ASSESSMENT OF SOCIO-ECONOMIC IMPACT OF URBAN EXPANSION ON PERI-URBAN COMMUNITIES; A CASE OF ADAMA CITY.

ZERIHUN LEGESSE BIZU

A Thesis Submitted to the Department of Geomatics Engineering

School of Civil Engineering and Architecture

Presented in Partial Fulfilment of the Requirement for the Degree of Master's in Geoinformatics

Office of Graduate Studies

Adama Science and Technology University

May, 2022

Adama, Ethiopia

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APPROVAL SHEET

I, the Major advisor of the thesis entitled as "Assessment of Socio-Economic Impact of Urban Expansion on Peri-Urban Communities; A Case of Adama City". and developed by Zerihun Legesse Bizu. hereby certify that the recommendation and suggestions made by the board of examiners are appropriately incorporated into the final version of the thesis.

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Advisor Signature Date

We, the undersigned, members of the Board of Examiners of the thesis by Zerihun Legesse Bizu have read and evaluated the thesis entitled "Assessment of Socio-Economic Impact of Urban Expansion on Peri-Urban Communities; A Case of Adama City". and examined the candidate during open defence. This is, therefore, to certify that the thesis is accepted for partial fulfilment of the requirement of the degree of Master of Science in Geo- Informatics Engineering.

_____ _____ _____

Chairperson Signature Date

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Internal Examiner Signature Date

_____ _____ _____

External Examiner Signature Date

Finally, approval and acceptance of the thesis is contingent upon submission of its final copy to the Office of Postgraduate Studies (OPGS) through the Department Graduate Council (DGC) and School Graduate Committee (SGC).

_____ _____ _____

Head of Department Signature Date

_____ _____ _____

School Dean Signature Date

_____ _____ _____

Office of Postgraduate Studies, Dean Signature Date

DECLARATION

I declare that this thesis proposal entitled "Assessment of Socio-Economic Impact of Urban Expansion on Peri-Urban Communities; A Case of Adama City".is my own work and has not been submitted to any university for similar purpose. The references used in this proposal are duly recognized by proper citations.

Zerihun Legesse	_____	_____
Name of student	Signature	Date

RECOMMENDATION

We, the advisor(s) of this thesis, hereby certify that we have read the revised version of the thesis entitled “Assessment of socio-Economic impact of urban expansion on peri-urban communities: The case of Adama city”. prepared under my guidance by Zerihun Legesse Bizu. submitted in partial fulfilment of the requirements for the degree of Mater’s of Science in Geo-informatics. Therefore, we recommend the submission of revised version of the thesis to the department following the applicable procedures.

Tilahun Erduno (PHD)	_____	_____
Major Advisor/Supervisor	Signature	Date
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Co-advisor	Signature	Date

ACKNOWLEDGEMENT

God is the glory for the good life and blessing given to me during the time of writing this thesis. Again, I would like to thanks, the Almightily God, who helped me begin and finish this thesis successfully. I am very grateful to my advisor, Tilahun Erduno (PhD) for his support, advice, useful comments and encouragement to improve the thesis to the current level and finalization. My special thanks go to Hika Dinsa (Ir.) (PhD candidate at ASTU), for his fruitful advising during my study. My special thanks go to Mr. Ahmed Tola (MSc) in Geoinformatics (ASTU) for his Technical support and Advice on GIS and Remote Sensing work. Thanks to my family who have always inspired and prayed for me to succeed. I would like to thanks Adama city Administration for their motivation, while I am collection data. More appreciation goes to Data collectors, those collected quantitative, quality data for my thesis, people of Adama Woreda (study area) were thanked for their support, and those gave their valuable time while they were interviewed. Finally, I am thankful to Adama Science and Technology University for its provisions of human power, materials and my respected Instructors with associated individuals in fulfilment of my qualification.

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LIST OF ACRONYMS

USGS	United States Geological Survey
GIS	Geographic Information System
UI	Urban Index
SAVI	Soil and Vegetation Index
MNDWI	Modified Normalized Difference water index
CSA	Central Statistics Agency
LULC	Land use land cover
sq.km	Square kilometre
UN	United Nations
MER	Main Ethiopian Rift
CBD	Central business district
CVA	Change vector analysis
ERDAS	Earth Resources Data Analysis System
PCA	Principal Component Analysis
GPS	Global positioning System
RS	Remote Sensing
SPSS	Statically Package for the Social Science
PUA	Pre-urban area
SSA	Sub-Saharan African
WDR	World Bank World Development Report,
PCA	Principal component analysis)
CPT	Central Place Theory
TM	Thematic mapper
ETM+	Enhanced Thematic Mapper Plus
OLI	Operational Land Imager

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ABSTRACT

Urbanization refers to a growth in the proportion of a population living in urban areas and the further physical expansion of already existing urban centres. In our country Ethiopia Until very recently, there are more than 925 urban centres at different growth stages in the country and the annual urban population growth rate was estimated to be above 4.3% (Mowed, 2006). The problems are cooperated with urban expansion are Urban Sprawl, Housing, Unemployment, Transport, Water, Sewerage Problems. Adama city is also highly affected by urban Expansion. The main objectives of this study were Assessing impact of urban expansion on peri-urban communities and LULC change in Adama City. To achieve the objective of this research secondary data like satellite images (Landsat 5-TM, 7-ETM+, and 8-Oli with spatial resolution of 30m, master plan and population data are collected from concerned sources. Primary data such as, house hold survey, interviews and ground survey were collected. Spatial analysis of LULC change analysis was done by GIS and ERDAS imagine while household survey, and socioeconomic data were analysed using SPSS. The finding of the study shows that during study period 1992 to 2022 urban/built up area of the town has significantly expanded by 15.50 percent against agricultural land loss of 14.55 percent over the study period. This indicates that there was a major land use/land cover change of the city with the agricultural land lost to built-up area being the dominant one. The built-up area has been expanding in all directions during the study period consuming land from the other land uses in and around the city. On the other hand, increase in non-farm job opportunities and infrastructure development in the study areas are notable. Finally, the urban expansion brought a significant negative impact on the livelihood elements of the peri-urban agricultural community as this study examined. Therefore, this study had assessed and found that the horizontal urban expansion has adversely affected the financial, social, natural, physical and human capital of the peri-urban agricultural community's livelihood.

Key words: - GIS, Urban expansion, pre-urban, RS.

CHAPTER ONE: INTRODUCTION

1.1 Background of the study

For most of human history, most people across the world lived in small communities. Over the past few centuries and particularly in recent decades this has shifted dramatically. There has been a mass migration of populations from rural to urban areas. Ritchie, H., & Roser, M. (2018). Urbanization refers to a progress in the proportion of a population living in urban areas and the further physical expansion of already existing urban centres. (Samson, (2009) and Alaci, (2010). The world is experiencing a historically unprecedented transition from predominantly rural to urban living. In 1950, one-third of the world's population lived in cities; today the number has already reached more than one-half, and in 2050 city dwellers are expected to account for more than two-thirds of the world's population.

Today, approximately 488 million Africans live in cities, and in 2050 it could be close to 1.4 billion people or 58% of the continent's population. Rapid and sustained urban population growth is bound to be a challenge to the provision of land, finance, infrastructure and other critical services, not least because of the massive backlogs that exist already. Urbanization is not a new phenomenon in Africa. It has been occurring since about 10,000 years ago when Africans began founding permanent settlements, which paved the way for the first urban revolution around the Nile Valley in Egypt (Muhammed 2011).

Urbanization history in Ethiopia can be summarized in four period's development stages. The first period was the pre-Italian Period (1900–1935) which was dominated by the social and economic role played by the dynasties at a given time. The second period, the Italian occupation period (1935–1941), is characterized by the construction of roads, bridges, schools, and other facilities by the Italians. The third period is the post Italian period (since 1950s) whereby the country was under socio-economic reconstruction with new phase of urban development. From those periods onwards, the number of towns increased with unprecedented population growth (Damte, 1993). With only 17% of urban population, Ethiopia is one of the least urbanized countries even by African standard. The country exhibits fastest rate of urbanization (CSA 2007). Written evidences further stated that the level of urbanization has been only 6% in the 1960, which has increased to 11% in 1984, 14% in 1994, and reached 17.2% by 2013 and projected to account for 30% of the total population in the year 2025 (MUDHCo 2013). As per the National Urban Systems Study (2015), the urban population of Ethiopia will increase by some 31 million and the total

population by 43 million between 2015 and 2035.) Furthermore, the country's urban population is expected to grow on average by 3.98% and by 2050, about 42.1% of the total population is expected to be inhabited in urban Centres (UN-HABITAT, 2007). Even though there are more than 900 urban centres in Ethiopia, Addis Ababa, its capital city, consisted of about 23% of the total urban population in the country (PCC, 2008).

Urbanization and urban growth are considered as a modern way of life manifesting economic growth and development. However, urbanization and urban development in Ethiopia faced a number of socio-economic problems (Tegenge, 2000).

Uncontrolled built-up area expansion and haphazard land developments are one of the crucial problems in Addis Ababa City which is experiencing rapid urban expansion towards surrounding regions that is causing environmental degradation and rural-urban land-use changes (Mohamed, A. & Worku, H. 2019). Ethiopia has been experiencing a rapid urbanization process since the implementation of economic development and privatization policy (Kassahun, s. &Tiwari, A., 2014) to stimulate national economic growth. However, as it is observed in numerous developing countries, the intensified constraints following the fast urbanization process in the country are unplanned and uncontrolled that resulting in scattered urban growth, loss of farm land and environmental degradation. Besides, the urban physical growth rate has been faster than the rise in infrastructures and service delivery in Ethiopia cities (MUDHCo, 2014). Adama is one of the fast-growing towns in Ethiopia, and entering a new stage of transformation with a large industrialization and rapid urbanization.

But many developments have occurred outside of proposed growth area and a majority of uncontrolled urban development or open space encroachments have occurred at the western and eastern part of the town following the main road 4 from Addis Ababa to Djibouti. In addition, reviewed literature implies that the growth rate of built-up lands exceeds significantly that of a population which demonstrates a massive urban area expansion and an inefficient use of land resources in Adama Town (Bulti & Sori, 2017). Therefore, the main objective of this study is to assess the socio-Economic impact of urban expansion on per-Urban Communities using geospatial technologies.

1.2. Statement of Problem

Urbanization is a process by which more and more people move from rural area or countryside to an urban area such as cities, towns, and that leads to expansion and growth of cities and towns. People move to cities because they believe in achieving better economic,

political, and social mileages there than the rural counterpart. It is a process by which large numbers of people move from rural areas to the towns and cities. It is areas are settlements in which most of the inhabitants (over 65%) are engaged in non-agricultural occupations such as commerce, manufacturing, administration and trading *(Thou, 2010).* The following problems are cooperated within urban expansion are Urban Sprawl, Overcrowding, Housing, Unemployment, Slums and Squatter Settlements, Transport, Water, Sewerage Problems, etc. In fact, several studies have been conducted on peri-urbanism for instance; study by Fayera, *(2005)* on "impacts of Addis Ababa expansion on farming community on peripheral area, indicated that the city's expansion programs implemented in different periods of time were not participatory and negatively influenced the livelihood of farmers on peri urban area. Similarly, study by Ermias, *(2009)* on "prospects and challenges of real estate development on livelihood of rural communities: the case of Lega Tefo Lega Dadi." Further found that in process of the establishment of the real estate in the area gave little attention to the peri-urban interface, due to the fact that such areas are neither being under the control of urban authorities nor under the control of rural authorities. Yet only a handful of people are made rich, while the majority is excluded from the opportunities that peri-urbanisms brings forth. This is an indication that the two growth rates differ and urban area grows in a more rapid pace *(Adugna,2016).*

In several big cities wealthy people are constantly moving from the crowded centres of the cities to the more pleasant suburbs where they can build larger houses and enjoy the space and privacy of a garden around the house. In some cities, the outskirts are also added to by squatters who build makeshift shacks of unused land although they have no legal right to the land. The difficulty of restricting town growth in either case is immense and most towns and cities are surrounded by wide rings of suburbs. There are several problems within urban expansion. Some of them are Urban sprawl or real expansion of the cities, both in population and geographical area, of rapidly growing cities is the root cause of urban problems also Adama city is highly affected by urban sprawl.

In the study area newly merged to urban kebeles are Dabe Soloke, Boku shenan and Daka Adii before five years they are not under Adama city rather than some village a rounding Adama city. Adama is horizontally expanding both physically and population growth. Consequently, peasants in those village lose their Agricultural land and it is directly and indirectly affecting the socio-economy of their family. They also lose of identity because displacement from their original home and go to new and may not familiar to the origin.

This problem is specifically more acute in those urban areas where there is large influx of unemployed or underemployed immigrants who have no place to live in when they enter cities/towns from the surrounding areas. The problem of unemployment is no less serious than the problem of housing mentioned above. One of the major causes of urban unemployment is the large-scale migration of people from rural to urban areas. Rural-urban migration has been continuing for a pretty long time but it has not always been as great a problem as it is today. The general poverty among the rural people pushes them out to urban areas to migrate in search of livelihood and in the hope of a better living.

Justification for study site selection Adama and surrounding kebele or city was selected based on the researcher past observation and experience about the expansion of the city, the area near pre-urban expands its city coverage to the peri-urban farming areas in a very fast rate and there are high numbers of the evicted household farming community who lives around the Adama city and lead their life through farming. Even if the problem (urban expansion) is affecting the overall livelihood of households who are evicted, there is limit number of researches finding specifically in this City, which motivated the current study.

1.3. Objective of the Study

1.3.1 General

The general objective of this study is to assess the impact of urban expansion on per-Urban Communities in Adama city.

1.3.2 Specific

The specific objective of the study is to;

- ❖ Analyse land use and cover change (LULC) of Adama city trend from 1992 to 2022 G.C
- ❖ Assess the impact of urban expansion on the surrounding communities.
- ❖ Evaluate the current status of the livelihoods of the peri-urban communities of the Adama City.

1.4. Research Question

- ❖ What has been changed in the LULC the study area from the period of 1992 to 2022?
- ❖ What are the impacts of urban expansion on the surrounding communities?
- ❖ What is the current status of Livelihoods of the peri Urban communities?

1.5. Significance of the study

In the developing countries like Ethiopia, urbanization is one of development issues to be addressed. That is why currently scholars, NGOs, governments, partners and other stakeholders have given a due attention on the theme.

Adama city is under the fast development and horizontal expansion at these days. This has been studied significantly by various studies. However, there is very limited studies carried so far concerned the impact of this expansion on the livelihood of the peri-urban agricultural community. This study therefore, attempts to fill this gap by identifying the socio-economic impacts as well as opportunities that come following horizontal expansion of city on farmers and affected communities generally.

(Nasser.N,2020) In Ethiopia, there were no satisfactory works on urbanization process that gives solutions to the socioeconomic problems facing the peri urban community particularly on farming communities living on the edge of the cities. The displaced farmers suffered, and faced different economic problems such as migration, separation from their social organizations, unemployment and poverty as well as conflict with the municipality and investors Hence, this study will focus on assessing the effects with rapid urban expansion of the study area in Adama City and its effect on the community in the peri-urban areas.

The study is significant for policy makers; urban planners and researcher as input in planning and contribution for existing knowledge for sustainable city development without threatening marginal groups of people living on periphery. And also deals on the new concept and burning current problems of the city such with uncountable value to the community or the urban industry in knowledge and technological transformation with that of socio-economic consideration. The result of this study is expected to have the following significance; Local government by visualizing the change trend in different years and providing reference information for the advance government, Police maker and urban designer by providing scientific basis for the development of town and Government and non-government, researcher, and professionals by providing available information about the impact of urban expansion on surrounding. In addition, it also provides the opportunity to understand the trends of changes in built up areas as a result of driving variables. Moreover, the findings of this study are an initial input for future research direction for interested groups in the area.

1.6. Scope of the study

The scope of the study is spatially bounded to Adama City and surrounding. Thematically, the study concentrates on an impact of urban Expansion on farm lands surrounding Adama City in selected kebele and respective land use changes to agricultural lands. In terms of methods, and data the satellite image data used for the study covers 1992,2002,2012 and 2022. mixed approach and the methods used in the collection of data were house hold survey (Questionnaire) and key informant interview. Generally, the study emphasizes on the impact of urban expansion on the surrounding peasants with the study area by using integration of Geographic information System (GIS) and Remote sensing data (Satellite image) as well as sample collection of target household those who lives there at minimum 15 years in the area.

1.7. Delimitation and Limitation

This study focuses mainly on the households whose lands were expropriated and those who had been dispossessed, dislocated and hence whose livelihood strategies get changed both by form and content. Besides, as expansion is a process taking place throughout a series of times, there is a need to get each phase's (years) information about the expansion. To get all the required information, fixing the appointment and meeting the former municipality staff from the previous position has contributed to the limitation of the study. The other issue worth mentioning here is that, data related to the impact of livelihoods assets due to urban expansion and annual individual household income earned from various resources before and after displacement generated through interviewing household heads are all depended on their remembering ability.

1.8. Thesis Organization

This thesis is organized in to five main chapters. The first chapter introduces the general overview including the background of the study, statement of the problem, objectives, and basic research questions of the study. Chapter two reviews of literature terminologies and technical problem-solving methods from the literatures. Both theoretical and empirical concepts of urban Expansion and impacts are explained in detail. Primary impacts of urbanization on livelihood geospatial related literatures that described. In Chapter Three, Historical, Physical and backgrounds of the study area is explained in detail. in this chapter also presents the research design, methodology and methods followed as well as the backgrounds of implemented data are involved. Brief description of data and datasets used as inputs of analyses is also specified in the same chapter. Chapter four analyses and

discusses the practical solutions of the problem towards the achievement of the designed purpose and objectives set in chapter one.in addition chapter four concentrates on the presentation, interpretation and discussion of the findings; and finally, chapter five summarizes the study in terms of summary, conclusions and recommendations.

CHAPTER TWO: LITERATURE REVIEW

2.1. Theoretical Framework

Urban growth is also referred to as the expansion of a metropolitan or suburban area into the surrounding environment. Practices of land use usually evolve over a long period under various environmental, political, demographic, and socio-economic circumstances (Muttitanon and Tripathi, 2005). Drivers, such as technological innovation, advancements in the energy sector, environmental public choices, and local-to-federal policies, all play an important role in defining land-use evolution (Seto et al., 2012). National or regional land use morphology usually changes with its economic and social development phases (Long, 2003, Long, 2012).

In many ways urban expansion is a spontaneous phenomenon that leads to displacing rural farming community (Tegegne, 1999). Even planned displacement has its own effect on the livelihood of the affected farmers. The effect of urban development or expansion on the rural farming community where agriculture is the main source of livelihood like Ethiopia is a least studied area. Ethiopia is one of the low urbanized countries having 14 percent urbanization level in 1994, which is less than that of other African countries (Tegegne 2000; Yeraswork and Fantu 2003).

In fact, some studies indicate that poor farm households likely to be vulnerable and marginalized in the course of rural-urban livelihood transition (Gregory & Mattingly, et.al, 2009). Additionally, in Ethiopia, moving out of poverty is more difficult to urban poor than the rural (Bigsten & Shimeles, 2008). These issues suggest that urban expansion induced poverty is likely to evolve in the peri-urban areas (PUA). Hence, it merits justifying empirically the effects of urban expansion in Africa at socio economic on preurban area policy for possible interventions. But the knowledge on effects of urban expansion on socio economic of the farm households in peri urban villages is very narrow.

2.2. Urban Expansion and pre-urbanization in global context

Urbanization is a complex socio-economic process that transforms the built environment, converting formerly rural into urban settlements, while also shifting the spatial distribution of a population from rural to urban areas. It includes changes in dominant occupations, lifestyle, culture and behavior, and thus alters the demographic and social structure of both urban and rural areas (Montgomery and others, 2004).

A major consequence of urbanization is a rise in the number, land area and population size of urban settlements and in the number and share of urban residents compared to rural dwellers. Urbanization is shaped by spatial and urban planning as well as by public and private investments in buildings and infrastructure. An increasing share of economic activity and innovation becomes concentrated in cities, and cities develop as hubs for the flow of transport, trade and information. Cities also become places where public and private services of the highest quality are available and where basic services are often more accessible than in rural areas.

(United Nations, 2019) as UN report Globally, more people live in urban areas than in rural areas, with 55 per cent of the world's population residing in urban areas in 2018. In 1950, 30 per cent of the world's population was urban, and by 2050, 68 per cent of the world's population is projected to be urban. There is significant diversity in the urbanization levels reached by different geographic regions. The most urbanized geographic regions include Northern America (82 per cent living in urban areas in 2018), Latin America and the Caribbean (81 per cent), Europe (74 per cent) and Oceania (68 per cent. The level of urbanization in Asia is now approximating 50 per cent. In contrast, Africa remains mostly rural, with 43 per cent of its population living in urban areas.

2.3. Urban Expansion and Pre-urbanization in Africa

(UN-DESA, 2014) The proportion of the world population living in urban areas rose from about 30% in 1950 to 54% in 2015 and is projected to rise to 66% by 2050. Africa's urban population has been growing at a very high rate (i.e. from about 27% in 1950 to 40% in 2015 and projected to reach 60% by 2050. in 2017, the main destination countries of intra-African international migrants were South Africa (2.2 million), Côte d'Ivoire (2.1 million), Uganda, Ethiopia, Nigeria and Kenya (UN-DESA, 2017).

Table 2.1 Rate of urbanization in region of Africa (sources Josef taye,2018)

REGIONS	1950	1980	2000	2015	2050
Sub-Saharan Africa	10.7	22.4	30.8	37.9	54.8
Africa	14.0	26.7	34.5	40.4	55.9
Eastern Africa	5.6	14.5	20.6	25.6	43.6
Middle Africa	14.0	27.5	36.8	44	60.8
Northern Africa	26.0	41.3	48.4	51.6	63.3
Southern Africa	37.7	44.7	53.8	61.6	74.3
Western Africa	8.4	23.6	34.7	45.1	62.7

Many governments now recognize the potential for migration to contribute to socio economic development. Rate of Urbanization in Regions of Africa (Regional Variations).

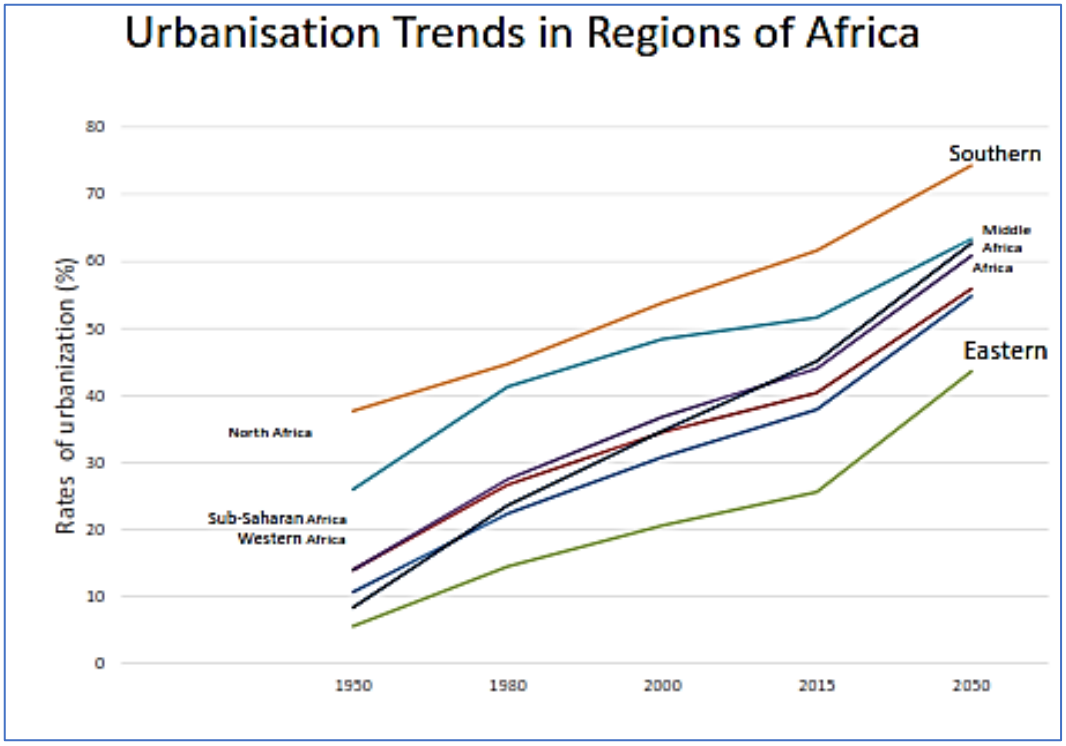

Figure: 2.1. Urbanization Trends in Regions of Africa (sources Josef taye,2018)

2.3.1. Negative Effects of Rapid Urbanization in Africa

Unemployment and urban poverty in some African countries. Accra (the capital) more than doubled its standard poverty incidence (4.4% in 1999 to 10.6% in 2006) and extreme poverty incidence rose from 1.3% in 1999 to 4.4% in 2006 (Joseph Teye, 2018). According to the researcher Housing problems and proliferation of slums which are characterized by overcrowded houses, limited electricity supply, poor access to water supplies, little sanitation and insecure living conditions. Proportion of households in two slums in Ghana (Nima and Old Fadama) without 'in-residence' water (76%); Toilet Facilities (78%) and Bathhouse (47%).

Low standard of living: Ironically, as urban cities thrive and it draws in more people, so do the slums. Most of the essential commodities are priced slightly higher or a lot higher than they are in semi-urban areas; as a result, most of these urban centres contain slum areas with extremely poor sanitation and sub-standard living conditions. Most of these areas are populated by those who have come in search of opportunities in these cities; you can argue that rapid urbanization also allows for such slums to exist in the first place. Urban expansion results in displacement, dislocation and segregation of urban neighbours in general and neigh

boring farmers in particular that result in social makeup disorder. unplanned and uncontrolled physical horizontal expansion of the cities greatly exceeds the resources available and has posed economic, social, and environmental challenges to the governments of the respective countries. (Hussien Mohamed Yusuf, 2013).

*Loss of natural habitat and ecosystems***:** Urban centres are always expanding as they take in more people; and as a result of this expansion, natural habitats and ecosystems are often filed in, paved over with new roads being built over the same. A recent UN report highlighted the fact that several species, both flora and fauna had become extinct as a result of deforestation and rampantly unchecked urbanization.

2.3.2. Positive effects of rural-urban movement and urbanization in Africa

Urban living has, in a few cases, contributed to access to education, health services, lower fertility, improved access to social services. Informal settlements tend to boom with various forms of entrepreneurial businesses and activities mostly in the informal sector. Recent studies in Ghana shows that incomes of the migrants were irregular, but higher than at places of origin. Finally, if well managed, both internal and international movement can contribute to socio-economic development.

Positive impact of urbanization: One of the main reasons for people to develop vast urban centres and one of the underlying needs for rapid expansion was the most basic requirement safety. Urban centres made it possible for local governments to centralize define pool resources and defend the population against various threats and most of them successfully. (Alan Behrens, 2018). Today, our cities are designed to help protect against natural threats such as storms, health outbreaks, floods and other natural disasters. In fact, most cities come equipped with disaster management which ensures that all its citizens are protected against all forms of threats. *Employment*: There's a good reason why the youth often head to big cities in search of employment. Urban centres often teem with opportunities that can offer individuals with some much-needed employment and moreover, these cities often come loaded with opportunities as well. In fact, the ratio of new entrepreneurial start-ups in big established towns is often many times over that of its smaller cousins. The fact is that urban centres, especially well-established urban centres provide you with invaluable resources that you can use to hone your entrepreneurial skills.

*Heath and transport***:** One important fact that sets apart an urban centre from the rest is the fact that its residents have access to premium medical services and even free medical services along with top-of-the-line transportation facilities.

2.4. Urban Expansion and Peri-urbanization Processes in Ethiopia

In comparison to other Sub-Saharan African (SSA) countries, Ethiopia's urbanization rate is low only 16% of the population is urbanized according to data published by the country's Central Statistical Agency. This is far less than the average for all SSA, at approximately 30 percent (World Bank World Development Report, WDR, 2009). urbanization in Ethiopia may be constrained by lack of labor mobility. Institutions that secure land rights lay the foundation for incentivizing rural populations to seek non-farm opportunities in order to supplement agricultural incomes. In Ethiopia, there are only limited opportunities for transfer of land rights in rural areas. But if migration or labor mobility is restricted, population settlement is not responsive to economic forces.

Ethiopia is among the poorest and least urbanized countries in sub-Saharan Africa. But since mid of 2000s, Ethiopia is achieving remarkable economic growth and urban population is growing rapidly as well. For instance, average annual urban population growth was about 4% in 2007 (Bane and Alemu, 2012) which is twice of the growth rate of urban Africa (Montgomery, 2008). This growth rate, if not larger, is expected to continue for some time because urban Ethiopia is still home to less than 20% of its people.

2.5. Urbanization and growth rate in Ethiopia

After Nigeria, Ethiopia is the second most populated country in SSA of the estimated 73 million people living in Ethiopia in 2007, roughly 84 percent live in rural areas and derive their income primarily from agriculture-based activities. Over the last 20 years many urban areas have experienced dramatic growth, as a result of rapid population growth and as the world's economy have been transformed by a combination of rapid technological and political change. Around 3 billion people virtually half of the world's total population-now live in urban settlements. And while cities command an increasingly dominant role in the global economy as centres of both production and consumption, rapid urban growth throughout the developing world is seriously outstripping the capacity of most cities to provide adequate services for their citizens. Over the next 30 years, virtually all of the world's population growth is expected to be concentrated in urban areas in the developing world. (Cohen, B. (2006).Currently, more than 54 percent of the world's inhabitants are living in urban regions. This implies that, by 2050, 68 percent of the world's inhabitants are expected

be urban, with nearly 90 percent of this growth will occur in Asia and Africa (United Nations, 2014). Africa is the least urbanized continent with 43 percent of its inhabitants 7 living in the urban region (United Nations, 2014). Sub-Saharan Africa is still the least urbanized region in the world, with less than one third of its population living in cities. However, sub-Saharan Africa is also experiencing the fastest urban growth in the world, and researchers predict that more than half of the region's population will be urban by the year 2025. Nevertheless, most African cities are challenged by problems related to unplanned and uncontrolled rapid urban growth as informal settlements (Magidi, J. &Ahemed, F., 2018), become a part of the urban ecosystems. In Ethiopia, the cities of Addis Ababa, Adama, and Hawassa have become the main hot spots to face the problems of urban dynamics. These cities have been facing urbanization challenges due to their uncontrolled fast-growing nature.

Urban development has exposed these cities to serious environmental deterioration. Green areas are being shifted to other land uses such as residential, industrial, and commercial developments (Terfa, B. K., Chen, N., Liu, D., Zhang, X., &Niyogi, D. (2019). Therefore, understanding and comparing the evolution of urbanization, in large and mid-sized cities could provide a reference for urban and ecological planning, and for sustainable development. Generally, Ethiopia is one of the least urbanized countries in the world today, and only 18% of its population lives in urban areas (JMP, 2014). In common with many other developing countries, however, this pattern is changing (Figure 5.4). Ethiopia’s urban growth rate is more than 4.0% per year, which places it among the highest in Africa and the world (MWUD, 2007).

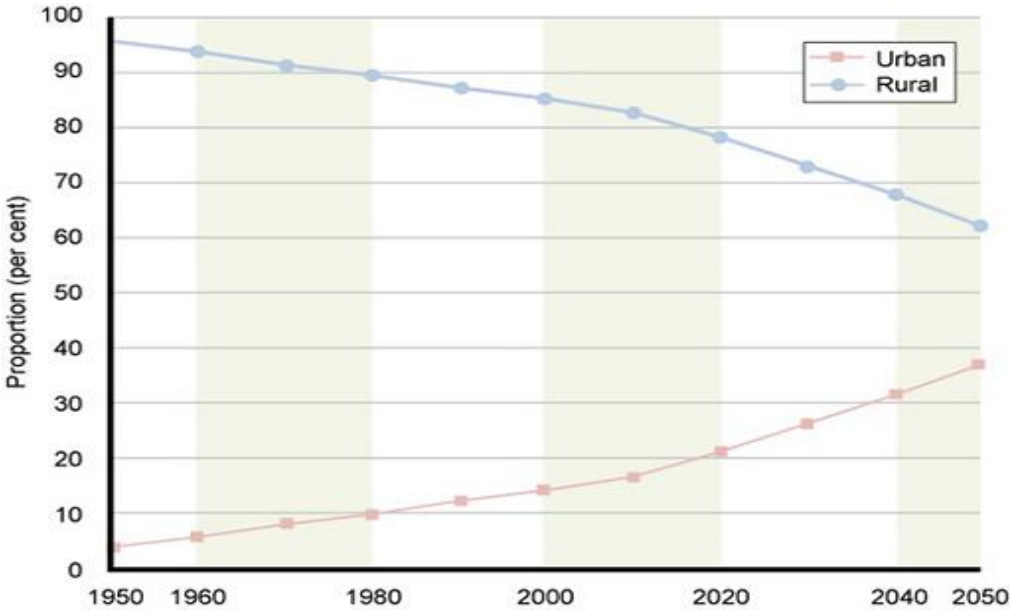

Figure 2.2. Changing proportion of urban and rural population in Ethiopia from 1950 to 2050 (estimated from 2014 onwards). (UNDESA, 2014)

The rapid increase in urban populations has meant that peri-urban areas are growing much more quickly than formal urban centres. Peri-urban areas are those areas immediately around a town or city. They are areas in transition from countryside to city (rural to urban), often with undeveloped infrastructure, where health and sanitation services are under pressure and where the natural environment is at risk of degradation.

2.6. Empirical review

The socio-Economic impact of urban expansion on peri-urban communities can be seen in two ways: which are positive and negative impact. According to Alaci (2010) well planned and managed urban growth and development can serve as a positive development factor. The benefits could be seen in terms of high demand on agricultural produces, access to developed extension services, and opportunities to non-farm employment (Satterthwaite and Tacoli, 2003).

However, unguided urbanization, like in most developing countries, negatively affects the natural environment and livelihoods in peri-urban areas (UN-HABITAT, 2010). This could be attributed to changes occurring in land use, water resources management, waste dumping, and increasing competition between agricultural and residential use of natural resources (Bah *et al*., 2003). As a result, urbanization could bring a dramatic increase in the concentration of poverty and environmental degradation in peri-urban zones (Marshall *et al*., 2009). agriculture and forestland. These studies showed the importance of RS and GIS analysis techniques for urbanization impact evaluation and pressures on peri-urban livelihoods.

Mundia and Aniya (2005) had analyzed the land use and land cover changes and urban expansion of Nairobi city using RS and GIS techniques. They used satellite images for 1976, 1988 and 2000 together with socio-economic data. Their finding revealed that the built-up area of the city had expanded by about 47km against loss of forests. Tadesse *et al.* (2001) had conducted a study in Addis Abeba and its surrounding area to detect its land use and land cover change between 1987 and 1999. They employed similar techniques to analyze Landsat Thematic Mapper images of 1987 and 1999. Their finding clearly revealed the loss of forest to urban and residential sprawl within the city limit and the surrounding area. His empirical finding revealed built up area of his study site has shown increasing trends at the expense of agriculture and forestland. These studies showed the importance of RS and GIS analysis techniques for urbanization impact evaluation and pressures on peri-urban livelihoods.

Tesfaye (2019) conducted a study on "Urban Expansion and Its Impact on the Livelihood of Peripheral Farming Communities: The Case of Assosa Town". this study is to assess socio economic impact of urban expansion on the livelihood of peripheral farming community of *Assosa* town. The Author Specifically evaluate the implication of urban expansion on the social environment, examine consequences of urban expansion on the economic environment in the study area and identify livelihood change of peripheral households related to urban expansion. As a result, they got from collected data and analysis the necessary focus on type of land loss due to urban expansion and compensation given instead of the land vacated results show 120 (70.3%) lose their land while 43 (29.7%) did not lose their land. This indicates that majority of farmers loosed their land. Finally, they conclude as the study show expansion has an impact on household livelihood.

(Heidarinejad, 2017) made a study on "*The effects of urban expansion on spatial and socioeconomic patterns of the peri-urban areas: a case study of Isfahan city, Iran".* The main objective of this research is to develop a suitable methodology for analysing the urban expansion from four different aspects (growth ratio, land cover change, spatial patterns, and socioeconomic forms) to identify the peri-urban areas in Isfahan city to facilitate the effective urban planning towards sustainable development.

In order to achieve their aim, they use the necessary data to quantify the spatial and temporal dynamics of urban expansion which often requires spatial analysis. A combination of remotely sensed (RS) data and geographic information systems (GIS) technologies could provide an eminently suitable means of assessing urban planning.

2.7. Land use Land Cover and Classification

Land Use Land Cover (LULC) generally refers to the categorization or classification of human activities and natural elements on the landscape within a specific time frame based on established scientific and statistical methods of analysis of appropriate source materials. To study the land cover, researchers need a tool to serve as an abstract representation of the situation in the field using well-defined diagnostic criteria (Foody, 2002). Classification describes the systematic framework with the names of the classes and the criteria used to distinguish them and the relation between classes. Generally, the image classification procedures may be carried out as follows:

(i) Design image classification scheme: they are usually information land use land cover classes.

(ii) conduct field surveys and collect ground information and other ancillary data of the study area.

(iii) Preprocessing of the image, including radiometric, atmospheric, geometric and topographic corrections, image enhancement, and initial image clustering.

(iv) Select representative areas of the image and analyze the initial clustering results or generate training signatures.

(v) Image classification algorithms running.

(vi) Post-processing: complete geometric correction and filtering and classification decorating (Heidarinejad, 2017) cited in (Lu and Weng, 2007).

(vii) Accuracy assessment: compare classification results with field studies. In image classification there are two major categories of classification techniques include unsupervised which calculated by software and supervised by human-guided classification.

Unsupervised classification is where the outcomes (groupings of pixels with common characteristics) are based on the software analysis of an image without the user providing sample classes. The computer uses techniques to determine which pixels are related and groups them into classes. The user can specify which algorism the software will use and the desired number of output classes but otherwise does not aid in the classification process. However, the user must have knowledge of the area being classified when the groupings of pixels with common characteristics produced by the computer have to be related to actual features on the ground (such as wetlands, developed areas, coniferous forests, etc.).

Supervised classification is based on the idea that a user can select sample pixels in an image that are representative of specific classes and then direct the image processing software to use these training sites as references for the classification of all other pixels in the image. Training sites (also known as testing sets or input classes) are selected based on the knowledge of the user. The user also sets the bounds for how similar other pixels must be to group them together. These bounds are often set based on the spectral characteristics of the training area, plus or minus a certain increment (often based on "brightness" or strength of reflection in specific spectral bands). The user also designates the number of classes that the image is classified into. For this study both supervised and unsupervised classification types apply for more accuracy assessment.

2.7.1. Classification Algorithm in image classification

Maximum Likelihood Supervised Classification: Maximum likelihood classification assumes that the statistics for each class in each band are normally distributed and calculates the probability that a given pixel belongs to a specific class. Unless you select a probability threshold, all pixels are classified. The maximum likelihood classifier is one of the most popular methods of classification in remote sensing, in which a pixel with the maximum likelihood is classified into the corresponding class.

The likelihood Lk is defined as the posterior probability of a pixel belonging to class k. In remote sensing, a pixel with the MLC is classified into the matching classes/categories. It is a statistical decision measure to assist in the classification of overlapping signatures; pixels are assigned to the class (categories) of the highest probability. However, it is slower to extract computations. The MLC tool considers both the variances of the class signatures when assigning each cell to one of the classless represented in the signature file. In supervised classification, the user or image analyst supervises the pixel classification process. In order to classify land covers, many researchers have showed greater interest in supervised rather than unsupervised methods (Ahmad, 2013). According to the Ahmad, the maximum likelihood classification is higher accurate than other classification algorisms. According to (Ahmad, 2016), the general procedures in ML are as follows:

- The number of land cover types within the study area is determined.
- The training samples for each of the desired classes are chosen using land cover information for the study area.

Support vector machine (SVM): The basic idea behind the support vector machines (SVM) is to construct separating hyperplanes between classes in feature space through the use of

support vectors which are lying at the edges of class domains; SVM seek the optimal hyperplane that can separate classes from each other with the maximum margin (Vapnik, 1995). SVM were originally designed as a binary linear classifier, which assumes two linearly separable classes to be partitioned. In most cases, the best separable hyperplane may not be located exactly between two classes. To account for this, an error item is introduced to manipulate the tradeoff between maximizing the separation margin and minimizing the count of training samples that locates on the wrong side.

SVM are further extended to deal with non-linear classification by using a non-linear kernel function to replace the inner product of optimal hyperplane. Several commonly used kernel functions include linear kernel, polynomial kernel, radial basis function (RBF), and sigmoid kernel (Haykin, 1999). Each of these kernel functions is constructed with multiple parameters, and the parameter settings can influence the performance of a specific support vector machine (Yang, 2011).

The performance of SVM has been examined through some comparative studies with other pattern classifiers for various land cover types (e.g., Huang et al. 2002; Foody and Mathur 2006; Keramitsoglou et al. 2006; Su and Huang 2009). Huang et al. (2002) found that SVM substantially outperformed maximum likelihood (MLC) or decision tree (DC) in terms of classification accuracy and even surpassed multilayer perceptron neural networks (MLP).

2.8. Land cover Change Analysis

Change detection is defined as the process of determining differences in the state of an object or phenomenon by observing it at different times (Im and jensen al., 2007). The general goal of the change detection in remote sensing includes identifying the geographical location, recognizing and quantifying the type of changes, and finally assessing the accuracy results (Im and Jensen, 2005). Change information may be obtained either in the form of simple binary change (i.e. change vs. no change as in the case of image differencing, image rationing, etc.) or detailed from-to change as in the case of using post-classification comparison (Im et al., 2007). There are two groups of change detection techniques based on the unit of image analysis, first, the traditional/classical pixel-based methods, in which an image pixel is the fundamental unit of analysis, second, the object-based method, in which image objects are first created and then subjected to further analysis (Naveena and Wiselin, 2015). In the pixel-based change detection techniques, the spectral characteristics of an image pixel are exploited to detect and measure changes without taking into considering the spatial context. On the other hand, object-based change detection is performed by separately

segmenting objects defined by a threshold from multi-temporal images and analyzing the changes based on the spectral information like averaged band values of the object by extracting various features (i.e., geometry and image texture) from the original objects (Naveena and Wiselin, 2015).

There are Four the most commonly used change detection methods were applied to the registered, normalized multi-temporal Landsat images These methods are;

Post-classification: - post-classification comparison methods use separate classifications of images acquired at different times to produce difference maps.

Image Differencing: - Image differencing change detection technique is performed by subtracting the digital number (DN) value of a pixel in one date for a given band from the DN value of the same pixel for the same band of another data.

Image Regression: - The regression intersection method of minimizing the effect of the atmosphere is attractive to many analysts as it provides absolute results from the image data without the use of ancillary data. The regression line method (RLM) determines a 'best fit' line for multispectral plots of pixels within homogenous cover types. Ideally, the intersection of lines must represent a point of zero ground reflectance since this is the only point at which radiometric values of two spectrally different materials can be safe.

Principal Component Analysis: - The central idea of PCA is to reduce the dimensionality of a data set consisting of a large number of interrelated variables, while retaining as much as possible of the variation present in the data set.

2.8.1 Algebra Methods

The algebra category includes image differencing, image regression, image rationing, vegetation index differencing, change vector analysis (CVA) and background subtraction. These algorithms have a common characteristic, i.e. selecting thresholds to determine the changed areas. These methods (excluding CVA) are relatively simple, straightforward, easy to implement and interpret, but these cannot provide complete matrices of change information. CVA is a conceptual extension of image differencing. This approach can detect all changes greater than the identified thresholds and can provide detailed change information. One disadvantage of the algebra category is the difficulty in selecting suitable thresholds to identify the changed areas. In this category, two aspects are critical for the change detection results: selecting suitable image bands or vegetation indices and selecting suitable thresholds to identify the changed areas. (Lu, D., Mausel, P., Brondizio, E., & Moran, E. (2004).

2.8.2 Transformation

The transformation changes detection methods based on colour or multispectral space transformations. They are based on Principal Component Analysis (PCA), Kauth-Thomas transformation, vegetation indices, and colour invariants. Principal Component Analysis (PCA) is the transformation of the multivariate data to a new set of components where data variation can be expressed by a first few components. One advantage of these methods is in reducing data redundancy between bands and emphasizing different information in derived components. However, they cannot provide detailed change matrices and require selection of thresholds to identify changed areas. Another disadvantage is the difficulty in interpreting and labelling the change information on the transformed images.

2.8.3. Classification

There are two main types of methods in classification-based change detection: multi-date classification methods and post-classification methods (Hu and Zhang, 2013, Huang et al., 2010, Singh, 1989).

Post-classification:-Post-classification with multi-temporal remote sensing images is one of the most popular change detection methods, providing the detailed "from-to" change information in real applications. However, due to the fact that it neglects the temporal correlation between corresponding pixels in multi-temporal images, the post-classification approach usually suffers from an accumulation of misclassification errors.(Wu, C., Du, B., Cui, X., & Zhang, L. (2017)

2.8.4. Advanced Models

The advanced model-based change detection category includes the Li–Strahler reflectance model, spectral mixture models, and biophysical parameter estimation models. In these methods, the image reflectance values are often converted to physically based parameters or fractions through linear or nonlinear models.

2.9. Conceptual framework

The world's urban population is expected to increase from 3.5 billion in 2010 to 6.2 billion in 2050, and almost all of this growth is expected to take place in less developed countries. Cities in developed countries will add only 160 million people to their populations during this period. Cities in the developing countries will need to absorb 15 times that number, or close to 2.6 billion people, thereby doubling their total urban population of 2.6 billion in 2010 (Angel, S., Blei, A. M., Civco, D. L., & Parent, J. (2012).Given the expected decline in urban densities, these cities are likely to more than triple their developed land areas by

2050. Increased global awareness is needed to better understand and plan for this massive expansion of cities in developing countries. Local and national governments, civic institutions, international organizations, and concerned citizens will need to advocate for and implement at least minimally adequate preparations. One of the most significant changes over the centuries has been urbanization, or the shift from rural areas to large cities.

According to *Camagni, R., M.C. Gibelli and P. Rigamonti (2002), urban* expansion of land uses can take place in five general forms:

a) *Infilling.* New developments are set in areas that were previously unused or being redeveloped to new uses. Brownfield redevelopments are a good example of urban expansion opportunities on sites that have lost their economic significance, such as old industrial sites or abandoned terminals (waterfronts or rail yards).

b) *Extension.* A standard form of expansion where land use is a development directly adjacent to existing land uses. New infrastructures such as streets and utilities are expanded from the existing network.

c) *Linear development*: Similar to extension, but in this case, the expansion is shaped by an existing corridor of circulation such as a highway or a transit line (subway, light rail). It directly takes advantage of the accessibility offered by the transport infrastructure. In some cases, the development is the rationale to expand an existing corridor.

d) *Sprawl:* A standard form of suburban development taking advantage of scattered lots. Each developer is taking advantage of an existing plot of land without much consideration of the existing urban pattern.

e) *Large-scale projects*: The setting of a large infrastructure project such as a new port, airport, industrial zone, logistics zone, or intermodal rail terminal consumes a large amount of land. Its operational rationale is often very different from the existing landscape so the level of integration to existing land uses is problematic.

2.9.1. Nature of urban Expansion

Urbanisation is an increase in the number of people living in towns and cities. Urbanisation occurs mainly because people move from rural areas to urban areas and it results in growth in the size of the urban population and the extent of urban areas. (Jenks, Burton and Williams, 1996:4) Two major arguments are forwarded as to the shape and size of cities. The first argument states that compact cities are important features of sustainable urban development in the future. The compact city has dominated many historic European cities and the European Community was the strongest advocate. A compacting city entails

higher density development and helps reduce demand for space and travel distance. Urban residents enjoy lower transport expense and power costs. It also reduces potential farmland encroachment by urban uses and makes most effective use of urban land (Hillman, 1996: 42). The second argument rejects the compact city and argues that compact city is unsustainable and un acceptable since the benefits obtained from compaction do not overweigh the losses to the social, economic and natural environment. Stretton (1996:51) in his study of urban compaction in Australia argues that loss of urban consolidation is higher than losses from extended urban settlement to the periphery and that solutions lie in reforming transport system rather than imposing compaction to the cities. Compact city development strategy has more recognition and is recently accepted for social and economic utilization of resources although developing countries rarely exercise compaction. Urban Expansion is mostly uncontrolled that one often sees overcrowding (slum and shanties) and extended unplanned settlement with acute shortage of infrastructure in one part and unutilized or partially developed vacant land on the other part.

2.9.2. Causes and Consequences of Urban Expansion

Causes of Urban Expansion: Urbanization is closely linked with transformation, industrialization, and sociological process of decision making. Most of the rapid urban sprawl in developing nations is due to rural-urban migration (Free encyclopedia,2010). According to (UN state report of the world population ,2007), urbanization occurs naturally from individual and corporate efforts to reduce time and expense in community and transportation while improving opportunities of jobs, educations, and housing and transportation statuses.

Urban growth refers to the rate at which the population, land area, or significant land-use increases. Urban expansion is the result of a complex set of interrelated socioeconomic and cultural forces. Land value, however, is often considered the chief driver of development patterns. Expansion tends to occur where property values are lower on the periphery of urban centers (Pendall, 1999). causes of urbanisation are natural population increase and rural to urban migration. Urbanisation affects all sizes of settlements from small villages to towns to cities, leading up to the growth of mega-cities.

Consequences of Urban Expansion: There is no specific theory to study the effect of urban expansion on rural farming community in the periphery. Scholars in the field of development are ruled the issue of urban development a growth from different perspectives. The

interaction of urban to rural was described in modernization theories of economic development.

The main model in this regard is the structural transformation model formulated by W. Arthur Lewis in the mid,1950s. The main focus of this model was the transfer of agricultural labor and growth of output and employment to the modern urban industrial Sector through wages that is higher than subsistence agriculture. The theorist postulated that the city offers cost reducing advantages in economic, social and Cultural facilities. However, this structural transformation has historically a great deal of upheaval, conflict, dislocation and human degradation in which the process involves winners and losers. In contrary to this structural transformation theory the dependency theory maintains that cites grow drastically by exploiting and holding back their surrounding regions established economic development in the city is only at the expense of the surrounding areas (Balchin, 2000:58).

The rapid urban expansion in developing countries is usually also cited with unplanned development in the periphery that requires high cost 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 expansions subsequently result social, economic and environmental problems to the society.

Urbanization has had important consequences for many aspects of social, political, and economic life (Kleniewski& Thomas, 2011). Urbanization is not limited to a specific region. It is now a worldwide phenomenon. Looking at the rates of growth, it would seem that only cities in developing countries are growing fast. But keep in mind that the majority of the population in the developed countries already live in cities.

(i) Social Consequences of Urban expansion*:* Urban expansion causes displacement dislocation and segregation that result in social fabrics disorder. There is also a possibility of isolation from the city development and sandwiched between the rich creating class difference. This began to accelerate the migration of the disadvantaged groups particularly the farming community who already inhabited the area. Even urban rich or middle-class incomers whose income permits to commute perhaps many could be attracted to the liveliness and benefits of the facilities in the centre. Thus, the community in the periphery could face problems of survival strategies, solidarity network, and system of power to which the social and economic activities are linked to their original location (megjia, 1999).

(ii) Economic Consequences of Urban Expansion: In developing countries people are migrating to the urban centres. From the centre, the poor move to the periphery for urban

renewal. These areas need provision of infrastructure like road Power line, water pipes, and drainage line. This requires high development cost draws on the finical capacity of the municipality. In many cases, the municipality cannot afford to provide and people remain deficient of basic menses of services. Because of this most of the residents are exposed to high cost of services to the dislocated rural community in particular and the customer in general. There is also limited work opportunity in such sites. This create an economic challenge on the dislocated and evicted farming community since they loose their means of livelihood (Herington, 1989).

(iii)Environmental Consequence of Urban Expansion: In many of the developing countries urban expansion is at the expense of productive and fertile agricultural farm land and forest. On the other hand, urban expansion is not accompanied by environmental protection system. particularly in expansion areas. This exposes the dwellers to sanitation related diseases and air pollution.

In addition to the farm land, environmental resources such as clean air and water, peace and quiet, and access to the country side are environmental values that the rural farming communities loose due to urban expansion in the periphery (Balchin, 2000).With this concept in mind, evaluation literatures can be seen in to two broad categories: environmental impact assessment, particularly land use and land cover dynamics analysis as a driver of change to peri-urban livelihoods, and impact of urbanization-induced displacement on peri-urban livelihoods. Conceptual frame work of the research is shown (figure 2.3) page(26)**.**

2.10. Research Gap

Researches (carried out at higher level) on the impacts of urban expansion on Adama City of local communities is limited and the situations and actors interested in peri-urban land are constantly changing to urban area. Moreover, those earlier studies are not comprehensive enough to give complete picture about the impact of urban expansion on expropriated and non-expropriated local peri-urban communities. Therefore, the purpose of this study is to Assess the impact of urban expansion on peri-urban local communities as a result of the growing demand for land for urban expansion.

The research gap found out here is although there have been several studies on the effects of urbanization in Adama city, but the majority have focused on urban sprawl, land disputes and land rights. However, this study seeks to fill the gap in the literature regarding the adverse social effects of urban expansion in the peri-urban areas of preurban surrounding Adama through the loss of agricultural land. It aimed to shed light on peri-urban land issues

and the poverty that characterizes it for the adoption of good land policies by the government and local authorities. Adam.G, (2014) It is evident that the demographic and spatial changes in the urban areas have shaken the stability of urban expansion in the peri-urban areas. Even though almost all new urban based developments and changes are concentrated in peri-urban areas, little has been done to investigate the impacts of urbanization on the preurban community relations and land use of the local peri-urban communities in Ethiopia. Peri-urban local communities around cities are indigenous communities whose livelihoods are primarily based on farming. Conceptual frame work of the study shown below fig:2.3

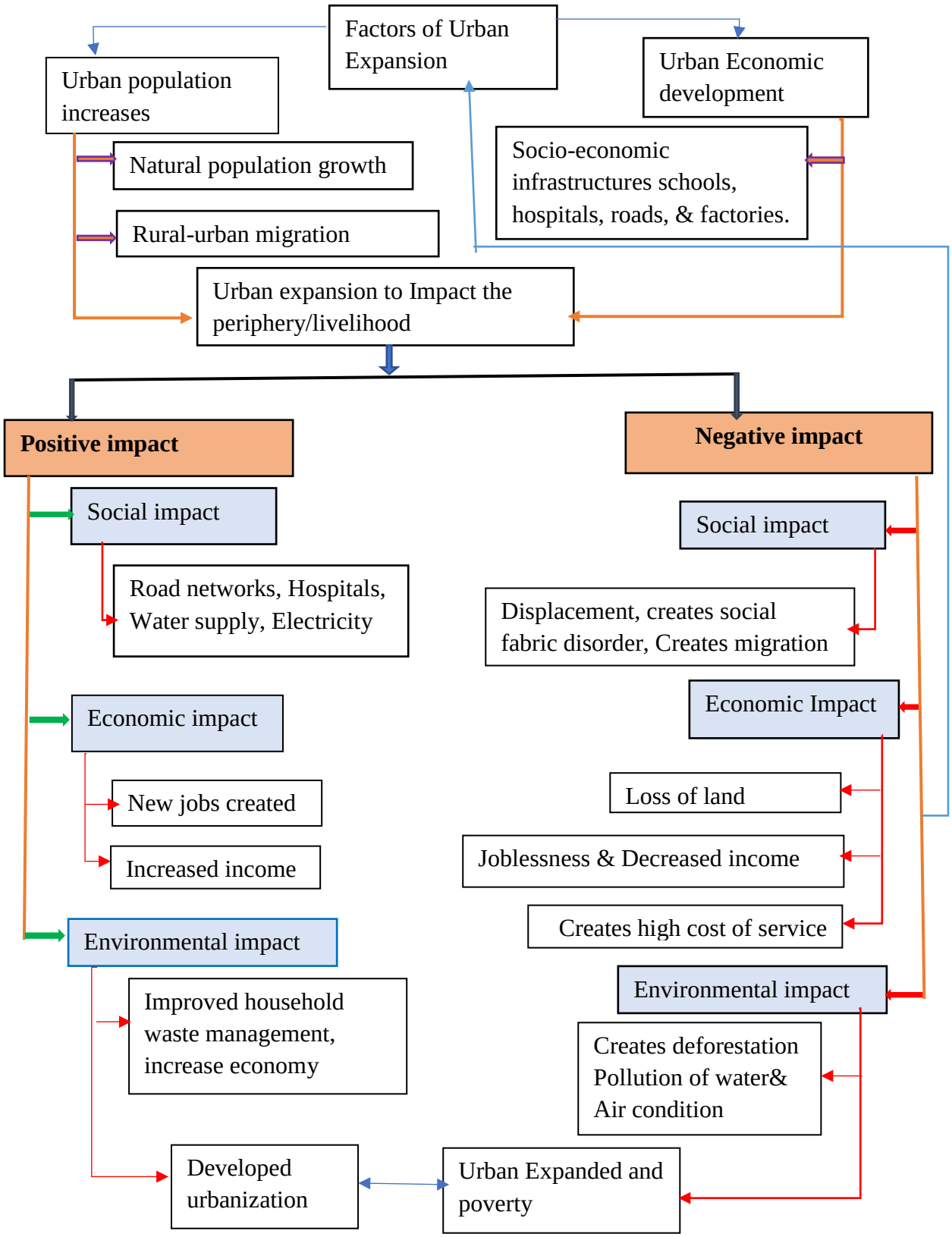

Figure 2.3: Conceptual Framework of the study. *(source Eyob.a,2010 and own edited)*

CHAPTER THREE: MATERIALS AND METHODS

This chapter describes the study area, materials, software used, required data, and data analysis. Moreover, detailed methodology the researcher will have been explain the Data used and methods to reach the objective of the study and, how the analysis is carried out. Finally, the framework of the overall methodology was designed in this section.

3.1. Description of Study Area

3.1.1 Location Description

Adama is located in the north-central part of the Main Ethiopian Rift (MER), within the East Showa zone of Oromia National Regional State. It's located about 100 km southeast of the capital city Addis Ababa. Adama city is one of the largest cities in Oromiya and it's found between escarpment and the Great Rift Valley in West and East, respectively. Adama is found in the Rift valley area in the upper Awash River Basin. Geographically, it is located at 8°27'N to 8°36'N and 39°12'E to 39°20'E. **Adama** is one of the fast-growing **towns** in the region. (Siraj Abduro ; 2020).

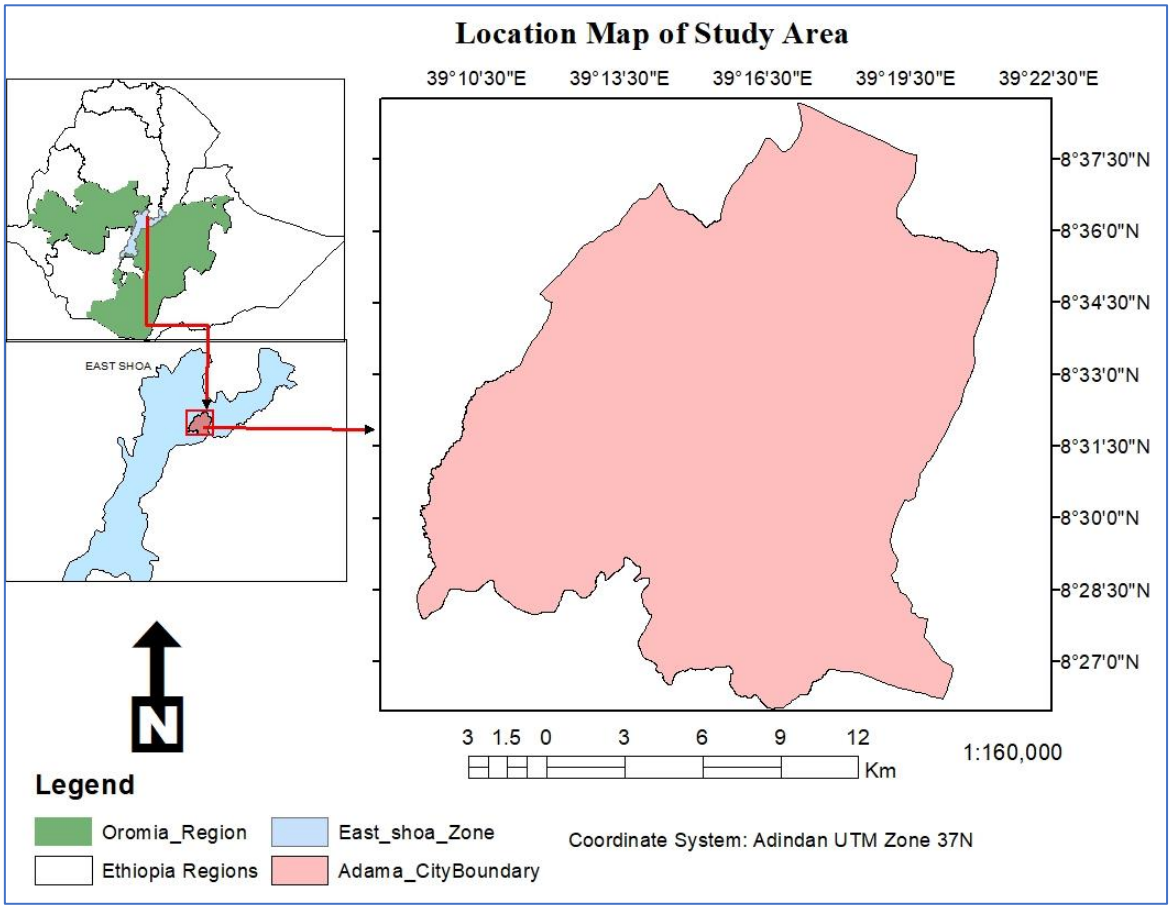

Figure 3.1: Location map of the Study Area

3.1.2. Topography

Adama town is mainly flat and surrounded by steep mountain escarpment to east and west while the flat to gentle slopping plain towards north-south direction. It is one of the Rift Valley towns situated on flat lowland with the mean annual ambient temperature between 19 0 C and 22 0 C. It was established in 1916 on flat terrain characteristics and surrounded by plateaus, mountainous and ridged topography along Addis Ababa to Harar road at distance of about 96 km(Bulti, D. T., Mekonnen, B., &Bekele, M. (2017).

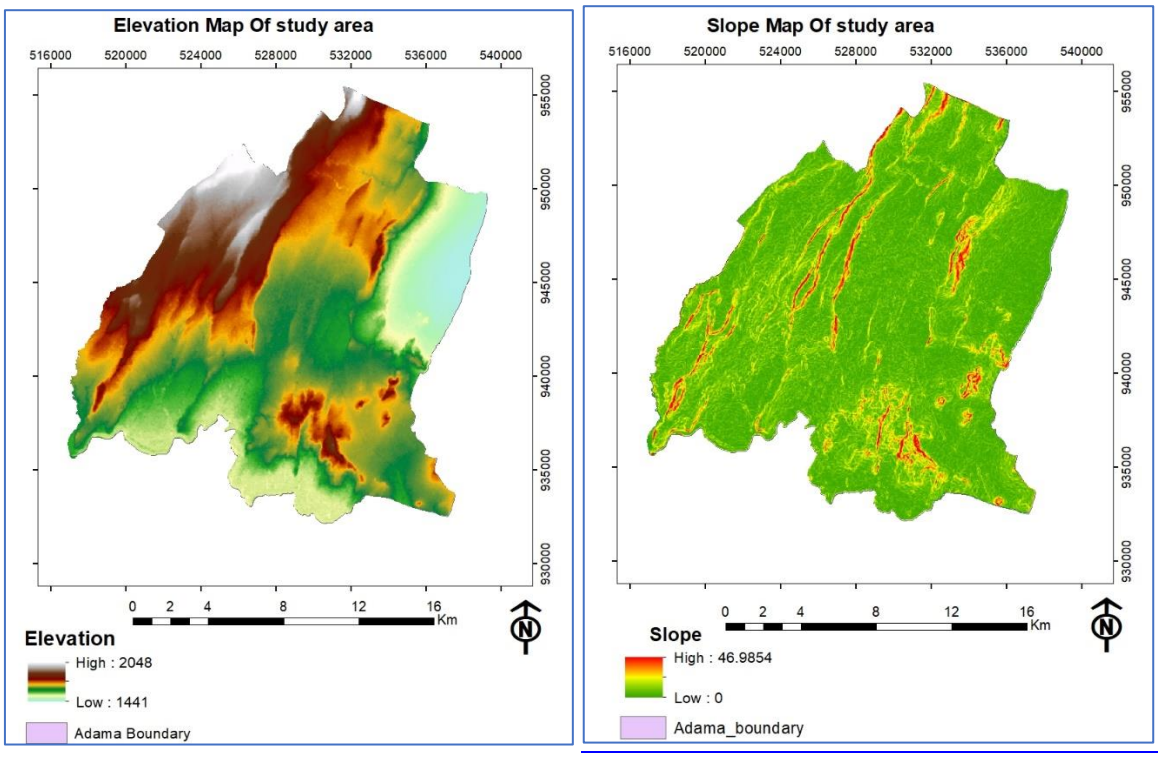

Figure 3.2. Topography of study area

3.1.3. Climate

Average annual rainfall of Adama City is about 866.25 mm. Most of the rain occurs in rainy season (June to September). The minimum wind speed occurs during September (1.65m/s), while the wind with high velocity occurs during December, January and February (3.05-3.2 m/s). The mean temperature in the City varies from 11.5 °C to 31 °C.(Bulti, D. T., Mekonnen, B., &Bekele, M. 2017).

3.1.4. Population

Adama district is one of highly populated districts. According to population and housing census conducted in 2007 by central statistics agency (CSA), the total population of Adama district is 155,321 (Tadesse, A., Bosona, T., &Gebresenbet, G. (2013).

According to CSA projections, the city's population grew by 4.8% annually between 2010 and 2015; by 2016, the total population was expected to reach nearly 400,000 (BoFED). Adama's demographic composition is characterized by a large working age group 28% of total population is under 15 years of age and its working age population (15 to 64) accounts for 69.7%. (CSA,2015)

3.1.5. land use and urbanization of Adama

Adama was established as a railway station depot in 1916. Its establishment and location have been influenced by many different factors. Conducive economic, social and geographical conditions are the crucial factors for rise and development of the town. The Italian occupation which lasted from 1936-41 made a great deal of contribution to the development of Adama. During their stay in the town, the Italians carried out a number of constructions works such as road transportation, communication and likes, which accelerated the grown of the town (Demelash, A.2020).

Bid-rent Theory The bid rent theory is a geographical economic theory that refers to how the price and demand for real estate change as the distance from the central business district increases. Land users, whether they be retail, office, or residential, all compete for the most accessible land within the central business district. It states that different land users will compete with one another for land close to the city centre. This is based upon the idea that retail establishments wish to maximize their profitability, so they are much more willing to pay more for land close to the Central Business District and less for land further away from this area.

Central Place Theory (CPT) is an attempt to explain the spatial arrangement, size, and number of settlements. The amount they are willing to pay is called bid rent. This can generally be shown in a "bid rent curve", based on the reasoning that the most accessible land, generally in the centre, is the most expensive land. In Adama the major land use category are residential, commercial, mixed use, grasslands, manufacturing and storage, recreation area open space, forest etc.

3.2. Data source and Materials use

3.2.1. Data Sources

In the data collection the researcher will have be gathering both spatial and non-spatial data from field and secondary (ancillary) data from its concerned source. The following table describes data required, types of data used in the study, formats and where the data were gathered from (Table 3.2).

Table 3.2. Data sources and description

S/N	DATA REQUIRED	Source	year	Resolution(m)	Data Formats	Purpose of Data
1	Landsat 5TM	USGS	1992	30 m Path =168 Row =54	Tiff	To prepare LULC map and change detection
	Landsat 7 ETM+	USGS	2002,2012		Tiff	
	Landsat 8-9 OLI	USGS	2022		Tiff	
2	DEM	ASTER			GRID	Show topography of study area
3	Adama city Revised Master Plan	Adama city municipality	2010	1:50000	Scanned/ Cad file	Extract boundary of the city
4	Census data	CSA			.text/ CSV	Population Sample size and analyze socioeconomic data
5	Socio Economic Data	Own Survey & Adama City Administration	2021/2022 projected			

Primary data sources: The primary data collection techniques used the questionnaire, GIS, remote sensing and surveying technologies to capture the data using either raster data capture or vector data. Besides the typical advantages of remote sensing images, Landsat images with medium spatial resolution and multiple spectral present a convenient data source for land cover study because they are free of charge and maximize the possible temporal monitoring period. Recently described Table 3.3 lists the acquisition dates and sensors for the selected satellite images. The Landsat Thematic Mapper (TM) data was adopted as the basis for image analysis and land cover classification from 1992 to 2022. Primary data sources such as ground survey (GPS), survey interview and questioner will be collected from selected population (indigenous people), municipality employers and leaders. The purpose of sampling is to enable a valid generalization to be made without studying the whole area under investigation.

Secondary data Sources: Secondary data were collected through document analysis from Woreda and kebele administration. The major sources of data were reports, plans, and publications of various government departments and non-governmental organizations. Secondary data such as satellite images, boundary data, master plan will be collected from

concerned source. In addition to this, previous report, documents, various journal papers, thesis, textbook and internet will be used as data source (Secondary data sources).

3.2.2. Material and software Used

For this study primarily, spatial data analysis software was used, in order to achieve the objective of the study the software used for this research are listed as bellows.

ArcGIS: ArcGIS is a software application developed by ESRI for working with maps and geographic information. It is used for creating maps and model, compiling geographic data, analysing spatial information, sharing geographic information and managing store geographic information in geodatabase. The ArcGIS selected for this study was the current version of 10.8 (ESRI).

ERDAS IMAGINE: for this study Erdas imagine (v2015) was used for raster-based software designed specifically to extract information from images including image preprocessing, processing and classification, and accuracy Assessment activities on satellite images.

Google Earth Pro: primarily we use google earth to timely check the current situation of lulc locations. Google Earth is a cloud-based geospatial analysis platform that enables users to visualize and analyse satellite images of our planet. Additionally, google earth was used to check the accuracy of land use/land cover class.

Microsoft office: is an application software package with one handle. It includes Microsoft word, Excel, power point etc. to create professional-looking documents, charts, calculations, reports and presentations at high speed and accuracy.

SPSS: SPSS Version 26 software setup was used for this research. SPSS is a software program used by researchers in various disciplines for quantitative statistical analysis of complex data. SPSS is mainly used in the following areas such as healthcare, research companies, education researchers, data miners, marketing and healthcare researchers and many others. In this study all data collected and encoded in SPSS was stored in SAV format. This makes the process of processing, analyzing and extracting data very easy. in addition, Descriptive statistics, including SPSS methodologies, are statistics of frequencies, crosstabs, and descriptive relationships that are very useful. Predicting various data to identify groups, including methodologies such as cluster analysis, factor analysis, and Predict a numeric result.

Table 3.3: Materials used for research

S.no	Name of soft ware	Sources	Purpose
1	Arc GIS 10.8	ESRI/	For storing, managing, and analysing spatial information and produce maps.
2	ERDAS IMAGINE 2015	Free	Processing and analysing satellite images
3	Microsoft word and Excel 2019	Microsoft	Documentation, calculation, chart, and presentation
4	SPSSV26	Open source	To analysing and interpret population data
5	Google Earth Pro	Online access	Change analysis, validation and prediction of futures.

3.3. Data collection methods

To collect appropriate data for the study both primary and secondary data collection method was employed for the study. Then to achieve the objective of this research, secondary data like satellite images, boundary data, master plan, Census data and others was collected from concerned source. Additionally, the administrative data deal with the functional dimension and describe the use of areas by the socioeconomic purpose. This information can be compiled by conducting surveys or censuses, and/or by using already compiled information from administrative and statistical registers, especially in built-up areas (settlements). The use of administrative data sources for statistical purposes is much depending on the original purpose of the registers. Record information based on activity data and technical information about LULC and ground properties can be used alone or combined with observations from satellite images to form a good total data source to derive land use land cover change Analysis.

3.3.1. Sample and sampling technique

Sampling has received varied definitions by major authors on different research methods. It has been defined as “the process of selecting a smaller group of participants to tell us essentially what a larger population might tell us if we asked every member of the larger population the same questions”. In this research, probability sampling was employed. Specifically, the availability sampling technique was applied to select samples from the target population (those displaced and currently live households around Adama City). The

researcher followed some procedures for sample selection and determination of sample size as seen in (figure 3.5).

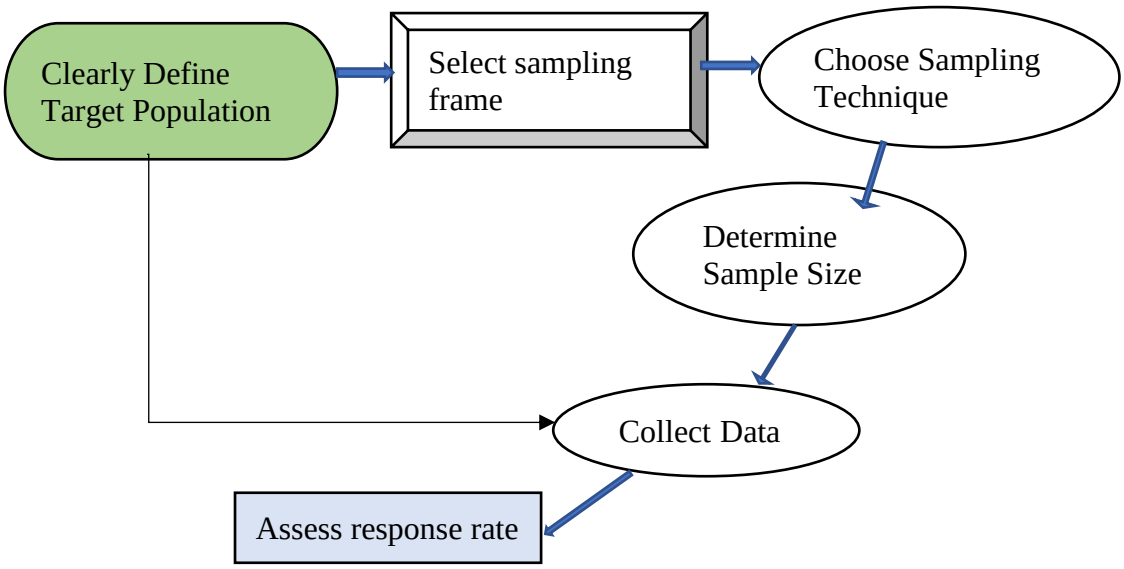

Figure 3.4: Sampling process steps. *Sources obtained from (Hamed,2020)*

Sample size determination and methods: In order to generalize from a random sample and avoid sampling errors or biases, a random sample needs to be of adequate size. What is adequate depends on several issues which often confuse people doing surveys for the first time. This is because what is important here is not the proportion of the research population that gets sampled, but the absolute size of the sample selected relative to the complexity of the population, the aims of the researcher and the kinds of statistical manipulation that will be used in data analysis. While the larger the sample the lesser the likelihood that findings will be biased does hold, diminishing returns can quickly set in when samples get over a specific size which need to be balanced against the researcher's resources (Gill et al., 2010). To determine the total sample respondents from the 1452-population targeted for the study, the Kothari formula used for calculating (Kothari, 2004) cited in (Belay, 2014). For questionaries' and interviews Participant 70 respondents out of 1452 are selected farmers in the thee urban & Preurban kebeles; [13,17,40] Boku, Dabe soloke, and Daka Adi respectively. In general, from pre-urban kebele surrounding Adama the study focuses on four 4 kebeles while Melka Adama kebele data is an available.

3.3.2. Household survey

Here questionnaire was prepared based on research objectives and administered to the displaced households. The questionnaires have both the Afaan Oromo and English version and the Afaan oromoo version questionnaire was distributed for those displaced households

who can read, write and understand and they fill the questionnaire and return, while for those displaced households who can't read and write the researcher himself read and fill the response of the respondents, see (Appendix#2) while questionaries' distributed for respondents. Here 26 questionnaires were administered. Information about household demographics, extent and types of livelihood, issue displacement due to urban expansion and the issue of compensation and compliance as well as the issue of coping mechanisms was collected through a household survey.

3.3.3. In-depth interview

Here interviewees were deliberately selected from displaced peri-urban individuals believed to have comprehensive knowledge about the area and the situation in which the study was done. The interviewees have displaced household heads. Efforts were done to include the different spectrum of views from different individuals of different levels. The interview was conducted by the researcher based on a pre-designed checklist. Information about livelihood, the effect of displacement on agricultural production, the effect of displacement on relationship of the displaced farmers and implication of urban expansion on community social services were collected through in-depth interviews.

3.4. Method of Data Analysis

The data which are collected through questionnaire were analyzed by using descriptive statistics such as percentage, frequency, and table. The data obtained through the in-depth interviews from government officials and community members selected from the peri-urban households were analyzed qualitatively. Concerning the data gathered from the household surveys, the researcher checked every completed questionnaire on the same day. The pre-coded questionnaires entered and analyzed using the statistical package for social sciences (SPSS) version 26.0. Descriptive statistics such as frequency and percentage were applied to examine the relationship and associations between variables. Finally, the spatial analysis of LULC trends are done to know the changes of urban expansion to preurban area. spatial data analysis was processed and analyzed using ERDAS IMAGINE 2015 and ArcGIS 10.8. The whole methodology flowed in this study designed as below (fig.3.5).

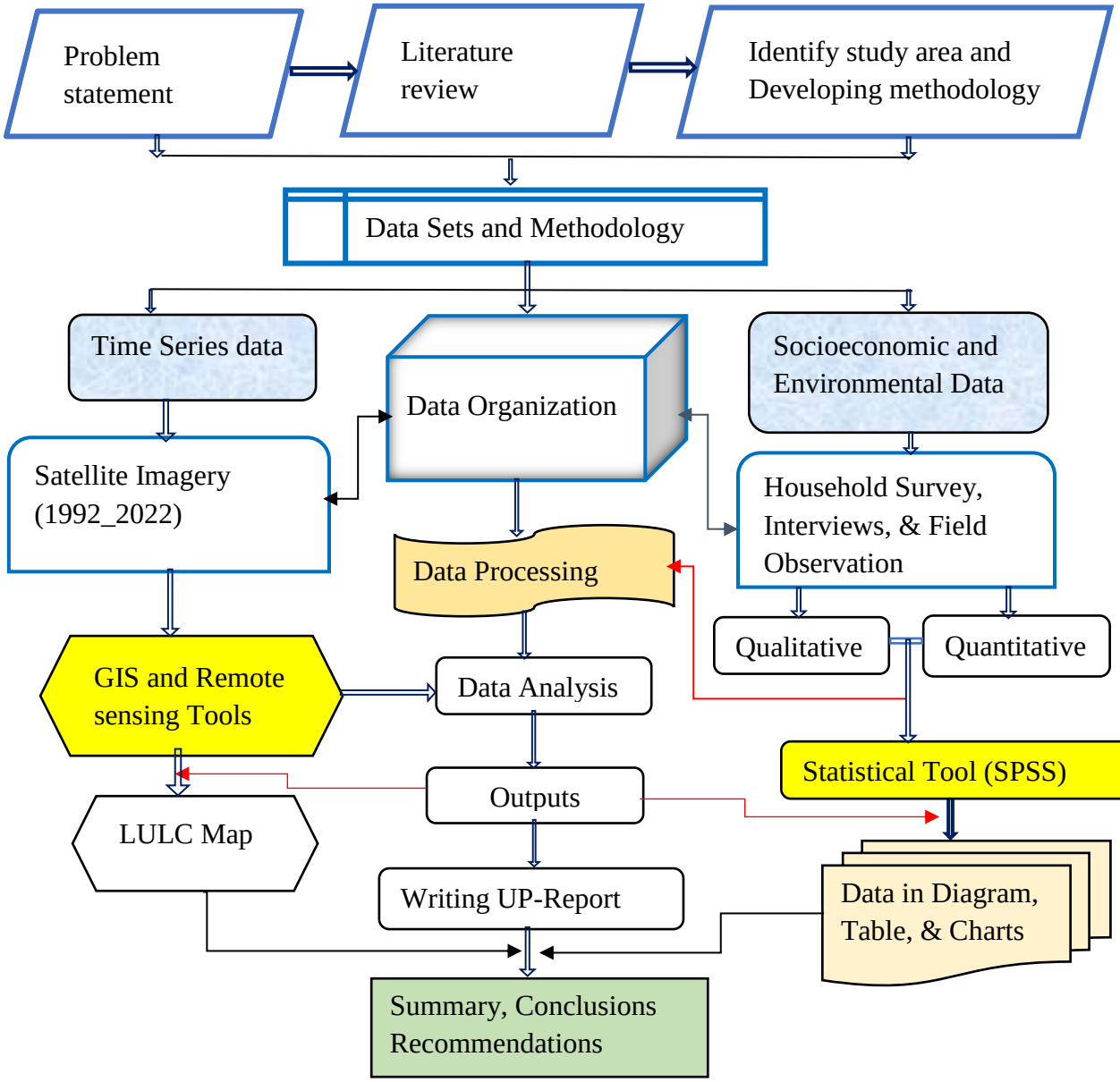

Figure 3.5: Technological Scheme of the work

3.4.1. Spatial data analysis

This study is analysing land use land cove change (LULC) dynamics of Adama city and its surrounding as well as its impacts on the peasants by Geospatial technology. To achieve the objective of the study both primary and secondary data will have been collected from their concerned sources and select appropriate tools and software. Due to the unavailability of high-resolution Remote Sensing data the study employs the Landsat images from the United States Geological Survey (USGS) which covers the entire study area.

However, Landsat TM imagery helps to avoid many issues often related to high resolution imagery used for mapping landscapes such as shadows caused by tall objects and high

spectral variation of the same land cover due to diverse spectral signatures of various construction materials found in urban areas (Lu, Li, and Moran, 2014).

Therefore Landsat [TM/ETM+, OLI] of 1992, 2012, 2002, and 2022 image will have been Downloaded to proceed subsequent phases. It is difficult to distinguish true changed areas from the detected change areas. For example, in agricultural lands, the change detection based on thresholds is often misleading due to the different phonological characteristics of crops. Fig bellow show the whole spatial analysis Methodology followed in this study.

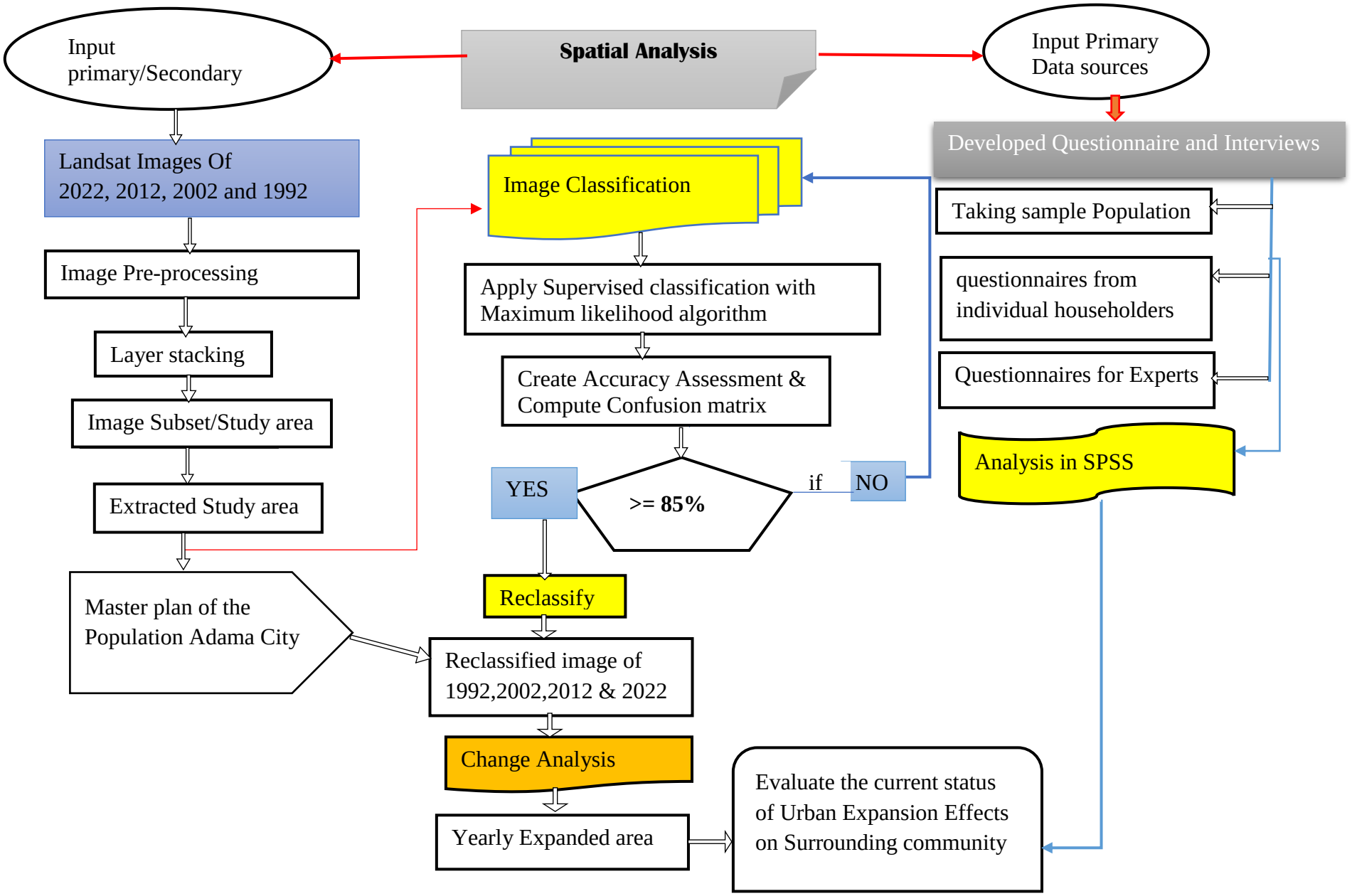

Figure 3.6: work flow of spatial analysis followed in the study

3.4.2 Spatial dataset and Gis Approach

After collecting all the relevant primary and secondary data and select appropriate software, the next task is describing the methods of the study. Based on the objectives of the study, the first task is image classification of different time land sat image depend on their spectral classes in order to perform change detection. Then identify driving forces of urban growth through literature review by considering the nature of study area this is an input for spatial logistic regression. Finally, with the help of ArcGIS tools identify different types of urban growth. Detail explanations of each method of data analysis are given in the subsequent sections. This study will have been trying to concern both Qualitative and quantitative approach of research.

Quantitative research is based on the measurement of the quantities or amount. It is applicable for phenomena that can be expressed in terms of quantities. Qualitative research on another hand is concerned with qualitative phenomena. (Kothari, C.R. 1995). The study analyses the LULC changing aspects of Adama City by using Geographic information system (GIS) and Remote sensing (RS) techniques. Landsat TM images of 1992, 2002 and 2012 and 2022 was downloaded to proceed to subsequent phases, and to analyse impacts of urban expansion on peri urban livelihood at least twenty-seven people's interview.

3.4.3. Image pre-processing

Before processing and analysis of the image data can occur, various pre-processing routines, appropriate to the desired output, must be applied to the imagery. These enhance the quality of the image data by reducing or eliminating various radiometric and geometric errors caused by internal and external conditions. Geometric correction procedures address errors in the relative position of pixels due to factors such as variation in altitude, attitude and velocity of the sensor platform, Earth curvature, panoramic distortion, relief displacement and non-linearity's in the sweep of a sensor (Catherine Bodart, Hugh Eva, René Beuchle,2011).

The satellite image of 1992,2001, 2012, and 2022, is processed by using Erdas Imagine. Then the image is corrected for the atmospheric, sensor and an illumination variance through radiometric calibration procedures.

Table 3: Description of satellite images used for this this study

Satellite	swath	Path/row	Acquired date/year	Resolution/ source	Data format
Landsat 5 TM	185 km	168/54	March,21,1992	30m	Tiff
Landsat 7 ETM +	185 km	168/54	Jan 22, 2002&	30m	Tiff
Land sat 7ETM+	185 km	168/54	Feb,02, 2012	30m	Tiff
Landsat8-9(Oli)	185 km	168/54	Jan,16, 2022	30m	Tiff

(Sources USGS,)

3.4.4. Land Use Land Cover classification

Classification describes the systematic framework with the names of the classes and the criteria used to distinguish them and the relation between classes. The rationale underlying the land cover classification using digital remote sensing data is that pixels within the same land cover class tend to group together or cluster in multispectral feature space and those groups of pixels from different cover classes tend to be separate from one another in multispectral feature space sited in (Lu and Weng, 2007).

Table 3.5: Description of LULC classes used for classification. (sources FAO,1998)

Land cover types	Descriptions and subcategories
Built-up area	Urban and suburban built-up including homestead area such as residential, commercial, industrial areas, villages, settlements, road network, pavements, Mixed urban or built-up land, other urban or built-up land.
Barren Land	Includes a surface with no vegetation, open land exposed soil, rocks, and sandy Areas Beaches, Sandy other than Beaches
Vegetation	Cropland and pasture, Orchards, groves, vineyards, nurseries and ornamental horticultural areas, Confined feeding operations, Other agricultural lands Deciduous forest land, Evergreen forest land, Mixed forest land
Agriculture	Areas of land used for growing agricultural crops

In this study four types of land class are selected for classification; Urban or built-up land category is characterized by intensive land use where the landscape has been altered by human activities. Additionally, vegetation refers to all lands used primarily for the production of food and some of the structures associated with this production. In addition to

the agricultural land, vegetation contains also forestland. Barren lands are also characterized by thin soil and the lack of vegetative cover in a non-urban setting.

3.4.5. Classification scheme for land cover mapping.

The research first applies unsupervised classification based on indices (for vegetation cover, bare land, and built-up) to have a brief picture of the area. Consequently, the LULC map was produced with land cover types such as agriculture land, vegetation, built up/settlement, and bare land for the study area using a maximum likelihood algorithm supervised classification. Below Diagram show Spectral indexes for image classification (figure 3.7)

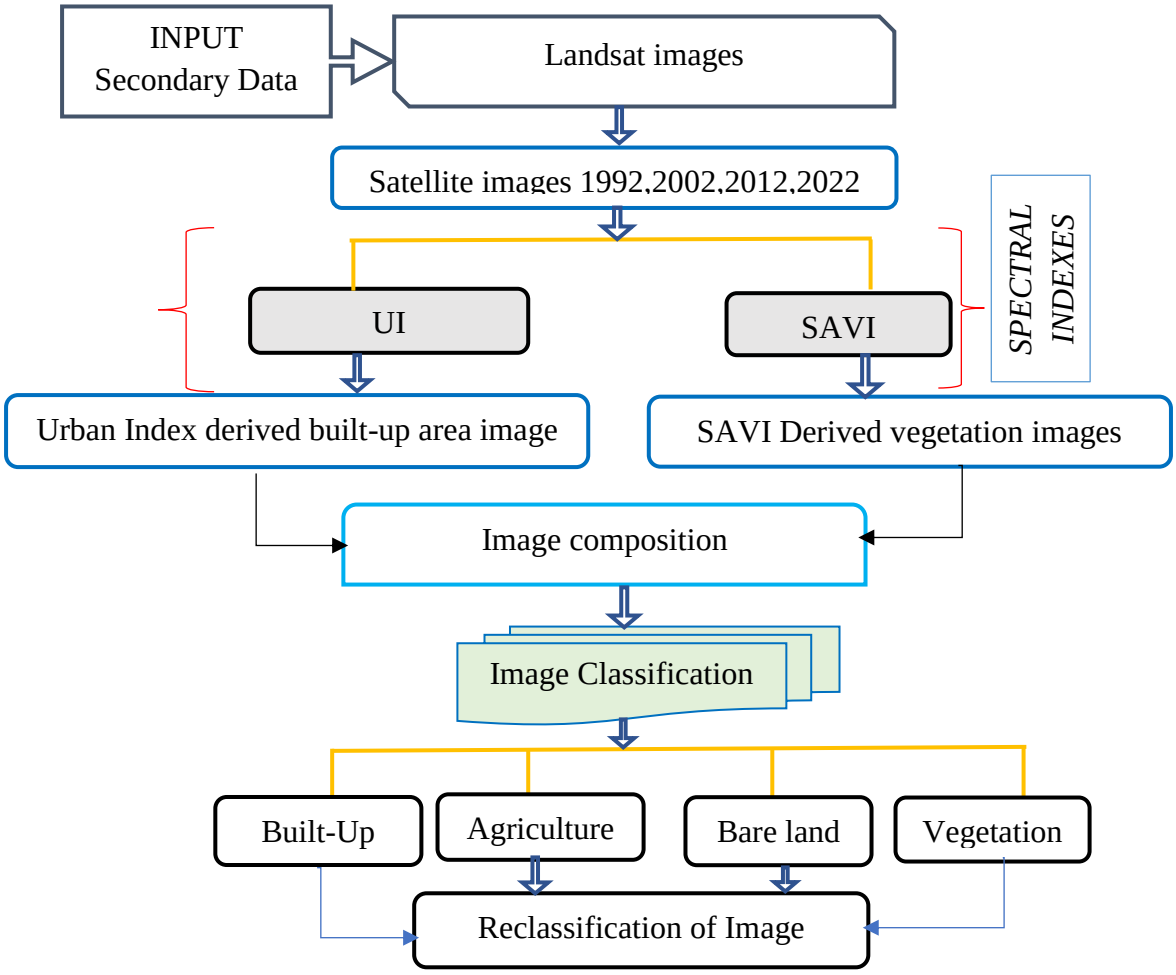

Figure 3.7: Classification schema. sources author developed and *(Heidarinejad, 2017)*

Accordingly, misclassification problems are often found in the land cover maps generated from traditional methods. A key concern is that the land cover maps derived from satellite images are often judged to be of insufficient quality for operational applications cited in (Heidarinejad, 2017). This study used spectral indexes to identify a specific land cover when multiple materials are mixed in one pixel.

Accordingly, the urban cover is grouped into four generalized categories, i.e., built-up land, barren land, and vegetation. Based on these two core elements indices, UI, SAVI, are selected to represent the major land cover classes.

(Ray, 1994). SAVI takes advantage of the high vegetation reflectance in NIR spectral range such as TM band 4 and high pigment absorption of red light, such as TM band 3 (Jensen, 2005). Although nearly everyone working with the remote sensing of vegetation knows the Normalized Difference Index (NDVI), this study employed SAVI to highlight vegetation features due to its advantage over NDVI when applied in an area with low plant cover such as the urban areas. The Soil-Adjusted Vegetation Index (SAVI) is expressed as follows:

$$SAVI = \frac{(TM_4 - TM_3) \times 1 +}{TM_4 + TM_3 + I} \quad \text{.....Equation (3)}$$

Where: TM4: Reflectance value of band 4 (near infrared) of TM sensor;

TM3: Reflectance value of band 3 (red) of TM sensor.

I: is a correction factor ranging from 0 for very high densities to 1 for very low densities.

After producing the vegetation image using SAVI, the built-up land image was produced using the Urban Index (UI) with the following equation:

$$UI = \frac{TM_7 - TM_4}{TM_7 + TM_4} \quad \text{.....Equation (4)}$$

3.4.6. Accuracy Assessment

In accuracy assessment, typically the land cover classification in the map is compared to the true land cover condition. This is done using the 'ground truth', or 'reference data'. Since the ground truth data is not practically attainable, researchers use the reference data such as higher quality data. Again, it is not possible to obtain the reference land cover classification for the entire region of interest, therefore, a statistical sampling method is used to produce a 'sample' i.e. subset or portion of the region mapped, and accuracy assessment is carried out. Most common method for accuracy assessment at present is the error matrix where a confusion matrix displaying the proportion of area that is correctly classified and mis-classified for the different land cover types is produced. It is helpful in estimating overall

accuracy, user and producer accuracy, errors of omission and commission, and Kappa Coefficient. (Stehman, S. V. (2009).

3.4.7. Confusion matrix and kappa coefficient

The general acceptance of the error matrix as the standard descriptive reporting tool for accuracy assessment of remotely sensed data has significantly improved the use of such data. An error matrix is a square array of numbers organized in rows and columns which expresses the number of sample units (i.e. pixels and clusters of pixels) assigned to a particular category relative to the actual category as indicated by reference data (Becker, 1998).

Validation or accuracy assessment is an integral component of most mapping projects incorporating remotely sensed data (Congalton, 2001).

The importance and power of the Kappa analysis is that it is possible to test if a LULC map is significantly better than if the map had been generated by randomly assigning labels to areas as (Dengiz, 2018) cited (Congalton, 1996). According to (Congalton, 2001), the Kappa coefficient lies typically on a scale between 0 (no reduction in error) and 1 (complete reduction of error). The latter indicates complete agreement, and is often multiplied by 100 to give a percentage measure of classification accuracy. Kappa is computed as,

$$\mathbf{K} = \frac{N\sum_{i=1}^{r} xii - \sum_{i=1}^{r}(x_{i+} \times x_{+i})}{N^2 - \sum_{i=1}^{r}(x_{i+} \times x_{+i})} \quad \text{.....Equation (5)}$$

W s in the matrix, r is the number of rows in the matrix,

xii is the number in row i and column i,

$x+i$ is the total for row i, and

$xi+$ is the total for column. (Gumma et al., 2019)

Kappa value greater than 0.80 (80%) represents strong agreement, a value between 0.40 and 0.80 (40 to 80%) represents moderate agreement, and a value below 0.40 (40%) represents poor agreement (Congalton, 1996). The acceptance and rejection of the supervised land use land cover classification value is depending on the value of Kappa. (Fung & Ledrew, 1988) examined the use of different accuracy indices, including overall, average and combined accuracies and the Kappa coefficient of agreement to determine an optimal threshold level for changes detection images. They recommended the Kappa coefficient because it considers all elements of the confusion matrix.

3.4.6. change Analysis

change detection refers to the process of identifying differences in the state of land features by observing them at different times. This process can be accomplished either manually by

hand or with the aid of remote sensing software. At this stage Erdas imagine and ArcGIS are used for change analysis of different year images. there are Four the most commonly used change detection methods were applied to the registered, normalized multi-temporal Landsat images. In this study change detection methods used classification which allow as to now the difference times to produce difference map.

3.5. Livelihood Investigation

In this study primary and secondary data During the survey data of 70 and 15 peoples will have be collected questioner survey and closed interview respectively. SPSS software will have been analysing frequency, percentage pie charts and tables. The previous section methods of spatial data analysis are only focus changes of futures, but the main objective of the study is not only change analysis rather than the general impacts of urban expansion on surrounding city such as socio-economy, Displacement from original places etc. therefore in addition to the above data analysing methods the researcher will have been used SPSS software to analysing the socio-economy disorder.

Different types of questioner survey have been collected from the selected kebeles at least 70 peoples may have been selected and 15 municipality workers also involved. socio-economy impacts of urban expansion will have be analysis by rising is competition of jobs, loss of identity, loss traditional life style, are they displacement, are they and their children loss agricultural land (if so how much by hectare), is compensation there when they loss their agricultural lands. (if so enough or not) and what are they income source today. For this study the researcher focused on three (3) kebele. Those are Boku-shenan, Dabe Soloke, and Daka Adi also Melka Adama kebele is preurban surrounding the city but it’s not included in those kebele because the data needed to analyse was not available. Because this selected Kebeles highly affected by urban expansion problem around Adama city. There for the researcher will have be going to use non-probability sample selection and use SPSS software which is widely used as a Statistical Analytic Tool. It is a comprehensive and flexible statistical analysis and data management. In general, the combination remote sensing and geographic information system (GIS) technologies and SPSS analysis have been used for this study.

4. RESULTS AND DISCUSSION

This chapter discusses and present the major findings of the study based on the spatial analysis of land use land cover, Socio economic data, household survey data and key informant interviewees. different data sets that were used to examine changes in the LULC patterns and Impact of urban expansion on peri urban livelihood in Adama City. The results were presented in table, chart, graph and maps.

4.1. Spatial Analysis of land use land cover Results

To achieve the objectives of the study, LULC of the study area were first classified from Landsat satellite images of 1992, 2002,2012 and 2022 to compute the LULC change trend of Adama City. The images were interpreted or classified into four classes, namely built up, Agriculture land, bare land and vegetation. The LULC maps generated after running a maximum likelihood supervised classification in ERDAS IMAGINE 2015 software. The results showed that, over the study period (1992–2022), the dominant land cover type in the study area was Agriculture land ranging between 60% and 70% of the total area.

Based on the data gathered, data analysis performed and LULC maps of last 30 years developed for 1992-2022 and coverage in different year for each class years presented in the following (figure 4.1- 4.2). area of each class (table 4.1) shows the statistical change analysis of LULC over the study period (1992 – 2022). An overall change in LULC of all the three reference years how urban Expansion expanded to farm land in each year is shown in (figure 4.2). Additionally, the results of analysis gathered data from respondents and experts of administration office was discussed. Finally, we discuss the Details of how effects of Peri urban farming community view during urban Expansion and Livelihood situation of displacement community.

4.1.1. Accuracy Assessment of the Classification

Accuracy assessment in this study revealed the overall accuracies of 90.18 %, 91.14%, 89.51 %and 88.56% with the Kappa statistics of [0.892 ,0.849,0.819 and 0.924] were calculated for the three reference years 1992, 2002 and 2022 respectively. This indicates that all classifications are in acceptable range because an overall accuracy of each year was greater than 85% and kappa coefficient greater than 0.80 represents strong agreement (Landis and Koch, 1977) is an indicator for a strong accuracy. Hence, the maps met the accuracy requirements for change detection analysis (Anderson et al., 1976), and there is a positive correlation between the remotely sensed classified samples and the reference data. Results

of user's accuracy in this study showed that in 1992 the maximum class accuracy was for Agriculture area (98%) and the minimum was for vegetation (85%). In 2002, user's accuracy ranges from lowest accuracy A (84%) to relatively correctly classified Built-up area (93%) whereas in the period 2022, it ranges from 82% (vegetation) to 93% (built-up). Most of the LULC classes have a larger producer's accuracy than overall accuracy almost all are greater than 85% except the class of Agriculture land (92%) in 2022. The details of error matrix tables results are shown in (Table 4.1 - 4.4).

Table 4.1: Error Matrix and accuracy assessment of land cover of 1992

Classified Data	Reference Data				Row Total	User Accuracy
	Built-up	Bare land	Agriculture	Vegetation		
Built-up	60.0	0	0	10.4	70.4	85%
Bare land	0	76	7.1	0	83.1	91%
Agriculture	6.03	1	86	1	88	98%
Vegetation	0	12.5	0	72	84.5	85%
Column Total	66.03	89.5	93.1	83.4	326	
Producer Accuracy	91%	85%	92%	86%		

Overall Accuracy = 90.18 (%) and Kappa Statistics K^ = 0.892

Table 4.2: Error Matrix and accuracy assessment of land cover of 2002

Classified Data	Reference Data				Row Total	User Accuracy
	Built-up	Vegetation	Agriculture	Bare land		
Built-up	79.7	5.19	1	0	85.89	93%
Vegetation	0.67	79.14	0.12	4.35	83.61	95%
Agriculture	1	0.75	62.33	10.78	73.86	84%
Bare Land	0	0.12	7.88	89.22	97.22	92%
Column Total	81.37	85.2	71.33	104.35	340.58	
Producer Accuracy	98%	93%	87%	86%		

Overall Accuracy = 91.14(%) and Overall Kappa Statistics K^ = 0.849

Table 4.3: Error Matrix and accuracy assessment of land cover of 2012

Classified Data	Reference Data				Row Total	User Accuracy
	Built-up	Agriculture	Vegetation	Bare land		
Built-up	82.18	0	13.9	1	97.1	85%
Agriculture	0	71.63	1	2.354	75	96%
Vegetation	11.716	0	62.4	0	74.1	84%
bare land	1	1	0	56.47	58.5	97%
Column Total	94.896	72.63	77.3	59.824	305	
Producer Accuracy	87%	99%	81%	94%		

Overall Accuracy = 89.51%) and Overall Kappa Statistics = 0.819

Table 4.4: Error Matrix and accuracy assessment of land cover of 2022

Classified Data	Reference Data				Row Total	User Accuracy
	Vegetation	Bare land	Built-up	Agriculture		
Vegetation	76.86	7.53	8.05	1	93.44	82%
Bare land	0.03	74.31	0	5.83	80.14	93%
Built-up	3.81	0.16	61.95	0.39	66.31	93%
Agriculture	1	0	10.69	84.78	96.47	88%
Column Total	81.7	82	80.69	92	336.36	
Producer Accuracy	94%	91%	77%	92%		

Overall Accuracy = 88.56%) and Overall Kappa Statistics = 0.924

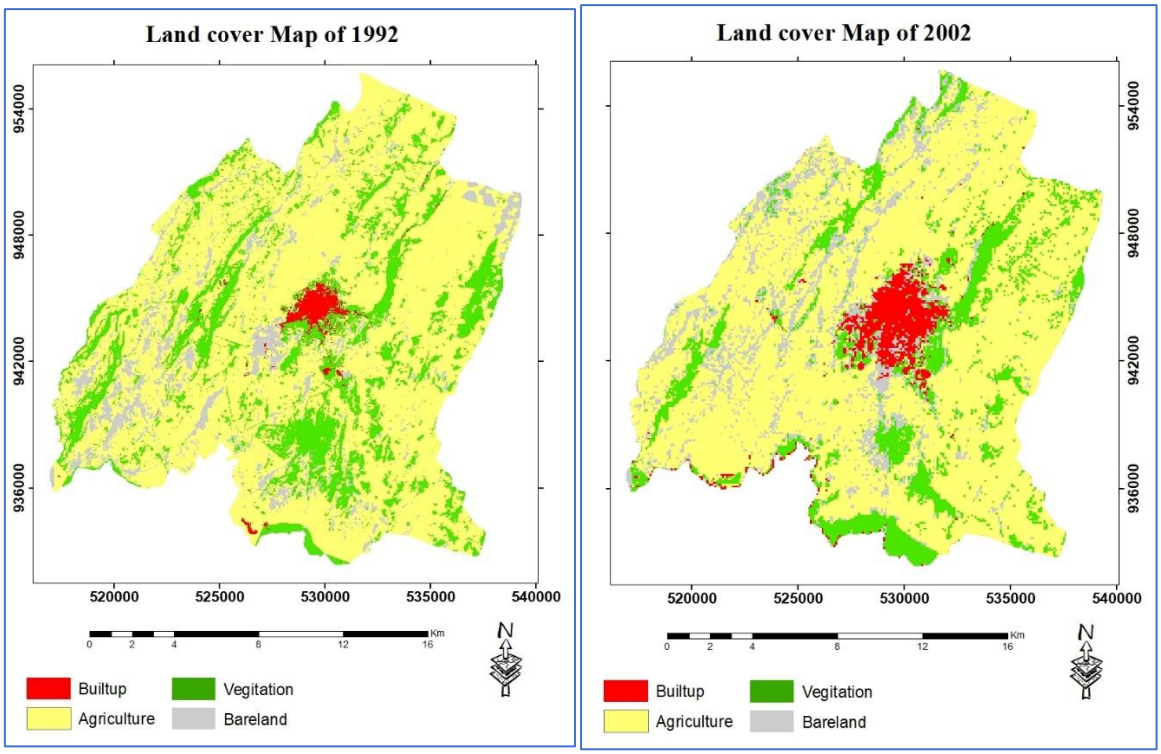

Figure 4.1: LULC map of Adama 1992 and 2002

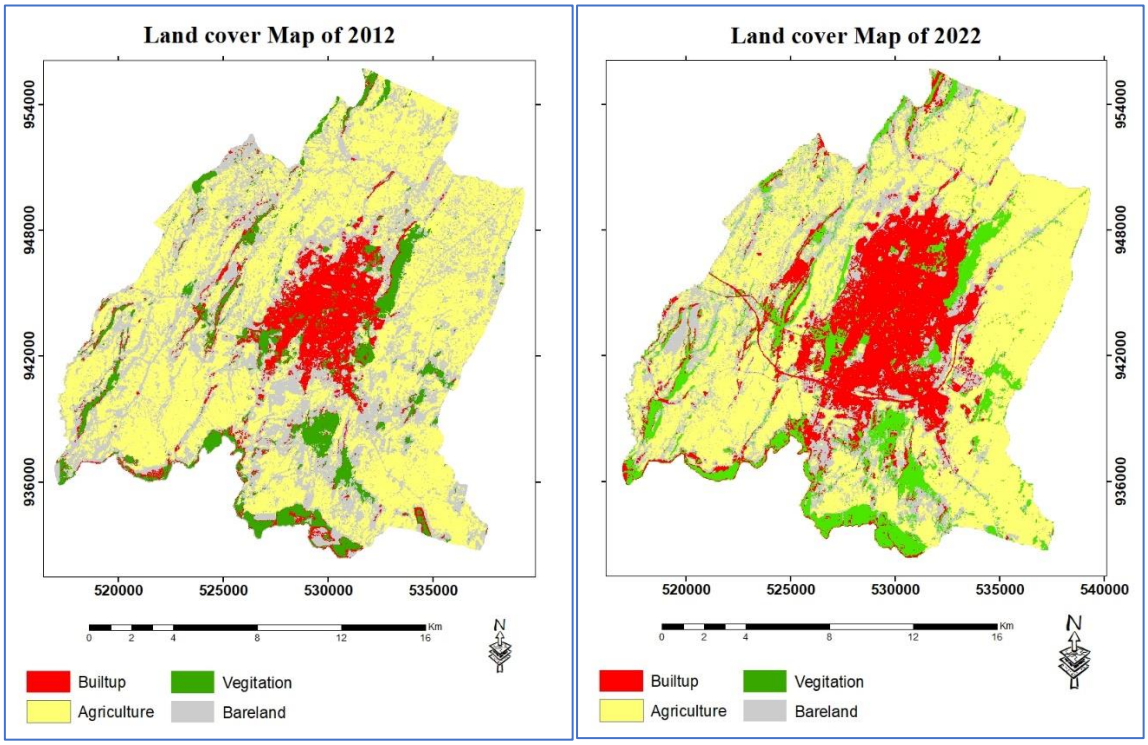

Figure 4.2: LULC map of Adama 2012 & 2022

4.2. Land use land cover change Detection.

In this study, four LULC maps were produced for the study period and spatiotemporal LULC dynamic process was analyzed (Table 4.5; Table 4.6.). Based on the LULC classification, over the past three decades, LULC in study area such as agriculture and bare land, vegetation was in continuous decline, while built-up land classes showed a varying pattern. In general, out of the four LULC classes identified in the study area, only built-up, showed continuous increment over the past 30 years. The extent of change within the study area of the individual LULC categories in hectare (ha) and the percentage (%) they occupied for 1992, 2002,2012 and 2022 are presented in Table 4.5.

Table 4.5: Area statistics and percentage of the LULC units for 1992, 2002,2012 and 2022

LULC Types	1992		2002		2012		2022	
	Area	area%	Area	area%	Area	area%	Area	area%
Agriculture	22065.7	70.2	18980.8	60.36	15399.5	48.97	12923.89	41.1
Bare land	2744.87	8.73	4005.91	12.74	7059.61	22.45	4561.428	14.5
Built-up	422.189	1.34	3899.88	12.4	6438.08	20.46	10160.21	32.3
Vegetation	6214.1	19.8	4559.83	14.5	2549.43	8.111	3800.678	12.1
Total	31446.86	100.0	31446.42	100.0	31446.62	100.0	31446.26	100.0

In 1992 the study area was dominated by Agriculture land covering 70.2% followed by Vegetation covering 19.8 % of the study area. Built-up and bare land shared 1.34% and 8.73% of the total area respectively. In 2002, Agriculture land, Vegetation, and bare land covered 60.36%, 14.50% and 12.74% of the total area respectively. The remaining parts of the area were covered with built-up (12.4%). In 2012 built-up area increased to (20.46%) and the remaining (79.54) was the share of other LULC classes. In 2022 built-up area more increased to (32.3%) and Agriculture land was decreased to 41.1% of land use land cover while the remaining (26.6%) was the share of other LULC classes (Table 4.5 and Table 4.6; Figure 4.1 and Figure 4.2).

Table 4.6: The Overall amounts and percentage of LULC Change during 1992-2022

LULC Types	1992 - 2002		2002 - 2012		2012 - 2022		1992 - 2022	
	Change (Δ/ha)	%	Change (Δ/ha)	%	Change (Δ/ha)	%	Change (Δ/ha)	%
Agriculture	-3084.9	-9.8	-3581.3	-11.4	-2475.61	-7.9	-9141.8	-29.1
Bare land	1261.04	4.0	3053.7	9.7	-2498.19	-7.9	1816.56	5.8
Built-up	3477.691	11.1	2538.2	8.1	3722.13	11.8	9738.02	31.0
Vegetation	-1654.27	-5.3	-2010.4	-6.4	1251.25	4.0	-2413.4	-7.7

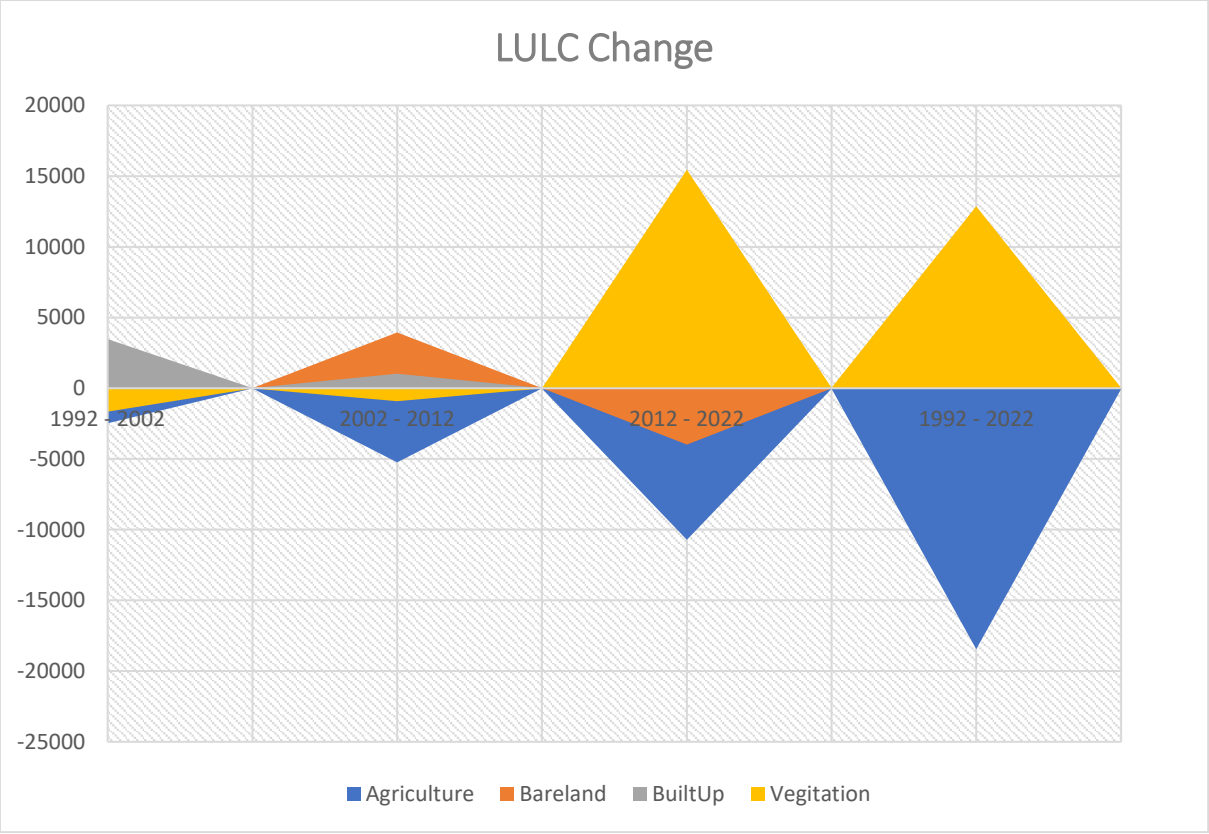

Figure 4.3: change analysis of land cover 1992 to 2022

4.2.1. Extent and Rate of Expansion of Built-Up Area

To show the rate of urban expansion in study area Within a time sequence, four satellite images from 1992, 2002, 2012 and 2022 were utilized to track the amount and rate of urbanization. During the analysis stage, a digital image interpretation of built-up area expansion was performed for each year, the total area (ha) of the built-up in each year and its percentage from each date of satellite interpretations were calculated and summarized. As a result, shows a map of urban expansion and area coverage for each year 1992, 2002, 2012 and 2022 area of [422.19, 3899.88, 6438.08, 10160.21] ha and [1.34%, 12.4% ,20.46%, 14.5%] of the study area was covered with built-up area respectively (Table 4.5).

Between 1992 and 2002, the built-up area of the land expanded by 12.4 percent and expanded by 8.10% from 2002 to 2012. From 2012 to 2022, the yearly pace of urban expansion was +3722.13ha (11.8) Furthermore, the computed figure is +9738.02 area and (31%) when the yearly rate of urban expansion is considered between 1992 and 2022. finally, the results of the study show that during study period 1992 to 2022 urban/built up area of the town has significantly expanded by 15.50 percent against agricultural land loss of 14.55 percent over the study period. This indicates that there was a major land use/land cover change of the city with the agricultural land lost to built-up area being the dominant one. The built-up area has been expanding in all directions during the study period consuming land from the other land uses in and around the city.

4.3. The Socio-Economic and livelihood Results

4.3.1. Demographic characteristics of respondents (Participants)

This sub section highlights the demographic and social characteristics of the sample households in the Adama city selected kebele. The demographic characteristics of the study participant are collected through a household survey. The major demographic issues discussed here are only those expected to have certain relationships with variables, age, sex, educational level, marital status, dislocation, income and occupation of the sample respondent households were presented below Table 4.7 and figure 4.8 below shows that among the total number of participants 50 (71.42%) are males and 20 (28.57%) are females. Here the name male and female did not indicate male household headed and female household headed, rather show the gender of the participant who completes a questionnaire by representing household. The average age of the respondents was 56 years. The age ranged from 20 to 76 years. Out of 70 respondents, less than 11% were younger than 30 years.

However, about 24% were older than 60 years. The majority of the farmers (35%) were found in the age range between 40 and 60 years as indicated in (Table 4.7).

Table 4.7: Number of participants by Gender and age

General characteristics	Particular feature	Frequency	Percent%
Sex	Male	50	71.4
	Female	20	28.6
	Total	70	100.0
Age	**Age**		
	<30	11	15.7
	30-60	35	50.0
	>60	24	34.3
	Total	70	100.0

Source: own survey February, 2022

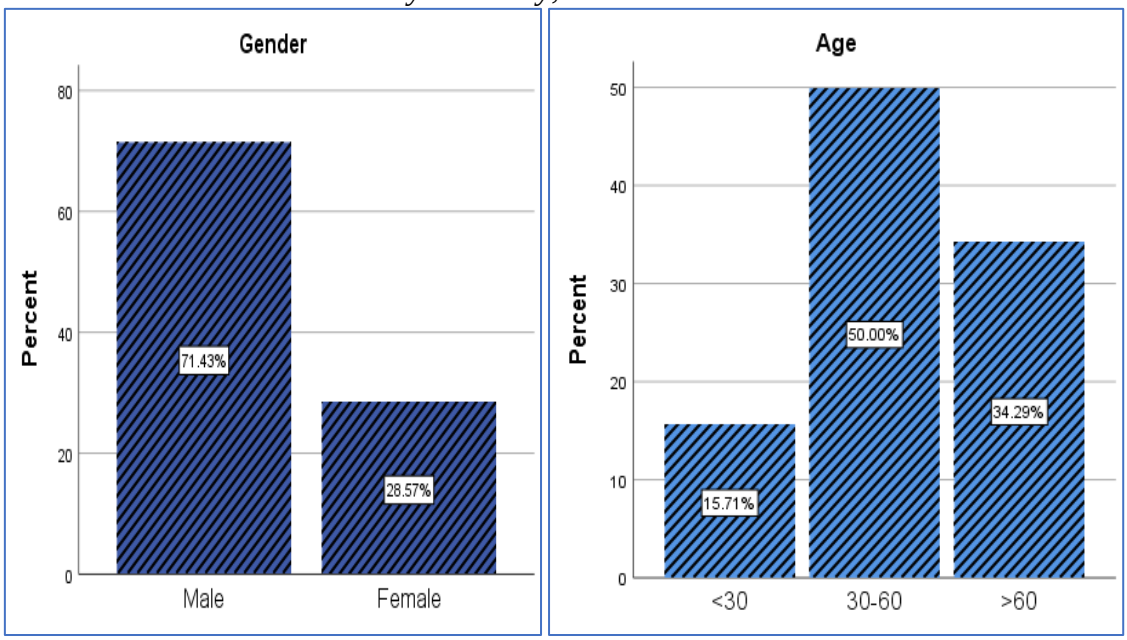

Figure 4.4: Graph show gender and age of respondents

Accordingly based on data gathered from respondent the results show marital status 60(85.7 %) of the participants are married, while the rest 10 (14.3%) of the respondents were not married. The other issue discussed was birth place of Respondents status. Adama city is divided into six sub-cities and about 18 kebeles. But the study was focused on only kebeles found in surrounding pre-urban (Boku, Dabe Soloke, and daka Adi. As a result, show 47.14% of the dislocated sample households are born in Adama and the rest 38.57%, 14.29% are surrounding Adama city and from another place respectively. See *(Appendix-1 socioeconomic demographic of study area).*

Table 4.8: Marital status of respondents

Marital status	Frequency	Percentage %
Married	60	85.7
Single	10	14.3
Total	70	100.0

Source: own survey February, 2022

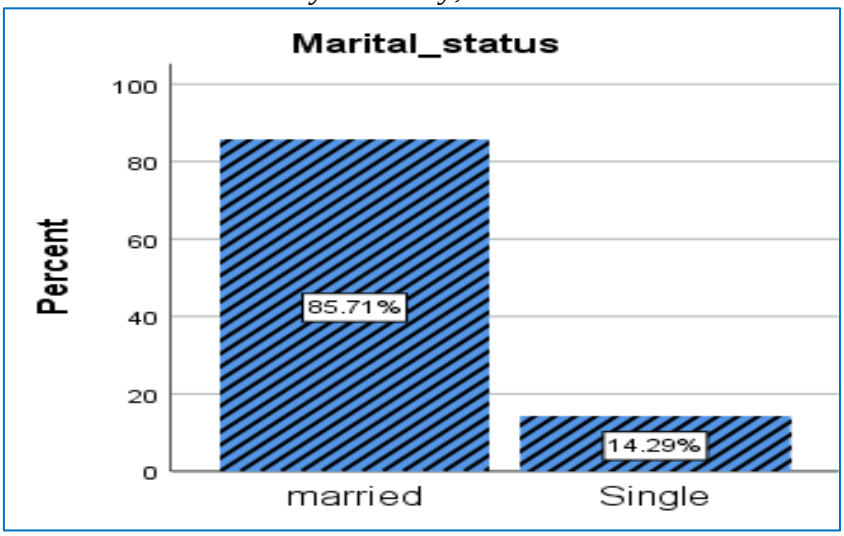

Figure 4.5: marital status of respondents

Education level has positive relationship with urban expansion in peri- urban community. Concerning educational background, 27(38.57%) of respondents were illiterate primary school, 18(25.71%), 15(21.43%) and 10 (14.29 %) are those who attained secondary level and above respectively Shown in Table 4.9 This implies that most of the peri-urban farming community whose land has been expropriated and thus their livelihood has been affected attributed to horizontal urban expansion have no educational qualifications by which they can be able to secure their alternative livelihood after eviction.

Table 4.9: Education status of respondents as reported.

Education status	Frequency	Percent
illiterate	27	38.57
1-8 (primary)	18	25.71
9-10 (secondary)	15	21.43
>12 and above	10	14.29
Total	70	100.0

Source: own survey February, 2022

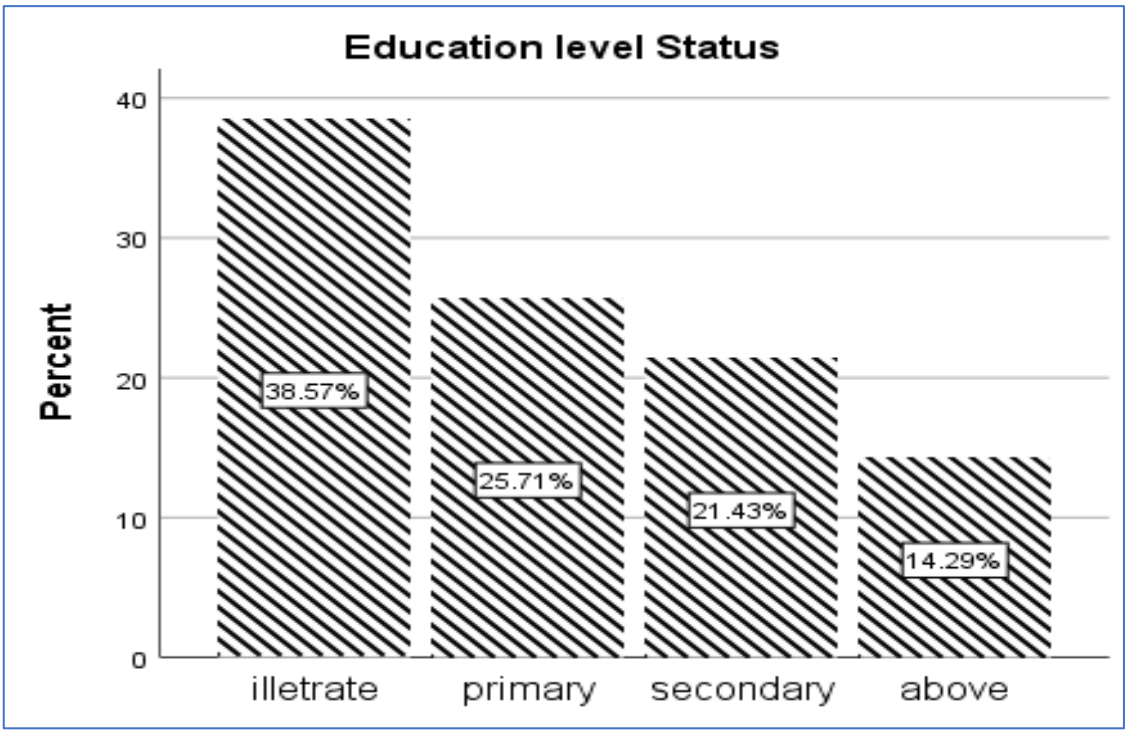

Figure 4.6: Education status of respondents

An Occupation (Job opportunity) is another variable which had negative and significant relationship with the livelihoods of peri-urban community due to urban expansion. The negative and significance relationship between the variables indicate that peri-urban community job opportunity decreases, the livelihood of the community became worse. The focus group discussion also agreed as job opportunity is negatively related to urban expansion and Urban expansion effects on livelihood brings jobless or unemployed 72.9%.

Table 4.10: Respondents occupational and monthly income.

occupation		Frequency	Percentage %
	Private employment	6	8.57
	Government	3	4.29
	Self employed	10	14.29
	Un employed	51	72.86
	Total	70	100.0
monthly Income		Frequency	Percent
	<1000	28	40.0
	1001-2000	18	25.7
	2001-3000	14	20.0
	>3000	10	14.3
	Total	70	100.0

Source: own survey February, 2022

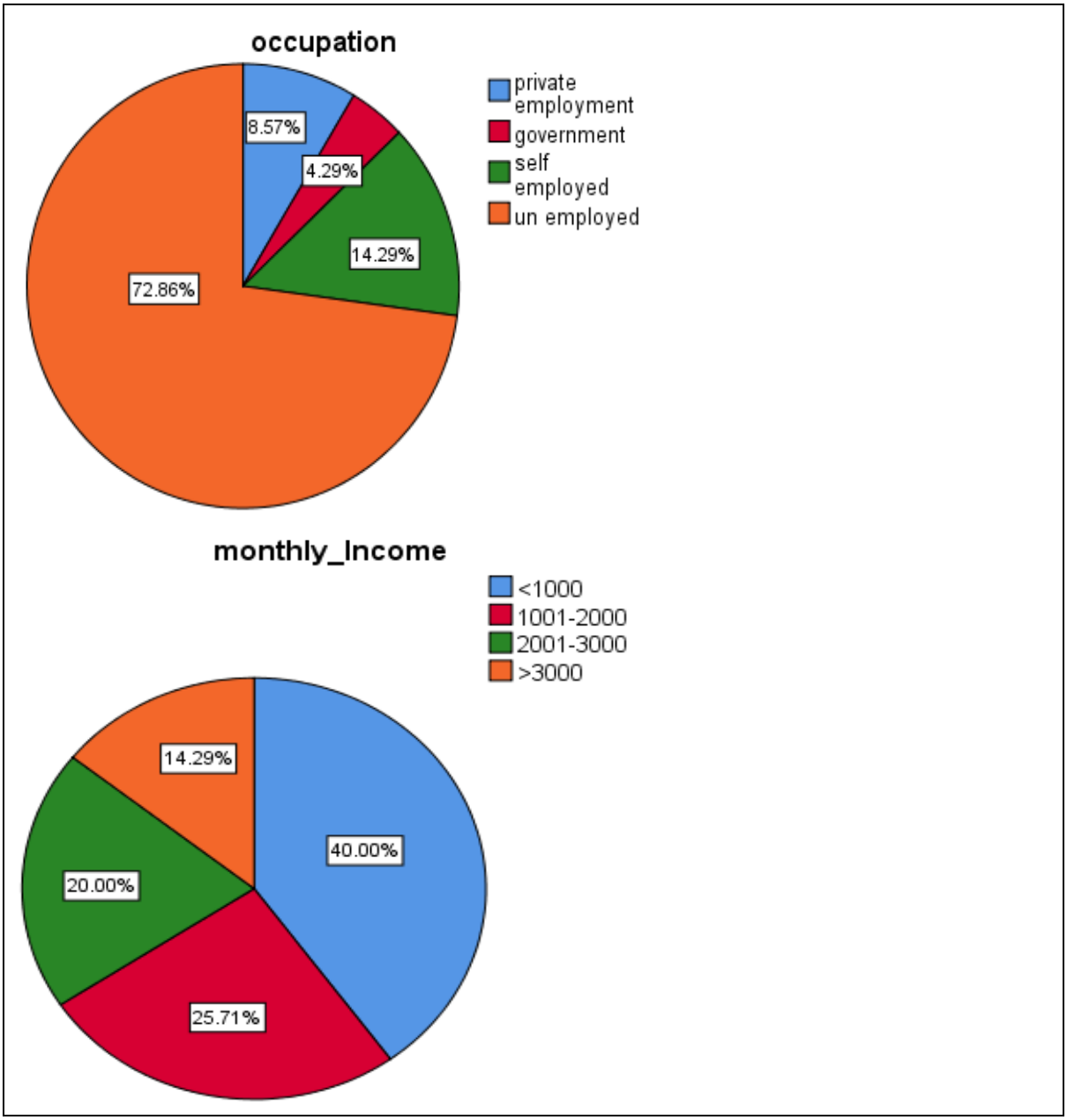

Figure 4.7: Occupation and Monthly income status of respondents

Urban expansion also has affect the life of the farmers in different ways like: in displacing from their geographic locations, by minimizing their sources of income from farming, by reducing the amount of yearly crop production, etc. as it was indicated in the focus group discussion more than 85% of the displaced households were farmers before displacement. so, farming has been the main source of income in my study area. Farming and the amount of crop production activities are directly dependent on availability of farm land. This means if there is no enough farm land to be cultivated there will be a reduction of income

obtained from agriculture. the monthly income of the community is 14.3% and this has shown a simple example how urban expansion effect on farmers life by leaving them without farm land. since the urban expansion is not accompanied by strategic and sustainable development plan which favors the displaced farmers from their long holding of fertile and productive farm land in a sustainable way.

4.3.2. urbanization effect on peri-urban community livelihood

Urbanization impacts on preurban livelihoods such as those on agriculture (agricultural land use and cropping pattern), forest, loss of grass land, loss of clean environment, loss of living home/shelters and other infrastructural facilities. Urban settlements and land under construction of infrastructural facilities have increased, which caused large-scale agriculture land reducing. The expansion, through without expropriating farmers land, destroys other assets of the farmers. The loss of their assets results in decline of their monthly income. Some displaced household heads still work on agriculture with limited access to farm land, some work as daily labour; others are in uncertain situation as a result of the change in the mode of life. Changes in the mode of life resulted in poor economic conditions that force some to engage in daily labour, local alcohol making (beverage), and petty trade as alternative source of income (sewale,2019). Therefore, the livelihood strategy adopted presently by the dislocated farming community is characterized as survival or necessity.

Table 4.11: Impact of urban Expansion on the livelihood loss their asset

		Frequency	Percent
Loosed Asset	Farm land	44	62.86
	Grass land	9	12.86
	Forest land	4	5.71
	Loss Of shelter	5	7.14
	Loss of clean Environment	8	11.43
	Total	70	100.0

Source: own survey February, 2022

Generally, as shown in table 4.11 and fig 4.8 shows what respondents saw as effects of urbanization on their livelihood. The effect of urbanization on people's livelihoods was asked

of all responders. As a result, the majority of respondents (62.86%) agreed that the primary impacts of urban expansion are loss of Agriculture/farm land,12.86% agreed that loss of grassland for cattle, 11.43% loss of clean environment, 5.71% loss of forest land and the rest 7.14% loss of shelter (Table 4.11).

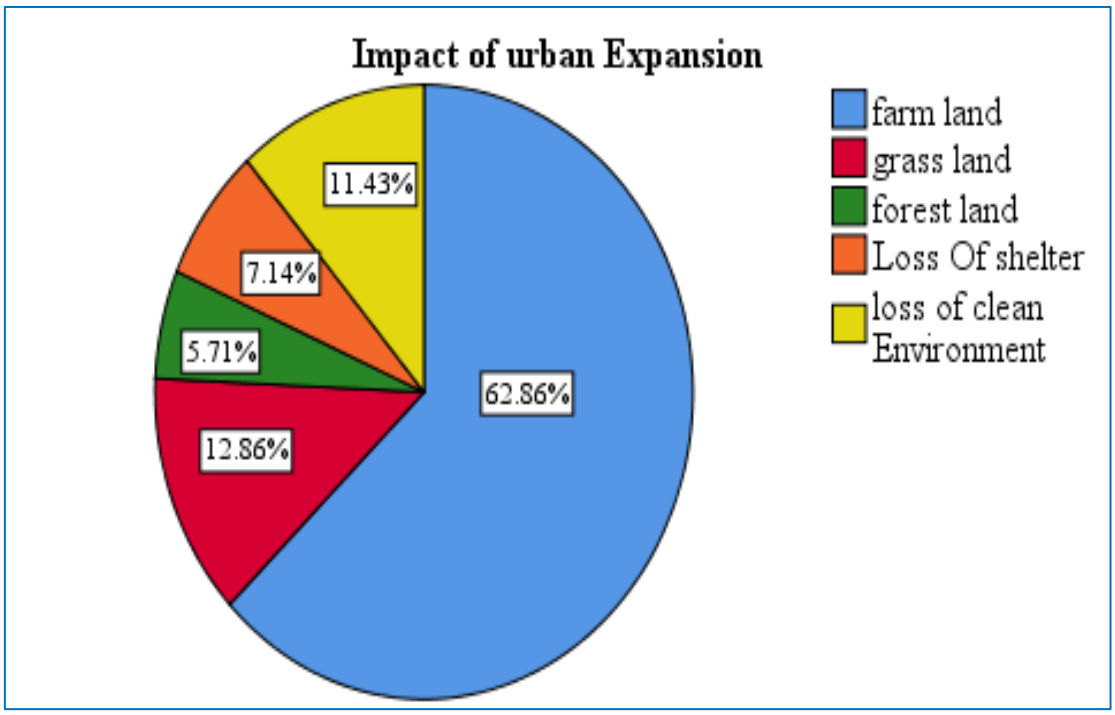

Figure 4.8: Impact of urban Expansion on the livelihood loss of their asset.

According to respondents interviewed About 62% percent of respondents proposed vertical expansion as a way to restrict urban expansion when asked about remedies. Developing a new technology for tracking developer activity. But According to 38% percent of respondents, this will aid in minimizing uncontrolled urban expansion and the resulting loss of agricultural areas.

4.3.3. Peri urban agricultural community explanation during urban Expansion.

As a result, show households view was observed towards the city's expansion, as Table 4.12 shows us, the sampled households responded differently 61.43% of the households strongly opposed the expansion while 21.43 % of households supported the expansion since they were expecting benefits in compensation and urban infrastructure and others 17.14 % neither opposed nor support. On the other hand, most of the respondents oppose urban expansion because of their livelihood problems.

Table 4.12: Number of respondent support and oppose during expansion

Alternatives	Num_ of participant (Frequency)	Percentage (%)
Oppose Expansion	43	61.43
Support Expansion	15	21.43
Neutral (No Problem)	12	17.14
Total	70	100.0

Source: Own survey February 2022& Spss

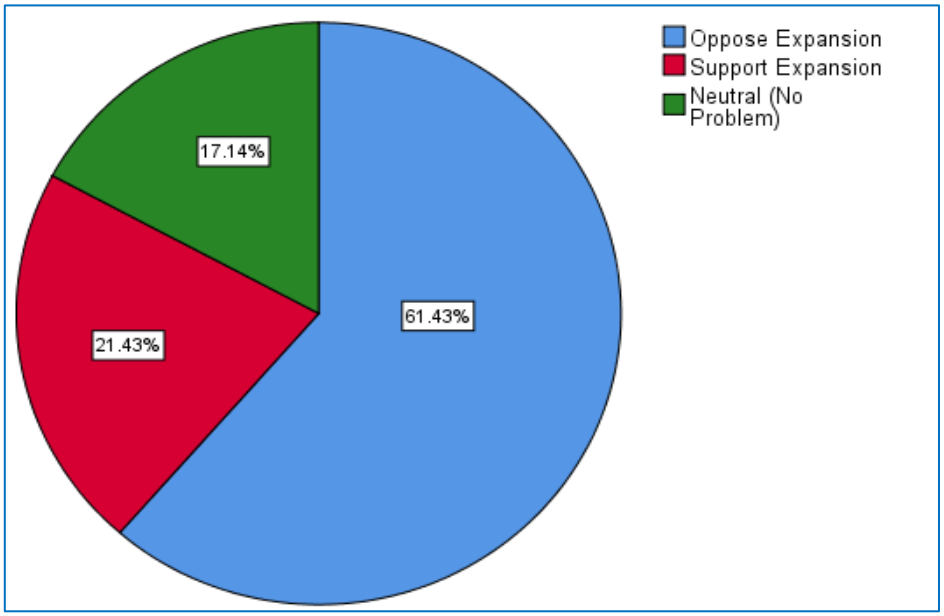

Figure 4.9: Number of Oppose and support urban expansion by percentage.

4.3.4. Livelihood situation of Adama city in Pre-urban area

The livelihood community were facing the problem of changing occupation which is new for them after the urban expansion due to they were lost their farming land, grass and other facility. According to demographic characteristics presented in previous section the of the study participant are collected through a household survey show that the major demographic variables consisted of age, sex, educational level, marital status, and educational background of the sample respondent households were presented below.

The male and female ratio in the sample household head is 71.43% male and 28.57% females. In terms of education the highest proportion 38.57 % is illiterate which is very high

by the area standard, about 25.71% percent has reached primary and only 21.43% percent attended secondary school and only 14.29 above secondary school

In related with the shift in occupation for the livelihood situation of displaced farmers, the majority (75.7) % of displaced farmers have shifted their occupation. While 24.3% of displaced farmers were continuing their occupation (farming) by renting land in other distant places for relatives.

The previous income earning activity of the displaced farmers was farming activities. But know most of the displaced farmers change their income-earning activities, these are daily labor work, cottage industries such as handcraft, alcohol brewing, pottery, and petty trades. Here those displaced farmers were forced to change their previous income-earning activities due to the reason for the reduction in production by their current land size.

Most of the displaced farmers (82%) were engaged in daily labor work, this is due to the reason displaced farmers need the money for daily consumption purposes. The challenge that inhibits the displaced farmers to employ in off-farm activities was the lack of sufficiently accessible works for all needy displaced farmers. Those displaced farmers were unable to employ in big industries in the town, due to the reason that industry works require a medium educational level and high level of skill and capacity.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

The rapid urbanization has led to extensive land use change particularly in those developing countries. In line with the development of urbanization, Agriculture(farm) land is decreasing dramatically, which presents the threat economy to the pre-urban livelihood. Urbanization though is important and basic place for industrial development, is reversely could have high potential to affect negatively the nearby peri-urban agricultural communities where urbanization is undertaken. Accordingly, in Adama city based on selected kebele farmers were dispossessed for agricultural livelihood assets in favor of urban development though it is evidenced that the extent for loss of assets differ from house hold to community.

According to results from respondent most affected peri-urban rural kebeles in the process of urban expansion are, Boku shenan, Dabe soloke, and Daka Adi. Those kebeles are under preurban before 5 years ago. The highest urban expansion in the Adama city was take place after 2012. Despite of the community's awareness of the expansion via orientations and some meetings by the city administration, the farming community was not made participant on the decisions making processes except participation or presence about the kinds and amount of compensations and related benefits to them for the farmland expropriated from them, for the property they lost and hence for their livelihood interruption and the effects on their family become savior.

The urban expansion brought a significant negative impact on the livelihood elements of the peri-urban agricultural community as this study examined. Therefore, this study had assessed and found that the horizontal urban expansion has adversely affected the financial, social, natural, physical and human capital of the peri-urban agricultural community's livelihood that was why these communities call themselves "urban made poor".

Regarding the newly started livelihood output, the findings have shown that 85 % of the households believed that they had not secured their livelihood. The reasons for the poor output of the newly livelihood system included poor training skills and lower educational sourced knowledge the households had on how to develop and manage money, lack of enough compensations, the low experience of households for an urban mode of livelihood and inadequate institutional follow-up and support are major gaps to fill.

The farmlands taken away for urban development were all types, which includes irrigated and non-irrigated. However, some farmers were partially disposed who left with some plots of farmlands and are so far engaging in agricultural activities as a source of income. The farmlands taken away from farmers dominantly used for the development of industries reserved (i.e. Adama industrial zone) for needy private investors and for the undergoing construction for the new projects. According to respondents' responses farmlands taken away from farmers are not developed for six (6) year to now (own survey and site visiting,2022).

Loss of agricultural livelihood assets without the replacement of alternative economic systems that grantees individual survival forced evicted farmers to shift from agriculture activities of occupation to non-agricultural. Though dispossessed farmers' occupational diversification reflected dynamic dimension after displacement as an alternative means of livelihood, the result of the study showed that the annual total income earned from non-agricultural economic activities showed smaller additional increase in overall economic outputs at family level.

Due to the reduction in farm size and loss of livelihood assets, evicted farmers annual income amount earned from various sources such as on-farm and off-farm activities were found decreased after eviction. However, agriculture continued to be the dominant livelihood sources of income for most farmers in the area. Lack of ability, education and land size constraints were barrier to spread diversified livelihood strategy for higher income earning activities. Family who evicted totally and being landless made little livelihood diversification and found vulnerable to less access for food than those who owned and evicted farmlands partially. Moreover, the link between loss of land, livelihood and vulnerability were painfully understandable when urban expansion towards the peri-urban areas implemented.

5.2. Recommendations

Adama city is one of the fastest growing industrial development central city in the Oromia regional state which expanded at distressing rate towards the peripheral productive farmlands for searching space to urban development purposes. Adama city administration also considers those peoples whom are affected by the expansion but not covered by the compensation program such as women and children current rehabilitation mechanism and procedure is not a guarantee for future survival strategies of peri-urban farmers. Therefore, the following are the various types of intervention suggestions that were given emphasis in livelihood asset building of dislocated and displaced farmers in the peri urban areas of Adama in order to minimize the status of vulnerability due to urban expansion.

- ☞ The land expropriation process should follow standardized and legally justified procedure. City Municipality should notify targeted peri urban farmers in advance, and then public consultation take place, to mutual agreement then proceeds to property valuation. Finally, provide training and rehabilitate evicted farmers.
- ☞ Compensation as one of the benefit packages in the process of urban expansion in the municipality of Adama has commonly applied to all evicted farmers though the amount of money paid considerably varied among households for the reason that payment was made based on the extent and the types of the dispossessed livelihood assets.
- ☞ Social and economic development in these areas is low the policies that evict farmers from their land without alternative means and improved capacity to expand their livelihood options and without creating better economic opportunity need be reconsidered.
- ☞ Urban expansion destroys socio-economy or assets and reduce income of the household through such actions as implementing horizontal expansion policy, low compensation rate, evicting farmers from their socio-economy relations without considering their future prospects.

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APPENDIXS

Appendix I: Demography & Socio-economic of Respondents

Table: Frequencies responds(participants)

Statistics

		ID	Gender	Age	Education	Marital status	Birth place	occupation	monthly Income
	Valid	70	70	70	70	70	70	70	70
	Missing	0	0	0	0	0	0	0	0
Mean			1.2857	2.1857	2.1143	1.1429	1.6714	3.5143	2.0857
Minimum			1.00	1.00	1.00	1.00	1.00	1.00	1.00
Sum			90.00	153.00	148.00	80.00	117.00	246.00	146.00

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	50	71.4	71.4	71.4
	Female	20	28.6	28.6	100.0
	Total	70	100.0	100.0	

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<30	11	15.7	15.7	15.7
	30-60	35	50.0	50.0	65.7
	>60	24	34.3	34.3	100.0
	Total	70	100.0	100.0	

Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	illetrate	27	38.6	38.6	38.6
	primary	18	25.7	25.7	64.3
	secondary	15	21.4	21.4	85.7
	above	10	14.3	14.3	100.0
	Total	70	100.0	100.0	

Marital_status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	married	60	85.7	85.7	85.7
	Single	10	14.3	14.3	100.0
	Total	70	100.0	100.0	

Birth_place

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Adama	33	47.1	47.1	47.1
	surround City	27	38.6	38.6	85.7
	from other place	10	14.3	14.3	100.0
	Total	70	100.0	100.0	

occupation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	private employment	6	8.57	8.57	8.57
	government	3	4.29	4.29	12.86
	self employed	10	14.29	14.29	27.15
	un employed	51	72.86	72.86	100.00
	Total	70	100.0	100.0	

monthly Income

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<1000	28	40.0	40.0	40.0
	1001-2000	18	25.7	25.7	65.7
	2001-3000	14	20.0	20.0	85.7
	>3000	10	14.3	14.3	100.0
	Total	70	100.0	100.0	

Appendix II: Questionnaire survey

ADAMA SCIENCE AND TECHNOLOGY UNIVERSITY

SCHOOL OF CIVIL ENGINEERING AND ARCHITECTURE

POST GRADUATE STUDY IN GEOINFORMATICS ASTU 2022 GC

QUESTIONNAIRE SURVEY STRUCTURE

Dear respondent, this interview is conducted for an academic purpose for the fulfilment of Degree of Masters of Science in Geoinformatics therefore your response is very important for the success of the study because all information that you provide determines the analysis and conclusion of the research. Hence, you are kindly requested to give your response. Your response will remain confidential. I would like to thank you in advance for your cooperation.

I. Participant information

1. **Residential address:** Sub City----------, Kebele ----------
2. **Birth place:** (a) ☐ In Adama city (b) ☐ Around the city (c) ☐ from other place
3. **Sex:** *(a)* ☐ Male *(b)* ☐female
4. **Age (in year):** (*a*) ☐ <30 *(b)* ☐ 30-60 *(c)* ☐ >60
5. **Educational back ground:** *(a)* ☐ Illiterate *(b)* ☐ primary school
   (c) ☐ Secondary school (*d*) ☐ above
6. **Marital status:** *(a)* ☐ Married *(b)* ☐ Single
7. **Occupation:** *(a)* ☐ Private employee *(b)* ☐ Government employee
   (c) ☐ Self- employed *(d)* ☐ Unemployed (e) ☐ NGOs
8. **Monthly Income (in Birr):** *(a)* ☐ [<500] *(b)* ☐ [501-1500]
   (c) ☐ [1501-2500] *(d)* ☐ [>2500]

II. Answer the questions according to the given instruction for each question.

9. What are the economic consequences that you have encountered due to urban expansion?
   (a) ☐ Decline in income *(b)* ☐ population displacement *(c)* ☐ High cost of living
   (d) ☐ lack of basic services *(e)* ☐ others specify _____.
   _____,
   _____.
10. **Do you have Residential house of your own?** *(a)* ☐ Yes *(b)* ☐ No

(c) ☐ if other specify_____.

11. Do you think that urban expansion has affected your living conditions?

(a) ☐ Yes *(b)* ☐ No

12. What kinds of basic infrastructural and service facilities do you obtain/access/ from the municipality? You can Select more than four (5) choices. Qnum05

(a) ☐ Health *(b)* ☐ schooling *(c)* ☐ market place

(d) ☐ Road and transportation service *(e)* ☐ Sewerage and drainage

(f) ☐ Water, light, telephone, etc *(g)* ☐ Others, please specify_____,

_____,
_____.

13. What kind of services are the most difficult to receive in your area? Qnum06

(a) ☐ Solid waste management Services *(b)* ☐ Water

(c) ☐ electricity *(d)* ☐ public transport (e) ☐ if there's other please specify____,
_____.
_____.

14. What negative impacts do you observe on social aspect of the community due to urban Expansion? Qnum07

(a) ☐ Increasing loss of identity *(b)* ☐ high competition for jobs

(c) ☐ loss of mutual trust among people *(d)* ☐ Loss of traditional way of life

(e) ☐ if there's other please specify_____, _____.

15. Do you displaced? *(a)* ☐ Yes *(b)* ☐ No

If Question no.15 is **YES** what do you loosed due to displacement?Qnum08

(a) ☐ farm land *(b)* ☐ grass land *(c)* ☐ forest land *(c)* ☐ loss of clean environment

(d) ☐ if there's other please specify_____, _____,
_____, _____.

16. What is your comment about urban expansion in your settlements both in negative impacts its benefits?

- **Urban Expansion benefits?**

- **Negative impacts of Urban Expansion?**

Appendix III sample Questionaries' prepared and converted to Afaan Oromo

Resp-022

YUUNIVERSIITII SAAYINSII FI TEEKNOLOOJI ADAAMAATTII

Muummee siivil Injinaaring fi Arkiteekichaarii

Kuuta Tokkoo :- raaga hirmaata

1. Naannoo jireenya : kuutaa Magaala Bokku, Ganda Bokku Shanan

2. **Iddoo Dhaloota** :- (a) Magaala Adaamaa (b)Naannoo ishee (c) Naannoo bira

3. saala a) Dhiira (b) Duubartii

3. Umrii (waaggadhan) a) <30 (b) 30-60 c)>60

4. Baruumsa : a) Qaalama (b) Sadarkaa 1.^ffaa c) Sadarkaa 2.^ffa d) 10+ fi isaa ol

5. fuudha heeruma: (a) kan fuudhe/heerumtee b) Kan hin fuudhin /hin heerumiin c) heeke/hiiktee

Kuuta lama:- Akkaata gaafiitiin deebisii

1. **Haala Hojii:** (a) hojii Qonnaa fi bu'a qonnaa b) Mootumma Qaaxaramee c) Hojii dhuunfaa koo (d) dhuunfa bira qaaxaramee (e) hojii hin qabu
2. **Gaalii Ji'a (birri):** (a) 1000 gad b) 1001-2000 c) 2001-30000 d) 3000 ol
3. **Dhiibbaa babaal'achuun Magaala isiin irraan gahe maaliidha?**

a) Galii keenya xiiqeseera b) Nu buqqiiseera c) jireenya qaala'adhaf nu saaxileera d) hanqiina tajaajila adda addaatiif nu saaxileera (e) hundaa (g) kan bira yoo jiraate _____

4. **Mana jireeny qabdu** (a) Eyyee (b) lakkii
5. **Babaal'achuun magaala jireenya keessan irraattii dhibbaa fide jira jettee yaaddaa?**
   (a) eyyee (b) lakkii (c)yoo jiraate fakkenyaa Baay'ina fayyadamaa kan karee tajaa
6. **Tajaajiila maal faa'a mana qopheessa irraa argattaan ?** argachuuf malee hin argan
   (a) Faayya (b) Mana Barumsaa (c) Daandii fi Kaara (d) iddoo Gaaba (f) Bo'oo bishaani fi Dhnagaala'a (g) hundaa
7. Naannoo keessanittii tajaajila maali argachuutu isiinittii ulfaata?
   (a) Iddoo Balfaa jajjaaboo ittii gatamuu (b) Bishaan (c) Ibsaa (d) Geejiba

8. Dhiibban guddaan magaalan babaal'achuun akkaa haaasaattii isiin irraan gahe maalii?
(a) Dorgoommii hojii (b) Wal-amaantummaa dhaabamuu (c) Waliin jireenyi Aadaa hirdhaachuu (d) kan bira yoo jiraate
9. Iddoo dur jirtuurraa Buuqatettaa? (a) Eyyee (b) Lakkii
10. Gaffiin lakk.9 eyyee yoo ta'e buuqa'uun maal isiin dhabsisee ? (a) lafa Qonnaa (b) Lafa magraa (c) Lafa bosona (d) hundaa (e) kan bira yoo jiraate
11. Kaasan isiinif kaafalame gahaadha jettee yaadda? (a) Eyyee (b) Lakkii
12. Deebiin gaaffii lakk.11 lakkii yoo ta'ee maal ta'u qaba?- Haala daadaa'amaan Qateburaa Midhamee Kara oso dandamachisan baredadhan Jedhaa kan tom qabus Kara.
13. Laftii isiin irraa buuqataani osoo hin misoomin jiru jira? (a) Eyyee (b) Lakkii
14. Deebiin gaffii lakk.13 eyyee yoo ta'e waggaa meeqafi hin misoomin jira?- Waggaa Jaha (6)
15. Waa'ee dhimmaa magaalan babaaldhaachu maal yaddaa? Bu'a fi dhibbaa isa
15.1 Bu'a Babaaldhaachu Magaalan siinif fide yoo jiraate- Tajaajilaata buralee Misoomaa Murtaree nuf lateraa Ekrof isaa akka Bishaan fi Ibsaa akka argaanut nuu tajaajilera
15.2 Dhibbaa babaaldhachuun Magaala isiin irraa gahe yoo jiraate- Dhibbaan isaa Lafaa Kenyaraa nu bugiseraa. Iddoo jireenyaa nuf Maluu nuu dhabsisera. Jireenyaa Mi'aaf nuu saxileraa akkusumaas hawasaa Walin jiraachaa tuxuu gargar bitinsee

Qopheessaan:- Zarihuun Laggasaa, Yuunivarsiitii saayinsii fi Teeknooloji Adaamaattii Barataa Mastaara siivil Inginaaringi Ebbiifama bara 2014

Hubaachisaa :- raga sassaabamuu kun dhimmii qorannoo ebbaatif qofa tajaajila kanaafuu raga sirrii ta'e naa kennuu kessaanif Galataa guddaa fi kabaaja isiinif qaba.

…………………………………………………………………………………………

Resp.001
Respondent: R
DD: ID

YUUNIVERSIITII SAAYINSII FI TEEKNOLOOJI ADAAMAATTII
Muummee siivil Injinaaring fi Arkiteekichaarii

Kuuta Tokkoo :- raaga hirmaata

1. **Naannoo jireenya :** kuutaa Magaala Beftuu, Ganda Beftuu Shoanan
2. **Iddoo Dhaloota :** (a) Magaala Adaamaa (b)Naannoo ishee (c) Naannoo bira
3. **saala** a) Dhiira b) Duubartii
3. **Umrii (waaggadhan)** a) <30 b) 30-60 c)>60
4. **Baruumsa :** a) Qaalama b) Sadarkaa 1.ffaa c) Sadarkaa 2.ffa d) 10+ fi isaa ol
5. **fuudha heeruma:** a) kan fuudhe/heerumtee b) Kan hin fuudhin /hin heerumiin c) heeke/hiiktee

Kuuta lama:- Akkaata gaafiitiin deebisii

1. **Haala Hojii:** a) hojii Qonnaa fi bu'a qonnaa b) Mootumma Qaaxaramee c) Hojii dhuunfaa koo (d) dhuunfa bira qaaxaramee (e) hojii hin qabu
2. **Gaalii Ji'a (birri):** a) 1000 gad b) 1001-2000 c) 2001-30000 d) 3000 ol
3. **Dhiibbaa babaal'achuun Magaala isiin irraan gahe maaliidha?**
a) Galii keenya xiiqeseera b) Nu buqqiiseera c) jireenya qaala'adhaf nu saaxileera d) hanqiina tajaajila adda addaatiif nu saaxileera e) hundaa (g) kan bira yoo jiraate ___________
4. **Mana jireeny qabdu** (a) Eyyee (b) lakkii
5. **Babaal'achuun magaala jireenya keessan irraattii dhibbaa fide jira jettee yaaddaa?**
(a) eyyee (b) lakkii (c)yoo jiraate fakkenyaf
6. **Tajaajiila maal faa'a mana qopheessa irraa argattaan ?**
(a) Faayya (b) Mana Barumsaa (c) Daandii fi Kaara (d) iddoo Gaaba (f) Bo'oo bishaani fi Dhnagaala'a (g) hundaa
7. Naannoo keessanittii tajaajila maali argachuutu isiinittii ulfaata?
(a) Iddoo Balfaa jajjaaboo ittii gatamuu (b) Bishaan (c) Ibsaa (d) Geejiba

8. Dhiibban guddaan magaalan babaal'achuun akkaa haaasaattii isiin irraan gahe maalii?
(a) Dorgoommii hojii (b) Wal-amaantummaa dhaabamuu (c) Waliin jireenyi Aadaa hirdhaachuu (d) kan bira yoo jiraate hunduuma
9. Iddoo dur jirtuurraa Buuqatettaa? (a) Eyyee (b) Lakkii
10. Gaffiin lakk.9 eyyee yoo ta'e buuqa'uun maal isiin dhabsisee ? (a) lafa Qonnaa (b) Lafa magraa (c) Lafa bosona (d) hundaa (e) kan bira yoo jiraate
11. Kaasan isiinif kaafalame gahaadha jettee yaadda? (a) Eyyee (b) Lakkii
12. Deebiin gaaffii lakk.11 lakkii yoo ta'ee maal ta'u qaba?- [illegible]
13. Laftii isiin irraa buuqataani osoo hin misoomin jiru jira? (a) Eyyee (b) Lakkii
14. Deebiin gaffii lakk.13 eyyee yoo ta'e waggaa meeqafi hin misoomin jira?- 6
15. Waa'ee dhimmaa magaalan babaaldhaachu maal yaddaa? Bu'a fi dhibbaa isa
15.1 Bu'a Babaaldhaachu Magaalan siinif fide yoo jiraate- [illegible]
15.2 Dhibbaa babaaldhachuun Magaala isiin irraa gahe yoo jiraate- [illegible]

Qopheessaan:- Zarihuun Laggasaa, Yuunivarsiitii saayinsii fi Teeknooloji Adaamaattii Barataa Mastaara siivil Inginaaringi Ebbiifama bara 2014

Hubaachisaa :- raga sassaabamuu kun dhimmii qorannoo ebbaatif qofa tajaajila kanaafuu raga sirrii ta'e naa kennuu kessaanif Galataa guddaa fi kabaaja isiinif qaba.

Dhimmaa hubaannoo barbaadu fi gaffiin kamuu gaafii fi deebii kana ilaalchiseee yoo jirate : Lakk.bilbiila 0912252758
Email:- zerishzbest@gmail.com

Appendix IV - Interview

Dear respondent, this interview is conducted for an academic purpose for the fulfilment of Degree of Masters of Science in Geoinformatics therefore your response is very important for the success of the study because all information that you provide determines the analysis and conclusion of the research. Hence, you are kindly requested to give your response. Your response will remain confidential. I would like to thank you in advance for your cooperation.

1. What are the main problems of Municipality to control urban expansion?
2. What is the role of woreda administration concerning conversion of land use?
3. Was the dislocated households acquired compensation for their assets?

   If the answer is no what is the reason _____

4. Is the compensation given by local government is enough?

   If the Q4 answer no what would you think about farmers future live and what measurements should be taken by government?

5. Is the compensation given by local government is fair?
6. Is there any income source generated for them?

   If answer of Question number 5 is yes list what are there?

7. Did local government pay for crop, yield and trees?
8. Were they engaged after loose their farm land (their final destination) ?
9. What are the strategies adopted by woreda administration to overcome likely effects imposed on dislocates?
10. Are training gave to them to start business and follow up them?
11. Did you measure their satisfaction after they took compensation and loose Agricultural land (farm land)?