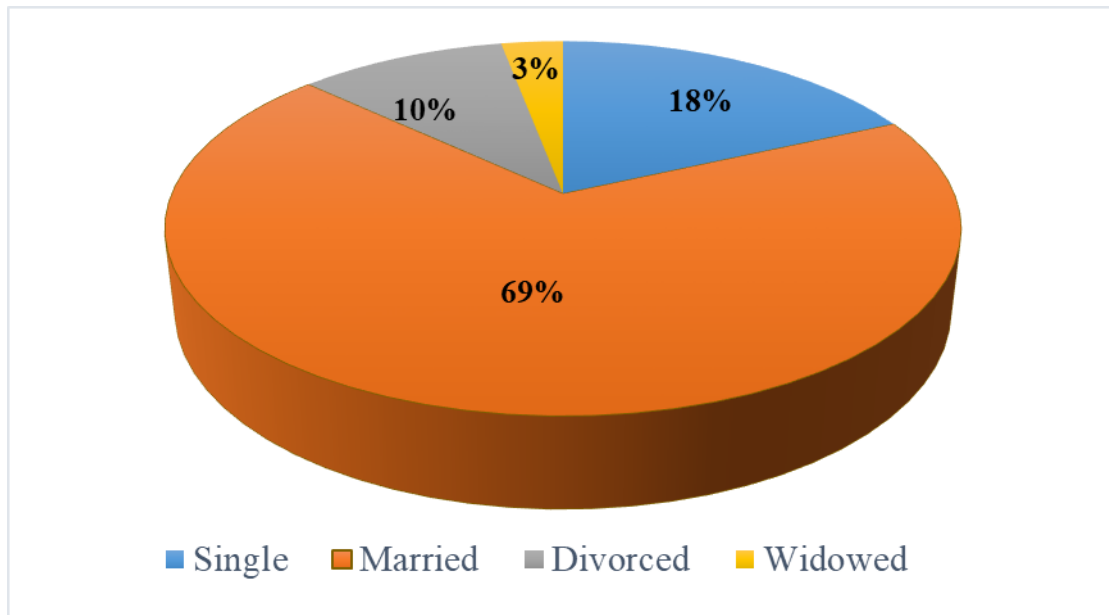
In other words, the data shows that the study area has a diverse population of household heads of all ages, but most are economically productive and have a good understanding of the city history and development. This is important because it means that the respondents have a wide range of perspectives and experiences that can be drawn on to inform the research project.



**Figure 5:-: Age Composition of Respondents**

### **4.2.3 Marital status of the respondents**

The household survey conducted revealed the following marital status distribution among the respondents: 18% identified as single, 69% were married, 10% were divorced, and 3% were widowed, as depicted in Figure 7. These statistics provide a snapshot of the community's demographic structure, offering valuable insights into the socio-economic characteristics of Adama City's population. The high percentage of married individuals (69%) suggests that family units remain a central aspect of social organization, which could be reflective of traditional cultural values within the area. The 10% divorce rate and 3% widowed rate may point to the challenges and transitions faced by certain households, particularly in relation to changes in family structures. Understanding these dynamics is crucial for assessing the broader socio-economic impacts of urban expansion in the city, especially in terms of how shifts in family composition may influence housing demand, economic stability, and community development.



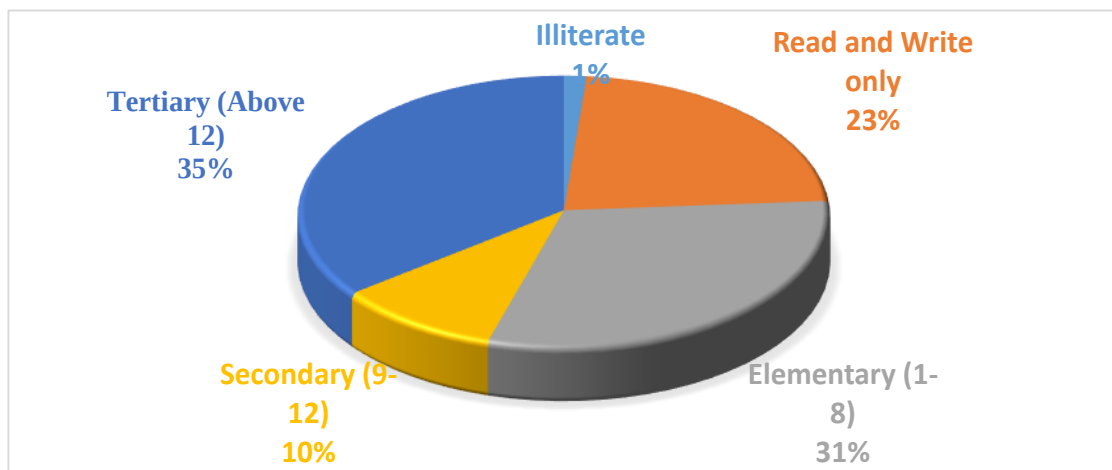
**Figure 6:-** Marital status of the respondents

#### **4.2.4. Educational level of the respondents**

The educational status of the respondents is a key factor in understanding the socio-economic consequences of urban expansion in Adama City. Figure 8 presents the educational background of the individuals surveyed, which is essential in analyzing how urban growth affects educational attainment. Among the respondents, 1.4% were illiterate, unable to read or write, which highlights the challenges faced by a small segment of the population in accessing basic education. A further 22.5% could read and write but had not completed formal schooling beyond basic literacy, suggesting that urban expansion may not be reaching all individuals in terms of educational support.

The largest portion, 30.7%, had completed elementary education (grades 1-8), indicating that urban growth may be driving more access to primary education, but there may still be gaps in continuing education beyond that level. With 10% having completed secondary education (grades 9-12), and 35.4% holding tertiary qualifications (college or university degrees), the data points to a relatively high level of higher education, which may be linked to the increasing demand for skilled labor in a growing urban economy.

These findings indicate that while urban expansion in Adama City may create more opportunities for education and employment, it could also be contributing to disparities in educational access and outcomes, particularly for those in lower-income households or those living in more peripheral areas. The educational levels of the population directly influence their socio-economic mobility, and understanding this dynamic is crucial for shaping policies that ensure inclusive development as the city continues to grow.



**Figure 7:-** Education level of the respondents

#### ***4.2. Changes in land use patterns due to urban expansion***

Adama City has undergone significant changes in land use patterns over three key periods: 1991-2000, 2000-2010, and 2010-2022. These shifts underscore the city's transformation, with important implications for urban development, environmental management, and future planning.

Table 2 Area of LULC Classes in Adama City from 1991 to 2022

| LULC Type   | 1991 (km <sup>2</sup> ) | 2000 (km <sup>2</sup> ) | 2010 (km <sup>2</sup> ) | 2022 (km <sup>2</sup> ) |
|-------------|-------------------------|-------------------------|-------------------------|-------------------------|
| Agriculture | 224.83                  | 235.90                  | 235.45                  | 173.55                  |
| Bare Land   | 57.60                   | 41.33                   | 35.04                   | 45.26                   |
| Built Up    | 6.46                    | 12.88                   | 20.42                   | 58.98                   |
| Vegetation  | 22.31                   | 21.10                   | 20.34                   | 33.15                   |

Table 3 Area and Percentage Change of LULC in Adama City from 1991 to 2022

| LULC Type   | 1991–2000<br>(km <sup>2</sup> , %) | 2000–2010<br>(km <sup>2</sup> , %) | 2010–2022<br>(km <sup>2</sup> , %) | 1991–2022<br>(km <sup>2</sup> , %) |
|-------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|
| Agriculture | +11.07 (+5%)                       | -0.45 (-0.2%)                      | -61.90 (-26%)                      | -51.28 (-23%)                      |
| Bare Land   | -16.27 (-28%)                      | -6.29 (-15%)                       | +10.22 (+29%)                      | -12.34 (-21%)                      |
| Built Up    | +6.42 (+99%)                       | +7.54 (+59%)                       | +38.56 (+189%)                     | +52.52 (+813%)                     |
| Vegetation  | -1.21 (-5%)                        | -0.76 (-4%)                        | +12.81 (+63%)                      | +10.84 (+49%)                      |

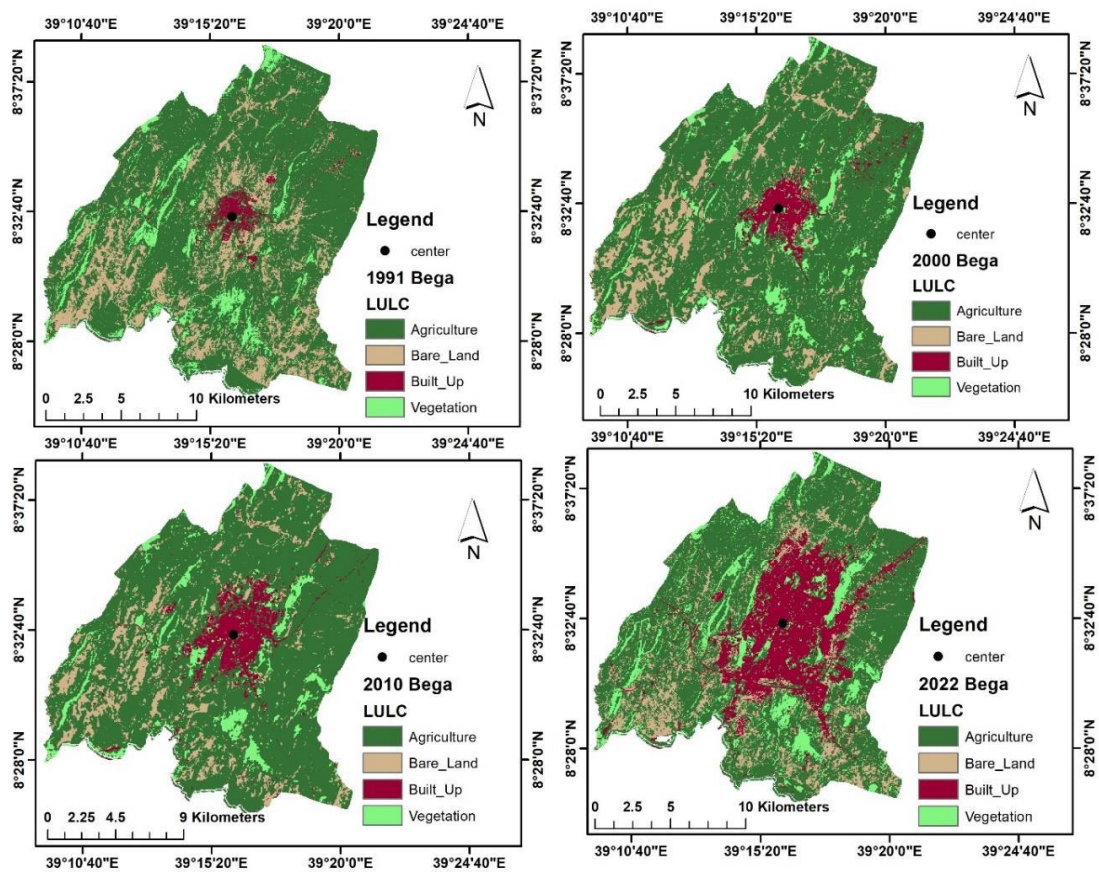
From 1991 to 2000, Adama City experienced moderate shifts in land use. Agricultural land expanded by 5%, from 224.83 sq km to 235.9 sq km, showing a slight increase of 11.07 sq km. Conversely, bare land, which is typically undeveloped or unused land, significantly decreased by 28%, dropping from 57.6 sq km to 41.33 sq km. The built-up area, representing urbanization, saw a substantial 99% increase, growing by 6.42 sq km, from 6.46 sq km to 12.88 sq km. During this period, vegetation cover also witnessed a small decrease of 5%, shrinking from 22.31 sq km to 21.10 sq km, reflecting the encroachment of urban development on green spaces.

From 2000 to 2010, agricultural land use experienced a slight decline of 0.2%, decreasing by 0.45 sq km, from 235.9 sq km to 235.45 sq km. In contrast, the built-up area continued to grow, expanding by 59% or 7.54 sq km, from 12.88 sq km to 20.42 sq km, as urban sprawl continued to accommodate a growing population. Bare land saw a reduction of 15%, from 41.33 sq km to 35.04 sq km, indicating the city's efforts to utilize previously unused spaces. Vegetation cover decreased by 4%, from 21.10 sq km to 20.34 sq km, although the change was less significant compared to earlier years.

Between 2010 and 2022, the transformation of Adama City became more pronounced. Agricultural land use saw a sharp decrease of 26%, shrinking by 61.9 sq km, from 235.45 sq km to 173.55 sq km, likely driven by both urban expansion and land-use change for industrial or infrastructure development. Interestingly, bare land increased by 29%, growing by 10.22 sq km, from 35.04 sq km to 45.26 sq km, suggesting that urban sprawl resulted in the conversion of previously built-up or semi-developed areas into vacant spaces. However, the most significant growth occurred in the built-up area, which expanded by an extraordinary 189%, increasing by 38.56 sq km, from 20.42 sq km to 58.98 sq km. This surge reflects the rapid urbanization and population growth the

city experienced in this period. On a positive note, vegetation cover saw a significant recovery, increasing by 63%, from 20.34 sq km to 33.15 sq km, possibly due to planned green spaces or reforestation efforts.

When looking at the entire period from 1991 to 2022, the cumulative changes are stark. Agricultural land use decreased by 23%, shrinking by 51.28 sq km, from 224.83 sq km to 173.55 sq km, reflecting the city's increasing conversion of agricultural land to urban uses. The bare land decreased by 21%, from 57.6 sq km to 45.26 sq km, highlighting a reduction in unused land, while the built-up area skyrocketed by 813%, expanding by 52.52 sq km, from 6.46 sq km to 58.98 sq km. This massive increase underscores the rapid urbanization of Adama City. Vegetation cover, in the long run, saw a 49% increase, growing by 10.84 sq km, from 22.31 sq km to 33.15 sq km, possibly as a result of concerted efforts to balance development with green spaces.



**Figure 8:-** LULC Map of Adama City from 1991 – 2022

Overall, the study demonstrates the rapid expansion of Adama City, primarily driven by urbanization and the increasing demand for housing and infrastructure. While agricultural land has decreased, and the built-up area has expanded dramatically, there have been some positive trends, such as the increase in vegetation cover in recent years. These findings highlight the complex dynamics of urban growth, the challenges of land use management, and the potential for future planning to mitigate negative impacts while fostering sustainable urban development.

### 4.3. Accuracy Assessment

LULC classification accuracy was assessed quantitatively using an error matrix, which is a commonly used method for evaluating LULC classification accuracy. The accuracy assessment in this study revealed the overall accuracies of 86.17%, 94.77%, 95.34%, and 89.78% for 1991, 2000, 2010, and 2022, respectively. These values indicate that all classifications fall within the acceptable range, as the overall accuracy for each year exceeds 85%. Additionally, the kappa coefficients of 0.73, 0.92, 0.93, and 0.85 for 1991, 2000, 2010, and 2022, respectively, suggest strong (almost perfect) agreement, which is a strong indicator of the accuracy of the classification results. A summary of the error matrix table results is presented in Table 5.

Table 4 Error Matrix of Land Use/Land Cover Classification (1991-2022)

| Land Use/Land Cover (LULC) | PA     | UA    | PA     | UA     | PA     | UA    | PA     | UA    |
|----------------------------|--------|-------|--------|--------|--------|-------|--------|-------|
|                            | 1991   |       | 2000   |        | 2010   |       | 2022   |       |
| Built Up                   | 67.38  | 95.73 | 93.09  | 100.00 | 92.15  | 99.35 | 94.39  | 98.18 |
| Bare Land                  | 64.87  | 77.51 | 97.14  | 90.18  | 98.74  | 97.52 | 85.98  | 82.06 |
| Vegetation                 | 85.75  | 87.60 | 92.24  | 97.70  | 96.42  | 86.92 | 81.54  | 90.88 |
| Agriculture                | 93.97  | 87.10 | 95.75  | 93.68  | 94.46  | 97.31 | 92.96  | 87.39 |
| Overall Accuracy (%)       | 86.17% |       | 94.77% |        | 95.34% |       | 89.78% |       |
| Kappa Coefficient          | 0.73   |       | 0.92   |        | 0.93   |       | 0.85   |       |

#### 4.4. Causes of urban expansion in the study area

The urban expansion of Adama Town is a multifaceted process influenced by a variety of interconnected factors, including social, economic, political, and environmental dynamics. Understanding the causes of urban expansion in the study area requires a comprehensive analysis of these factors. To identify the key drivers of this growth, a household survey was conducted, gathering insights from local residents. Based on the responses from the survey, several factors have been highlighted as significant contributors to urban expansion in Adama City. These include population growth, improved infrastructure accessibility, the reclassification of former rural settlements into urban areas, the town's topography, its proximity to Addis Ababa, and land speculation. The following figure (Figure 10) presents a summary of the respondents' views on the factors influencing urban expansion in Adama.

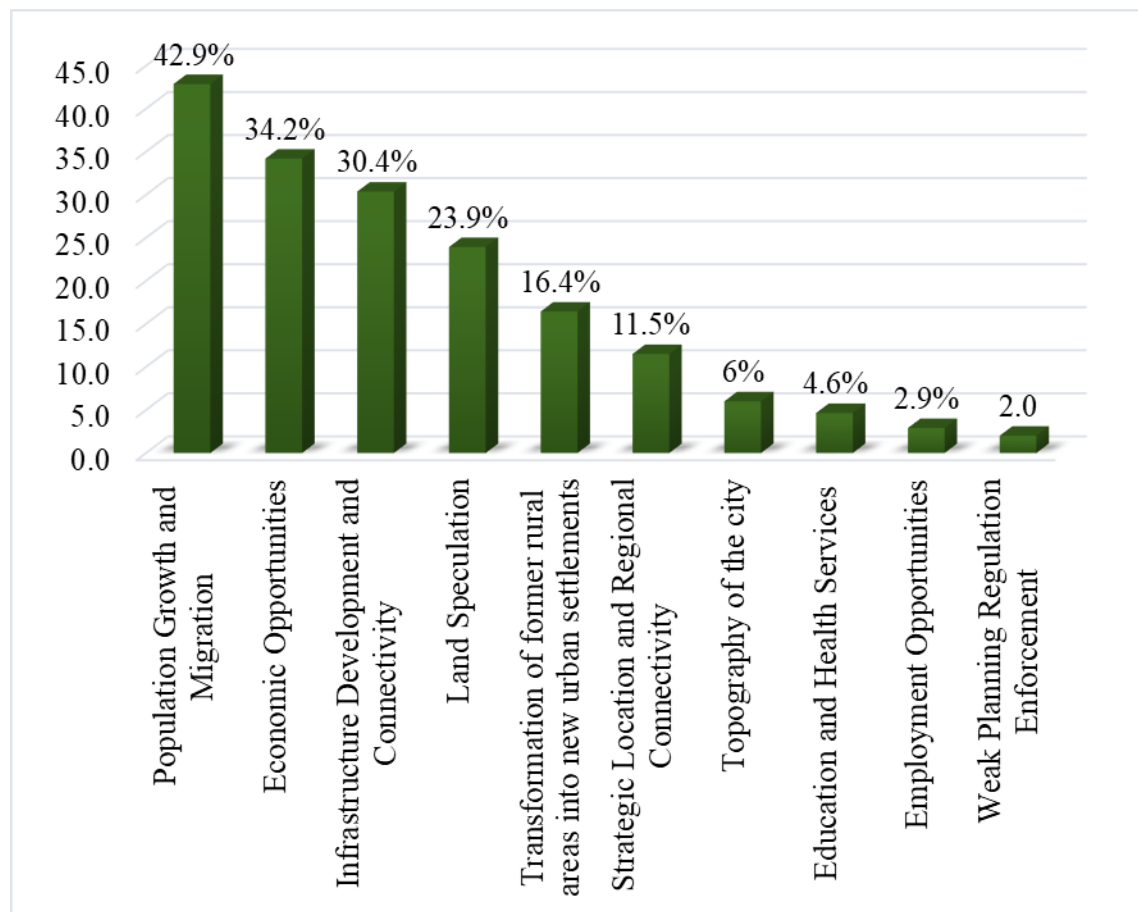


Figure 9: Factors contributes to urban expansion

The factors identified by the respondents are discussed in detail in the following sub-sections, supported by data gathered from interviews, focus group discussions, and field observations. These insights provide a deeper understanding of the key drivers influencing urban expansion in developing countries. The subsequent analysis delves into each factor, presenting both qualitative and quantitative evidence to support the findings.

#### **4.4.1. Population Growth and Migration**

The rapid growth of Adama's population has been a primary cause of urban expansion. As the town experiences an influx of people from rural areas, it has seen significant demographic changes, which have resulted in urban sprawl. According to the survey, 42.9% of respondents identified population growth and migration as the main factor driving urban expansion in Adama. This percentage highlights that more than one-third of the respondents recognize population growth as a significant contributor to the rapid growth of the city. The migration from rural to urban areas is a well-established phenomenon in many developing countries, and Adama is no exception, as it has become a central point of attraction for those seeking better opportunities.

The reasons why population growth leads to urban expansion in Adama are multifaceted. A primary factor is the increased demand for housing, commercial services, and public amenities. As the population expands, new neighbourhoods need to be developed, and existing ones must be expanded to accommodate the growing demand. This demand for new housing developments and commercial spaces pushes the urban boundaries outward. The process of urban expansion is further accelerated as developers respond to the increasing demand for land, leading to the establishment of new residential and commercial zones on the outskirts of the city.

Another significant consequence of population growth is the strain it places on existing infrastructure and resources. As the town's population increases rapidly, the existing infrastructure, such as water supply systems, road networks, and public schools, struggles to meet the needs of the growing population. The inadequacy of infrastructure in central urban areas drives the expansion of infrastructure into newly developed areas.

New water lines, road systems, and schools are built in the suburbs and outlying districts, facilitating further urban growth. This demand for infrastructure expansion in peripheral areas, combined with the need to accommodate new residents, is a key driver of urban sprawl in Adama.

The focus group discussions further revealed that rural-to-urban migration plays a critical role in Adama's population growth. People are leaving rural areas in search of better economic opportunities, access to education, healthcare services, and improved living standards. The promise of better employment prospects, particularly in industries and services concentrated in urban areas, encourages people to move to Adama. As they settle in the town, they contribute to the overall population increase, intensifying the demand for housing and services. These trends align with studies from other developing regions, where rural-to-urban migration is often cited as a driving force for urban growth.

Supporting these findings, Kassa's (2014) study highlighted that population growth is a significant factor behind urban expansion in many developing countries, including Ethiopia. Kassa's research underscores that as population numbers increase, there is a higher demand for housing, land, and various resources, which often results in the development of new suburbs on the outskirts of cities and the densification of existing urban areas. This phenomenon of urban sprawl is particularly evident in cities like Adama, where rural migrants contribute to both the population growth and the subsequent strain on urban infrastructure and services.

Thus, the combination of migration from rural areas and natural population growth has created a cycle of increased demand for housing, services, and infrastructure, all of which contribute to the continued urban expansion of Adama. This dynamic is common in developing cities where rapid population growth outpaces the development of infrastructure, requiring both government and private-sector interventions to ensure that urban expansion is managed in a sustainable manner.

#### **4.4.2. Economic Opportunities**

Economic opportunities have been identified by 34.2% of respondents as a primary factor driving urban expansion in Adama. This reflects the significant role that economic growth, especially in the industrial and commercial sectors, plays in the town's rapid urbanization. The proliferation of industries, businesses, and commercial activities within Adama has had a direct impact on its spatial growth, contributing to a steady outward expansion. According to information obtained from one of the key informants,

*".....as industries grow and new businesses establish themselves in Adama, they attract both workers and entrepreneurs, which creates a demand for additional infrastructure, housing, and services. Adama's industrial base, particularly in manufacturing and services, requires large areas of land for the construction of factories, offices, and commercial facilities. This demand for space has led to the development of surrounding areas to accommodate these new establishments. Consequently, new neighborhoods and industrial zones are being established on the town's periphery, further driving the spread of the urban area."*

The information obtained from the focus group discussion revealed that, in addition to providing jobs, economic opportunities also stimulate the local economy by attracting investments and businesses in the town. This has made Adama an increasingly important center for trade and industry in the region. As more businesses and industries settle in the area, the need for residential areas to house workers has become a significant driver of urban sprawl. This shift in land use, from agricultural to industrial and commercial, is a common pattern in many rapidly growing urban centers.

Interviews with key informants and focus group discussions revealed that the availability of economic opportunities, such as employment in factories, service sectors, and trade, is a major draw for migrants from surrounding rural areas. These migrants, in search of better livelihoods, contribute to the population growth of the town, which in turn creates more demand for housing, retail services, and public infrastructure.

#### **4.4.3. Infrastructure Development and Connectivity**

Infrastructure has consistently played a pivotal role in driving urban expansion in Ethiopia, as it provides the essential services and amenities necessary for people to live and work in urban areas. A survey conducted in Adama revealed that 30.4% of respondents identified infrastructure facilities as a key factor in the city's urban growth. In addition, focus group discussions highlighted that many individuals migrate from rural areas to Adama in search of improved access to social infrastructure such as education, healthcare, transportation, electricity, and communication services.

Studies conducted by El-Bouayady et al. (2024) and Koroso et al. (2021) emphasize the critical role that infrastructure plays in fostering urban expansion. Firstly, the development of infrastructure significantly facilitates commuting, making newly developed areas more desirable for residents. This is particularly beneficial for individuals working in central urban areas who require reliable transportation options. Secondly, infrastructure development provides businesses with the support they need to flourish. Areas with well-established transportation networks are more appealing for businesses that rely on the efficient movement of goods and services. Lastly, the improvement of infrastructure contributes to an enhanced quality of life for residents in expanding urban zones. Access to amenities such as parks, recreational spaces, and other public services not only makes these areas more attractive to live in but also improves the overall livability of the neighborhoods. This collective impact of infrastructure development is a major factor driving urban growth. According to one of the key informants:

*".....improved connectivity has made it easier for people to live further from the urban core while still being able to access employment and services. This enhanced transportation network allows residents to enjoy more affordable housing options on the outskirts of the city, without sacrificing access to the jobs and amenities located in the central urban areas. As a result, we have seen a shift in settlement patterns, with more people choosing to live in newly developed neighborhoods that are well-connected to the main city through roads and public transportation."*

#### **4.4.4. Land Speculation**

Land speculation, the practice of purchasing land with the intent to sell it for profit, often in the short term, is a significant driver of urban expansion. This phenomenon is particularly prominent in the outskirts of towns and cities, where speculators buy land in anticipation of future urban development. Even in the absence of immediate demand for urban space, this speculative activity can lead to the conversion of agricultural land and open spaces into urban areas. Such transformations contribute to the rapid spread of urban boundaries, even when there is no pressing need for new development in these regions (Islam, 2016; Oyalowo, 2022).

A survey conducted in Adama revealed that 23.9% of respondents identified land speculation as a primary factor contributing to urban expansion in the city. Many key informants and focus group discussion participants shared similar views, acknowledging the influence of land speculation in shaping the city's growth. As one key informant explained, speculators often purchase land on the city's periphery with the expectation that its value will increase once urban development reaches these areas. This expectation leads to an artificial increase in demand for land in previously rural areas, resulting in the conversion of agricultural land to residential or commercial uses.

The findings of this study align with those of Girma et al. (2023) and Hailu et al. (2024), who identified land speculation as a major cause of urban expansion in Dukem town and Addis Ababa city, respectively. Both studies highlight the role of speculative land transactions in driving urban sprawl, suggesting that this practice plays a significant role in the growth patterns of Ethiopian towns. The increasing trend of land speculation, driven by the expectation of future development, is thus a common challenge in urbanization processes across various towns in the country.

#### **4.4.5. Transformation of former rural areas into new urban settlements**

Urban expansion is a complex phenomenon that is often driven by the transformation of rural areas into urban settlements. This shift, which has been observed in many parts of the world, occurs as former rural areas are reclassified to accommodate new urban

development. This process has profound implications for the physical growth of cities, the distribution of resources, and the quality of life for residents. As cities expand, rural areas are gradually incorporated into urban territories, leading to the creation of new neighborhoods and the extension of city boundaries.

In the case of Adama city, 16.4% of survey respondents identified the transformation of former rural areas into new urban settlements as a major contributor to urban expansion. This transformation facilitates the development of urban areas on the outskirts of existing towns, often extending the urban sprawl into previously agricultural lands. Studies have shown that while this process can bring numerous benefits, such as improved access to urban services and new economic opportunities, it also presents significant challenges. Tekalign (2023) highlighted both the positive and negative consequences of this transformation, emphasizing that while it can improve living standards and access to amenities, it also leads to the displacement of rural populations, the loss of fertile agricultural land, and the uncontrolled spread of urban sprawl.

Key informants and field observations in Adama suggest that reclassifying rural areas into urban settlements plays a crucial role in the city's expansion. The main benefits of this transformation include the availability of new land for urban development, which is critical in rapidly growing cities like Adama, where land is in high demand. Moreover, this reclassification process has paved the way for the establishment of new neighborhoods and industrial zones on the town's periphery, contributing to the spread of urban areas into less densely populated regions. This phenomenon mirrors similar trends observed in other cities worldwide. For instance, research in Latin American cities, such as in Mexico City, has demonstrated that the transformation of rural land into urban settlements often results in the rapid expansion of the urban footprint, which can further perpetuate issues related to land use management, infrastructure provision, and social inequality (Lopez-Morales, 2016). Furthermore, in cities like Cape Town, South Africa, the shift from rural to urban has been associated with the loss of agricultural land, a trend that has led to debates about the sustainability of such expansions and their long-term impacts on food security (Kok et al., 2017).

#### **4.4.6. Strategic Location and Regional Connectivity**

Urban expansion is often influenced by a variety of factors, with infrastructure and strategic location being key drivers in many cities worldwide. In the case of Adama, the town's rapid urbanization can be attributed to its strategic location and regional connectivity, which have played a significant role in attracting businesses and residents alike. Adama serves as a crucial transportation and commercial hub within the Oromia Region, which has positioned it along major highways, including the road that connects Addis Ababa to the southeastern regions of Ethiopia. This centrality has made Adama a prime location for trade and transport, driving both economic growth and urban expansion.

A household survey conducted as part of this study revealed that 11.5% of respondents identified the strategic location and regional connectivity of Adama as one of the main contributors to urban expansion. Key informant interviews and focus group discussions further supported this finding, with participants emphasizing that the town's accessibility to other regions has facilitated the movement of people and goods. According to one key informant, "The location of Adama along key transportation corridors has made it an attractive destination for businesses looking to expand their market reach, as well as for individuals seeking new opportunities."

The role of strategic location in fostering urban growth is well-documented in studies from other parts of the world. For instance, in cities like Lagos, Nigeria, and São Paulo, Brazil, rapid urbanization has been linked to their positioning along major trade routes and their proximity to larger metropolitan areas (Adeyemi, 2020; Souza, 2018). These cities, much like Adama, have seen increased commercial activity and residential migration due to their advantageous locations, which facilitate access to transportation networks and enhance their attractiveness to both businesses and individuals.

Furthermore, research by Lee and Lin (2019) in Southeast Asia has shown that cities with strong regional connectivity often experience a surge in industrial activities, which in turn leads to the growth of residential areas to accommodate workers and their

families. This pattern is reflected in Adama, where the growth of local industries, particularly in manufacturing and commerce, has spurred the need for housing, infrastructure, and services, further contributing to the town's expanding urban boundaries.

#### **4.4.7. Topography of the city**

Urban expansion in cities is influenced by a variety of factors, and one such significant factor is the topography of the area. A city's geographical layout can either facilitate or hinder its growth, depending on the availability of land, the ease of infrastructure development, and natural protective features. In the case of Adama city, the relatively flat plateau upon which it is situated plays a crucial role in its expansion. According to a survey, 6% of respondents identified the town's topography as a contributing factor to its urban growth. This flat terrain allows for easier construction and the development of new residential, commercial, and industrial areas, making it an attractive location for both developers and new residents.

Focus group discussions and key informant interviews further emphasized the importance of the town's topography. One key informant noted, "The town is located on a flat plateau, which makes it easier to build infrastructure such as roads, housing, and factories. The surrounding mountains also offer a natural barrier, which provides some protection against flooding and other environmental risks." This unique feature of Adama's topography not only facilitates urban expansion but also adds a layer of environmental security that makes the city more resilient to potential natural disasters.

Similar patterns of topography-driven urban expansion can be observed in various parts of the world. For instance, cities in the Netherlands, like Amsterdam, have capitalized on their flat landscapes to develop extensive urban areas and transportation systems. Similarly, in many parts of the United States, cities such as Phoenix have expanded rapidly due to the availability of flat, arid land conducive to large-scale infrastructure projects. Additionally, studies by various urban planners have highlighted how the natural landscape, including mountains and rivers, can serve as both a barrier and a

benefit in guiding urban growth. For example, in Tokyo, the surrounding mountains and sea help define the city's boundaries, limiting expansion in some areas while encouraging dense development in others (Saito et al., 2015).

Therefore, the topography of Adama plays an essential role in its urbanization, providing a suitable foundation for infrastructure development and offering natural protection from certain environmental hazards. This geographical advantage is reflected in the city's ongoing growth and has been a contributing factor to the increasing demand for housing, industry, and services.

#### **4.4.8. Topography of the city**

Weak planning regulation enforcement has emerged as a critical factor contributing to urban expansion, particularly in rapidly growing cities like Adama. This issue is common in many developing countries, where urban growth often outpaces the development of effective planning frameworks and enforcement mechanisms. Inadequate regulation enforcement leads to uncoordinated growth, encroachment on agricultural land, inadequate provision of infrastructure, and the proliferation of informal settlements. According to the household survey conducted in Adama, 20% of respondents highlighted weak planning regulation enforcement as a significant contributor to the city's urban expansion. Key informant interviews and focus group discussions further corroborated this view, revealing that the lack of strict enforcement of zoning laws and land use regulations often results in the uncontrolled spread of residential and commercial developments into areas that should be preserved for agriculture or public use.

Comparative studies from different parts of the world, such as in Sub-Saharan Africa and South Asia, have shown similar patterns. For instance, research by Kivell (2015) in Kenya found that weak urban planning enforcement led to the growth of informal settlements in Nairobi, with many new developments emerging in flood-prone areas or where infrastructure was insufficient to support increased populations. Similarly, in India, studies by Bhagat (2019) pointed out that urban sprawl in cities like Mumbai is

often driven by the failure to enforce land-use regulations, resulting in the encroachment of informal settlements on valuable land and the development of unplanned urban areas.

In Adama, the challenge is amplified by rapid population growth and migration from rural areas, as people flock to the city in search of better economic opportunities, healthcare, and education. As noted in the household survey, a significant proportion of respondents mentioned that the appeal of living in urban areas outweighs the challenges posed by poor planning regulation enforcement. This reflects a broader trend seen in other growing cities, where informal housing developments are often seen as a necessity due to the lack of affordable, regulated housing options.

Moreover, the lack of effective enforcement mechanisms in Adama has led to the establishment of informal settlements and the encroachment of residential and commercial properties into areas not designated for urban development. This has resulted in the loss of agricultural land, the degradation of the environment, and the strain on public services such as water, sanitation, and waste management. As noted by a key informant, "The failure to enforce land-use regulations means that agricultural and vacant lands are quickly being converted into residential and commercial areas, often without the necessary infrastructure to support them."

#### ***4.5. Consequences of Urban Expansion in the Study Area***

To understand the impacts of urban expansion in the study area, a survey was conducted to gather respondents' perspectives. The results indicate that urban expansion has several significant consequences, ranging from increased demand for housing and infrastructure to environmental and social impacts. These are discussed in detail below.

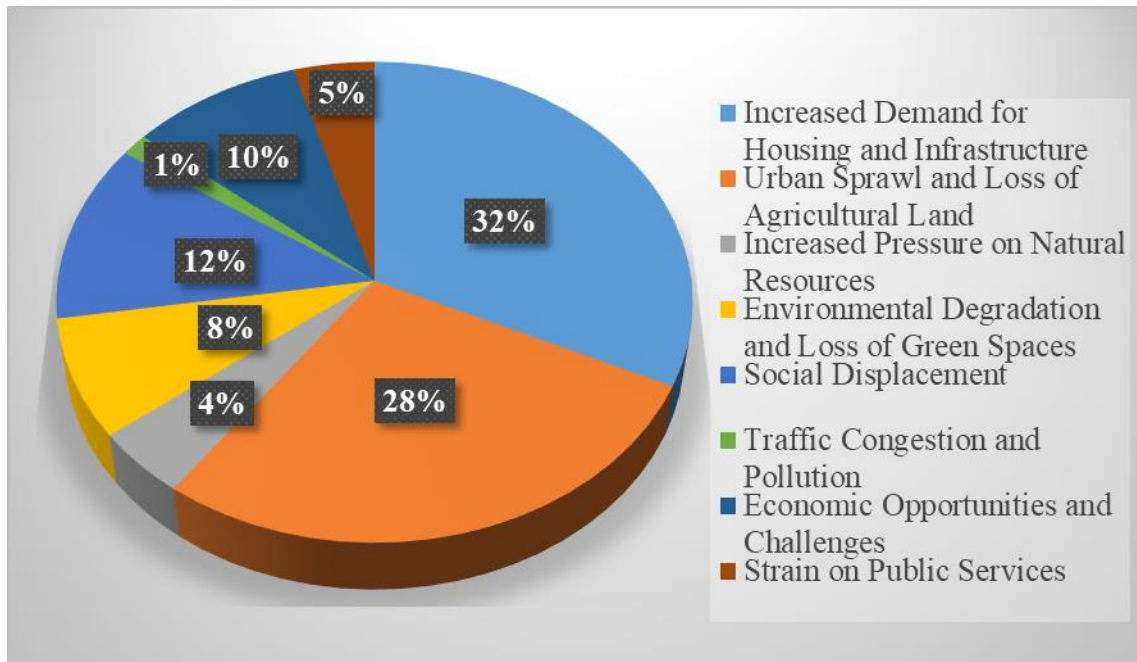


Figure 10: Consequences of Urban Expansion in the Study Area

#### 4.5.1. Increased Demand for Housing and Infrastructure

Urban expansion is a complex phenomenon that can have far-reaching consequences for cities around the world. As cities grow, various factors such as population migration, economic opportunities, and infrastructural development play key roles in shaping the urban landscape. In Adama city, a substantial percentage of the survey respondents (32%) highlighted the increased demand for housing and infrastructure as one of the most significant consequences of urban growth. This growing need for residential areas, roads, schools, healthcare facilities, and other public utilities reflects a broader trend observed in rapidly urbanizing regions globally.

From the data gathered through household surveys, key informant interviews, and focus group discussions, it became evident that the surge in population due to migration from rural to urban areas has significantly contributed to the rising demand for housing and infrastructure. Key informants stressed that the influx of people into Adama from surrounding regions has created pressure on existing housing stock, driving the need for

both new residential developments and improvements to infrastructure such as roads, utilities, and public services. This situation mirrors findings from global studies, where urbanization is often linked to an increased need for basic amenities. For instance, in Addis Ababa, population growth and migration have been similarly linked to the heightened demand for housing and essential services (Kassa, 2014). As urban areas expand, the boundaries of the city are stretched, prompting the development of previously rural areas to accommodate new settlements and the necessary infrastructure.

Moreover, as more people move into the city, local authorities are confronted with the challenge of meeting the escalating demand for services. This includes not only residential space but also schools, health centers, and transportation networks. As noted by other studies on urban expansion, such as those by Oyalowo (2022) in Nigerian cities, rapid population growth often outpaces the ability of municipal governments to provide the requisite services, leading to overcrowded and inadequate infrastructure.

The consequences of this rapid urban growth are not just limited to the need for housing and infrastructure. Urban sprawl—another significant consequence—is a common byproduct of this phenomenon, as cities stretch outwards to accommodate growing populations. In cities like Nairobi and Lagos, urban sprawl has led to the development of informal settlements on the outskirts of the city, where the availability of public services is limited. This issue is echoed in Adama, where key informants noted that the expansion of urban areas often comes at the cost of agricultural land, further exacerbating the housing shortage and placing additional strain on the city's infrastructure.

#### **4.5.2. Urban Sprawl and Loss of Agricultural Land**

Urban sprawl and the consequent loss of agricultural land is one of the most significant and concerning consequences of urban expansion, as observed in many growing cities worldwide. In the context of Adama city, a considerable proportion of respondents, 28%, identified urban sprawl and the loss of agricultural land as a key consequence of the city's expansion. This finding highlights the increasing pressure on agricultural

spaces as urban areas extend outward, leading to the conversion of fertile land for residential, commercial, and industrial purposes.

Through household surveys, focus group discussions, and interviews with key informants, it became evident that the conversion of agricultural land into urban zones is a direct result of rapid population growth, commercial development, and infrastructure expansion. Respondents shared that the growing demand for housing, businesses, and infrastructure in urban centers contributes significantly to this trend. Consequently, many areas that were once dedicated to farming have been reclassified as urban zones, resulting in the displacement of farmers and the reduction of available farmland.

Field observations in Adama corroborated these insights, with numerous instances of farmland being sold or cleared to make way for new developments. As a result, the community is experiencing a decline in local food production capacity, with potential long-term consequences for food security in the region. This aligns with similar findings in other parts of the world. For example, Oyalowo (2022) noted that urban sprawl, driven by speculative land development, often leads to the encroachment on valuable agricultural land, affecting both rural livelihoods and food production. A similar trend has been observed in cities across sub-Saharan Africa and Asia, where urban growth often takes precedence over agricultural preservation, leading to a reduction in food-producing areas.

Additionally, the consequences of urban sprawl extend beyond just the loss of farmland. In some cases, it also results in the fragmentation of agricultural spaces, making it harder for farmers to operate efficiently and profitably. This fragmentation can lead to smaller, less productive farming units, further exacerbating challenges in food production. In line with the global experience, studies in countries like India and Brazil have shown that rapid urbanization often compromises agricultural landscapes, leading to an imbalance between urban growth and agricultural sustainability.

### **4.5.3. Environmental Degradation and Loss of Green Spaces**

Urban expansion, particularly in rapidly growing cities, often comes with significant environmental consequences, which are critical to understanding its broader impacts. These consequences can include the degradation of natural ecosystems, loss of biodiversity, and a reduction in green spaces. A key aspect of urban expansion is that it typically requires the conversion of land previously used for agriculture, forestry, or wetlands into urban zones. This transformation often results in the destruction of habitats that are essential for maintaining biodiversity and the overall health of the environment. This issue was highlighted by 8% of respondents in a household survey conducted in Adama, who identified environmental degradation as one of the primary consequences of urban growth.

The survey findings were supported by key informant interviews and focus group discussions, which revealed that the rapid spread of housing and infrastructure in Adama is often achieved at the expense of public parks and green spaces. This aligns with a broader pattern observed in other rapidly urbanizing regions around the world, where urban sprawl frequently leads to the encroachment on natural areas, such as forests, wetlands, and farmlands. Similar findings were documented by researchers such as Terfa et al. (2019), who noted that while urban expansion brings economic opportunities, it often comes with trade-offs in terms of environmental sustainability. In their study, they pointed out the loss of green spaces as a significant cost of urbanization, leading to decreased air quality, increased heat islands, and the destruction of vital habitats for wildlife.

Globally, studies have shown that the conversion of natural land into urban areas reduces the availability of critical ecological services, such as water filtration, air purification, and carbon sequestration. For instance, in rapidly expanding cities in Asia and Africa, the loss of wetlands and forests has led to increased flooding, soil erosion, and a decline in water quality. In particular, cities like Nairobi and Jakarta have witnessed similar environmental degradation as their urban boundaries expanded, with many of the city's ecosystems being replaced by concrete and asphalt.

Furthermore, the degradation of green spaces in urban areas can diminish the quality of life for residents, as these areas often serve as places for recreation, relaxation, and environmental education. As cities grow, the pressure to accommodate growing populations often leads to the prioritization of housing and commercial development over environmental preservation. This phenomenon has been observed not only in Ethiopia but also in various urban centers across the world, including the rapid urban growth seen in cities like Sao Paulo and Lagos.

#### **4.5.4. Social Displacement**

Urban expansion has also led to 12% of respondents identifying social displacement as a key consequence. As urban areas grow, local residents especially farmers and low-income groups are often forced to relocate due to rising land values and speculative developments. Key informant interviews revealed that many displaced families struggle to find affordable housing or land in urban areas, exacerbating social inequality.

#### **4.5.5. Increased Pressure on Natural Resources**

Urban expansion increases the demand for water, energy, and other natural resources, as noted by 4.5% of respondents. The survey data and focus group discussions indicated that urban areas are increasingly facing water shortages and energy supply issues due to the growing population. This is consistent with findings by Kasraian et al. (2019), which show that resource consumption tends to rise sharply as cities expand.

#### **4.5.6. Traffic Congestion and Pollution**

Urban expansion often brings about several challenges that impact the quality of life, sustainability, and long-term growth of cities. While the primary focus tends to be on the positive aspects, such as economic development and infrastructure growth, it is essential to recognize the various consequences that urbanization can cause. Traffic congestion and pollution are among the most notable challenges, and these issues have been highlighted in studies from different parts of the world, including developing and developed countries.

In Adama city, although only 1.5% of respondents in a recent household survey identified traffic congestion and pollution as major consequences of urban expansion, it is evident that these factors are critical concerns for the city's residents. Interviews with key informants and focus group discussions pointed to the increasing number of vehicles on urban roads as a significant contributor to the growing traffic bottlenecks. As the urban population increases, the demand for transportation rises, leading to a higher number of private vehicles, commercial vehicles, and public transport. This surge in vehicles results in traffic jams, longer commute times, and increased pollution levels.

The key informants noted that one of the primary drivers of these issues is the lack of proper urban planning in rapidly expanding cities. In Adama, this is particularly evident, as the city has not kept pace with the rising demand for infrastructure, especially in terms of roads and transportation systems. This is consistent with findings from studies conducted in other fast-growing cities worldwide. For example, a study by Cervero (2013) in several African cities found that urban expansion often outpaces the development of adequate transportation networks, leading to severe traffic congestion. Similarly, in rapidly urbanizing cities like Mumbai, India, and Jakarta, Indonesia, traffic bottlenecks and pollution have become major concerns as populations grow and infrastructure development lags behind (Patel et al., 2018; Suhartono et al., 2020).

Moreover, increased vehicle numbers directly contribute to higher emissions, which worsen air quality and have detrimental effects on public health. Focus group discussions in Adama revealed that residents are becoming increasingly concerned about the health risks associated with poor air quality, including respiratory problems and cardiovascular diseases. This concern mirrors studies from cities around the globe, where urban expansion has led to air pollution and associated health issues. For instance, research by Zhang et al. (2017) in Beijing highlighted how rapid urbanization and increased traffic have significantly deteriorated air quality, leading to a rise in respiratory diseases. Similarly, in Lima, Peru, traffic-related pollution has been linked to an increase in asthma and other respiratory ailments (Perez et al., 2015).

#### **4.5.7. Economic Opportunities and Challenges**

Urban expansion also presents both economic opportunities and challenges, as noted by 9.5% of respondents. On one hand, it can create new jobs, attract businesses, and stimulate local economies. On the other hand, the cost of infrastructure development and the unequal distribution of economic benefits pose challenges to sustainable urban growth. This dual nature of economic impacts is supported by Choe and Roberts (2011), who noted similar findings in their study of urban growth in China.

#### **4.5.8. Strain on Public Services**

Urban expansion often places a considerable strain on public services, particularly in rapidly growing cities. As urban areas expand and populations increase, the demand for essential services such as healthcare, education, water supply, and waste management rises significantly. These services, which are crucial to maintaining public well-being and quality of life, can become overwhelmed when the existing infrastructure fails to keep up with the increased demand. This phenomenon is not unique to Adama, as studies from other parts of the world have highlighted similar challenges in urbanizing regions. For instance, urban growth in cities like Lagos (Nigeria) and Dhaka (Bangladesh) has been associated with an increasing gap between service demand and supply, which in turn exacerbates issues of public health, sanitation, and education (Olumuyiwa, 2018; Kamruzzaman et al., 2020).

In the case of Adama, the strain on public services has been particularly noticeable in sectors such as healthcare, education, and water supply. According to the household survey conducted in the city, 4.5% of respondents identified the pressure on public services as a key consequence of urban expansion. Focus group discussions further confirmed this, revealing that public schools and healthcare centers in several parts of Adama are struggling to meet the needs of the rapidly growing population. One key informant shared, “There is a significant challenge in providing water supply to the recently settled community and the displaced farming community in Adama town. This issue arises from the financial limitations of the water supply and sewerage office to

extend pipelines to expansion areas, coupled with the low income level of the community, which limits their ability to contribute financially to addressing the problem.”

This finding is consistent with broader trends observed in other urban centers worldwide. For example, research in India and Kenya has shown that as cities expand, the increased demand for basic services often outpaces local governments’ capacity to provide adequate infrastructure and support systems (Baker et al., 2017). Moreover, cities facing rapid urbanization frequently experience a mismatch between the geographic distribution of services and the growing residential and commercial developments, further complicating service delivery.

The lack of sufficient public infrastructure in Adama has led to a situation where newly developed urban areas, especially those on the outskirts of the city, often lack access to basic services like potable water and adequate healthcare facilities. Additionally, the financial constraints of municipal services, coupled with low-income levels in newly settled areas, limit the ability of residents to contribute to the costs of expanding these services, thereby exacerbating the problem. The feedback from key informants and community members points to a growing need for integrated planning and investment in public services to ensure that infrastructure can keep pace with the demands of urban expansion.

In light of these challenges, the experience of Adama aligns with global research that emphasizes the importance of forward-looking urban planning. A key component of managing urban expansion effectively is ensuring that public services are not only increased but also distributed equitably to meet the needs of all residents, particularly in underserved areas. Studies by Satterthwaite (2018) suggest that improving public service delivery through efficient planning, investments in infrastructure, and strengthening local governance can help mitigate some of the negative impacts of rapid urban growth.

## CHAPTER FIVE

### CONCLUSION AND RECOMMENDATION

#### *5.1 Conclusions*

The study on the causes and consequences of urban expansion in Adama City provides a detailed analysis of the changing land use patterns, driving factors, and implications of urban growth from 1991 to 2022. It highlights the dynamic nature of Adama's urbanization process, driven by a combination of socio-economic and environmental factors, and emphasizes the challenges and opportunities for achieving sustainable urban development. Over the 31-year period, Adama City has undergone significant land use transformations. Agricultural land decreased by 23%, reflecting the encroachment of urban development on farmland, while the built-up area expanded dramatically by 813%, indicating rapid urbanization and population growth. Meanwhile, bare land reduced by 21%, and vegetation cover increased by 49%, suggesting mixed impacts of urban expansion on green spaces and undeveloped land. These changes underscore the necessity for strategic urban planning to balance development with environmental conservation.

The study identifies several key drivers of Adama City's urban expansion. Population growth, accounting for 42.9 % of the driving factors, has created increased demand for housing, infrastructure, and services due to both natural growth and rural-to-urban migration. Infrastructure accessibility, contributing 30.4%, has played a crucial role by improving access to essential services such as education, transportation, healthcare, and communication, thereby fostering urban growth and attracting migration. Additionally, the reclassification of rural settlements into urban zones, driven by their proximity to the city, has further catalyzed expansion. Adama's strategic location near Addis Ababa has also acted as a significant growth stimulus. Land speculation and favorable topographical conditions have shaped development patterns, with availability and market dynamics influencing the urban footprint.

The rapid expansion of Adama City has led to significant consequences. Environmentally, the reduction in agricultural land and the changes in green spaces highlight the challenges of maintaining ecological sustainability amidst urban growth. Socio-economically, while population growth and infrastructure development have improved accessibility and services, they have also placed increased pressure on existing resources and systems. Urban challenges such as sprawl, infrastructure strain, and land-use conflicts have emerged, particularly in areas where expansion occurred in an unplanned manner. These outcomes underline the complexity of balancing urban development with environmental and social considerations.

The findings stress the importance of adopting sustainable urban development practices in Adama City. Recommendations include promoting mixed-use development and densification to minimize urban sprawl, enhancing green infrastructure, and preserving agricultural land to mitigate environmental impacts. Investing in resilient and inclusive infrastructure is vital to accommodate population growth and improve quality of life. Strengthening land-use policies and governance frameworks is also necessary to guide balanced and sustainable development. In conclusion, while the urban expansion in Adama City has created economic opportunities and improved infrastructure, it has also posed challenges for land management and environmental sustainability. Addressing these issues requires integrated planning approaches that align with the city's long-term development goals and prioritize the well-being of its residents. The insights from this study provide a foundation for policymakers and urban planners to design strategies that foster sustainable growth and resilience amidst ongoing urbanization trends.

## ***5.2. Recommendation***

The findings from the study on the causes and consequences of urban expansion in Adama City reveal significant trends in land use changes, primarily driven by rapid urbanization, population growth, and infrastructure accessibility. These trends underline both opportunities and challenges in managing the city's expansion. Based on the analysis, the following recommendations and future research areas are proposed to guide sustainable urban development and improve urban management strategies:

### **1. Promote Sustainable Land Use Management**

- Given the significant reduction in agricultural land (23%) and the dramatic increase in built-up areas (813%) between 1991 and 2022, it is critical to prioritize sustainable land use policies. Implementing stricter zoning regulations and promoting mixed-use developments can help balance urbanization and preserve agricultural and green spaces.
- Green spaces should be integrated into urban planning to mitigate the effects of urban sprawl and improve the quality of life for residents.

### **2. Enhance Urban Infrastructure**

- Infrastructure accessibility emerged as a significant factor in urban expansion. It is essential to invest in modern infrastructure, including transportation networks, healthcare, education, and utilities, to support the growing population. Expanding infrastructure in underdeveloped areas and ensuring equitable access for all residents will foster more inclusive urban growth.

### **3. Encourage Vertical Growth and Density**

- The expansion of built-up areas has predominantly spread outward, often onto agricultural land. To address the challenges of land scarcity, the city should encourage vertical urban development and higher-density housing. This approach can reduce pressure on land resources while providing adequate space for growing urban populations.

#### **4. Urban-Rural Integration**

- Addressing rural-to-urban migration through targeted rural development initiatives can reduce the burden on urban centers like Adama City. Investing in rural areas to improve economic opportunities, infrastructure, and living conditions can help manage urban expansion while promoting balanced regional development.

#### **5. Utilize GIS and Remote Sensing for Urban Planning**

- The accuracy assessment of land use/land cover (LULC) classification in this study demonstrates the utility of GIS and remote sensing tools for urban planning. These tools can help monitor urban growth, track land use changes, and inform decision-making processes to ensure sustainable development practices.

### ***5.3. Further Research***

Future research in Adama City should focus on assessing the long-term environmental impacts of urban expansion, particularly regarding air and water quality, waste management, and biodiversity, to support more sustainable policies. Studies on the urban heat island effect and climate change adaptation strategies, such as green roofs and urban forestry, are essential for mitigating heat-related issues. Additionally, exploring the socio-economic impacts of urban growth, especially on marginalized populations, can guide equitable development policies. Research on sustainable transport systems and mobility options, alongside land use patterns, will be crucial for building resilience against natural disasters and ensuring efficient urban growth.

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