"IMPACTS OF UNCONTROLLED URBAN EXPANSION ON URBAN DECAY USING REMOTE SENSING AND GIS TECHNIQUE: THE CASE OF AMBO TOWN, ETHIOPIA"

Tamirat Teshome Terefe

A Thesis Submitted to the department of the Architecture

School of Civil Engineering and Architecture

Presented in Partial Fulfillment of the Requirement for the Degree of Master's

in Urban Planning and Design

Office of Graduate Studies

Adama Science and Technology University

June, 2023
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APPROVAL SHEET

I, the advisors of the thesis entitled "**Impacts of uncontrolled urban expansion on urban decay using remote sensing and GIS technique: the case of ambo town, Ethiopia"** and developed by **Tamirat Teshome** hereby certify that the recommendation and suggestions made by the board of examiners are appropriately incorporated into the final version of the thesis.

Yared Girma (PhD) ______________________ ___________________

Advisor Signature Date

We, the undersigned, members of the Board of Examiners of the final open defense by **Mr. Tamirat Teshome** have read and evaluated his thesis entitled "**Impacts of uncontrolled urban expansion on urban decay using remote sensing and GIS technique: the case of ambo town, Ethiopia"** and examined the candidate. This is, therefore, to certify that the thesis has been accepted in partial fulfillment of the requirement of the **Degree of Masters in Urban Planning and Design.**

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External Examiner Signature Date

Final 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).

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School Dean Signature Date

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Office of Postgraduate Studies, Dean Signature Date

DECLARATION

I hereby declare that this Master Thesis entitled "**Impacts of uncontrolled urban expansion on urban decay using remote sensing and GIS technique: the case of ambo town, Ethiopia"** is my original work. That is, it has not been submitted for the award of any academic degree, diploma or certificate in any other university. All sources of materials that are used for this thesis have been duly acknowledged through citation

Tamirat Teshome	____________________	**3/7/2023**
Name of the student	Signature	Date

RECOMMENDATION

I, the advisor of this thesis, hereby certify that I have read the revised version of the thesis entitled "**Impacts of uncontrolled urban expansion on urban decay using remote sensing and GIS technique: the case of ambo town, Ethiopia"** prepared under my guidance by **Tamirat Teshome** submitted in partial fulfillment of the requirements for the degree of masters in **Urban Planning and Design**. Therefore, I recommend the submission of revised version of the thesis to the department following the applicable procedures.

Yared Girma (PhD)	__________________	___________
Name of Major Advisor	Signature	Date

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

ArcGIS	Aeronautical Reconnaissance Coverage Geographic Information System
CBI	Composite Blight Index
CBI	City Blight Index
GCP	Ground control points
GDP	Global Domestic Products
GIS	Geographical Information system
LULC	Land use/land cover
LULCC	Land use/ land cover change
PT	Population after some of time
Po	Current population
RST	Remote sensing Techniques
SPSS	Statistical package for the social sciences
TM	Landsat Thematic Mapper
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
UA	Urban accessibility
UB	Building Materials
UD	Urban Density
VGS	Vegetation/ impervious surface
WGS	World Geodetic System

ABSTRACTS

Urban blight is a complicated issue that can have a negative effect on urban residents' quality of life. The use of remote sensing and GIS techniques can provide valuable insights into the extent and severity of urban blight. Urban poor populations in Ambo Town's inner cities lead to social and economic problems. Thus, this study aims to assess the existing condition of urban blight and map the spatio-temporal pattern of urban decay in Ambo using multi-date remote sensing data. The change detection of multiple Landsat images was conducted to map and analyses the extent and rate of urban growth in Ambo Town between 1992 and 2022. The study was conducted based on qualitative and quantitative approaches using spatial analysis of remote sensing and GIS techniques and survey methods. The primary data sources were collected using questionnaires and observations to identify the perceptions of office employees and the town's community on the factors that contribute to urban blight in the inner part of Ambo town. The secondary data sources were collected using satellite images. The results of the study showed that grassland and agricultural land covered 41.45% and 33.94% of the total area at the beginning of the study, respectively. By contrast, the proportion of the urban class was 2.93% in 1992 and rose to just over 16.65% in 2022. Agriculture decreased by 59.31% in the past 30 years, with grassland contributing the most net change in a built-up area (765 ha), followed by agriculture land (612 ha) and forest area (34 ha). That level of urban blight by the physical composite blight index town was 0.78; the socioeconomic and political composite blight scores were 0.66 and 0.72, respectively. The composite blight index, which takes into account physical, sociological, economic, and political variables, is 0.72 overall. The Composite Blight Index appears to be a measure of the degree of blight in Ambo town, with a value of 0.72 signifying a moderate amount of blight. Urban growth is associated with population growth, economic development, and the expansion of infrastructure and services, while urban blight is associated with economic decline, population loss. Therefore, this information can be used to inform policy decisions related to urban renewal, rehabilitation, and redevelopment, with the goal of creating more sustainable and livable urban environments

Keywords: Economic blight; physical blight; remote sensing and GIS; urban blight; urban growths

CHAPTER ONE

INTRODUCTION

The study was motivated by the following primary reasons: There may be a lack of research on urban blight in Ambo town specifically, or in Ethiopia more generally. By conducting a comprehensive analysis of urban blight in Ambo town, the thesis could fill a gap in the existing literature and provide valuable insights into the issue. This research briefly states the problems related to urbanization and illustrates urban blight, or the deterioration and abandonment of housing, commercial buildings, and public infrastructure, can have significant economic, social, and environmental impacts on communities. Visual inspections and surveys, which are traditional techniques of studying urban blight, can take a lot of time, be arbitrary, and be expensive. Remote sensing and GIS technologies provide an alternative approach to analyzing urban blight that is more efficient, objective, and cost-effective. Remote sensing involves obtaining information about an object or area from a distance using aerial or satellite imagery, while GIS involves the creation and manipulation of digital maps to analyze relationships between different variables. Remote sensing and GIS can help urban planners and policymakers better understand and address urban blight to create healthier, more vibrant, and sustainable urban environments.

1.1 Background of the study

Urban blight refers to the decline and deterioration of physical, social, and economic conditions in urban areas. It can often lead to social and economic problems, including lower property values, increased crime rates, and reduced quality of life for residents. Globally, The population of human settlements tends to grow, as does their physical development gradually(Seto, 2015),from The population and physical development of human settlements tend to grow succession: Hamlet → Village → Town → City → Conurbation(Tóth, 2021). This transformation process and the consequences from rural to urban denotes urbanization (Gui et al., 2019) and it has long been associated with human development and progress(Kuddus, 2020).

Urban blight was a term used to describe the physical and social decline of urban areas(Leon & Schilling, 2017). It is characterized by a range of negative conditions, such as deteriorating infrastructure, abandoned buildings, vacant lots, high crime rates, poverty, and unemployment(Maghelal & Andrew, 2014). It was a range of negative impacts on the individuals and communities living in these areas. It can lead to health problems, reduced property values, increased exposure to crime and violence, loss of social capital and community cohesion, and limited access to basic services such as healthcare, education, and public transportation. Caused by a range of factors, such as population decline, economic decline, natural disasters, and changing patterns of land use. It often affects low-income areas with weak housing markets and limited access to resources(Girma, 2016). Efforts to address urban blight typically involve a range of interventions, including urban planning and design, economic development initiatives, social programs, and policy changes.

The World Bank report on urban development shows that it accounts for around 80% of global GDP is generated in cities, and if control well, urbanization can contribute to sustainable growth by increasing productivity, which can lead to innovation and new ideas (Benti, 2022; Koop, 2017). In addition to the multidimensional benefits, urbanization also brings some benefits negatively affects the environment and exacerbates sociocultural problems. That is mostly the case contributes to the decline in ecosystem services, including air and soil pollution loss of biodiversity (Schirpke & Scolozzi, 2020).

Small urban settlements act as production and distribution hubs for products and services, bridging the gap between rural-urban and urban-urban linkages (Gebrechristos, 2014). To effectively manage the growth of tiny urban areas at the small-town size, a minimal "basic plan" (Benti, 2022). However, most urban developments in the nation tend to be impulsive and quick, typically arising from squatter camps (Benti, 2022) usually emerging from informal settlements(Terfa et al., 2019)

Over the past three decades, Ethiopia's urbanization has increased quickly (Koroso, 2021). Many cities grew quickly, and numerous satellite villages appeared all around the big cities (Zubair & Ojigi, 2015). The study by (Jenberu, 2020) Migration is one of the causes accelerating the nation's rapid urbanization. The motivating elements that led to the formation and unplanned growth of Ethiopia's current urban centers, however, were disregarded, and their effects are less well understood and recognized (Benti & Terefe, 2021). The nation's ability to establish suitable urbanization management strategies that can direct by disregarding the causes of spontaneous urban development from the start, the sustainability of future urban centers was hampered from the beginning. (Mohamed & Worku, 2020).

Remote sensing approach comes in hand in this context(Maghelal & Andrew, 2014). Though the process producing slum is different from one city to another involving historical, social and economic forces, the physical manifestations are uniform both spatially and temporally in cities. The study focuses on measurement of the physical manifestation of urban decay from satellite remote sensing data. These findings highlight the importance of addressing urban blight not only for the physical improvement of areas, but for promoting public safety and reducing crime rates. In conclusion, remote sensing and GIS techniques have shown great potential in identifying and analyzing urban blight. The quality of life for inhabitants can be enhanced, and community revival can be aided, by legislators developing solutions that are based on research to solve blighted regions.

1.2 Problem statement

Urbanization promotes socio-economic development and improves the quality of life. It is the most powerful and visible anthropogenic force that has caused the fundamental conversion of natural to artificial land cover in cities(Dewan, 2009). However, Ambo town's central business district's existing housing stocks are inadequate to cater to the increasing population, such that the low-income group has been complicated by the high rate of population growth, overcrowding, slums, and substandard housing, as well as unhealthy and poor environmental conditions. The influx of rural immigrants, deplorable urban services and infrastructures, and a lack of implementation of planning policies are expressions of this problem.

Ambo Town is one of Ethiopia's cities with the greatest population growth. The town has attractive potential, which contributed to its accelerated growth. Hence, the expansion of the town is becoming irregular and uncontrolled, often resulting in the creation of urban blight. In nearly 15 years, the population of Ambo town will double itself. This is a short doubling time when compared with the doubling time of Ethiopia, which is 23 years. As data from office, report indicates that in Ambo, 49% of the housing condition needs immediate improvement, and 20% is dilapidated, overcrowded, poor infrastructure provision, bad sewerage (waste disposal) system, unpleasant looking site, poor access street, open space, greenery, and improper morphological order at the core city center, which needs rejuvenation.

So, these have partly increased the population of the town that would make the doubling time of Ambo town to be shorter. Road network problems, incompatibility, urban deterioration, poor urban quality, inefficient traffic management, sanitation emergencies, illegal settlement, unplanned fencing, quarrying, and deforestation are identified in the public forum. Most existing studies have focused on developed countries, and there is a need for more research in developing countries. Most existing studies have focused on the physical aspects of urban blight, such as the condition of buildings and infrastructure. However, there is a need for more research on the social and economic impacts of urban blight on local communities, including its effects on health, safety, and economics. And also the impacts of urban expansions on the inner city without guides for planning and there is no information available regarding the scope and trends of the changes that took place in Ambo over time. Besides, there have been no extensive studies conducted related to urban growth and its impacts on urban blight in inner towns.

1.3 Objective

General objective

The aim of this study is to assess the current state of urban blight and map the spatio-temporal pattern of urban decay in Ambo towns.

Specific objective

1) To Analyze the land use/land cover changes Ambo town from 1992–2022.
2) To assess the spatial distribution of urban blight by analyzing it's socio-economic, physical, and land use characteristics.
3) To determine the blight level index of the study area based on the urban blight indicators

1.4 Research question

1) What are the land use/land cover changes in Ambo town from 1992-2022?
2) What is the spatial distribution of urban blight in Ambo town based on it's socio-economic, physical, and land use characteristics?
3) What are the urban blight indicators used to determine the blight level index?

1.5 Significance of the Study

The study's attempt to extract useful information from remotely sensed images and analysis of urban blight by using remote sensing and GIS techniques lies in its ability to provide a more accurate and comprehensive understanding of the problem. This can result in actions that are more successful and efficient, creating urban environments that are healthier, livelier, and more sustainable. Additionally, by using these technologies, traditional field-based methodologies may be used with less money and resources, making them more practical and approachable for urban planners and decision-makers.

The consequences of this examination should offer higher records for approximately the adjustments in city land use quantified through the integrated application of GIS and remote sensing in the analysis of urban decay. By using these tools, researchers and policymakers can identify areas of the city that are most affected by urban blight, prioritize resources for intervention, and track progress over time. This approach can help make the process of addressing urban blight more efficient, objective, and cost-effective. Overall, the examination of urban blight utilizing GIS and remote sensing methods has the potential to greatly raise the standard of living for people who live in afflicted areas and help build more resilient and sustainable communities.

1.6 The Scope of the Study

This study deals with Ambo town, west Shewa, Ethiopia, Ambo town's geographical location is roughly between 080 56’30’’N - 080 59’30’’N latitudes and 370 47’30’’E - 370 55’15’’E longitudes. To do this, it would be necessary to gather and analyze satellite imagery and other geographical data in order to locate the town's deteriorating and decaying areas. Ambo's inner parts were one of the most important neighborhoods of Ambo from the past to the present because they were located at the heart of the city and included the majority of commercial activities. As the primary nucleus of Ambo, Arada was one of the areas where urban decay was widely seen. The study could also involve conducting field surveys to gather additional data on the physical condition of buildings and other infrastructure in the identified blighted areas, as well as examining socio-economic factors that may contribute to urban blight, such as poverty, unemployment, and lack of access to basic services. Additionally, the study could examine how urban planning and policy decisions could be informed by GIS and remote sensing data to promote sustainable urban development and address the root causes of urban blight.

1.7 Limitation of the Study

The study faced many problems during the progress of the thesis. The constraints of time and resources and the political situation in Oromia were the big limitations experienced when conducting interviews with stakeholders. It's possible that GIS and remote sensing technologies can't collect comprehensive data at a small scale. Many stakeholders wanted to remain strictly anonymous. Furthermore, throughout the data gathering stage, certain informants' willingness was difficult to gauge. The difficulty of getting high-resolution satellite images is required to undertake this study. Finally, the study findings may be limited in their generalizability to other contexts, as the factors contributing to urban blight may vary widely between different urban areas and regions.

1.8 Organization of the Study

The thesis is split into five chapters. Each chapter systematically and effectively examines the content and data of the study accordingly. The fundamental chapters in the thesis are further demonstrated as follows

Chapter One: Introduction to the Study introduced the thesis by laying out the main topic of the study, research problems, objectives, questions, significance, scope, and research design in detail. Chapter Two: Literature Review is a chapter that discusses key definitions relating to urban decay, urban blight, parameters of urban decay, the composite blight index, and a case study. Chapter Three: Research Methodology is a chapter that discusses the methodology of the research. The chapter explains the methods used for the study and the process of data collection and analysis in detail. Chapter four contains the results and interpretation of the data analysis, and the last chapter includes the conclusion and recommendation

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This section presented a review of the literature including research papers and reports regarding theoretical concepts of urban growth and theories of urban blight. The review also assessed in detail the urban growth and its consequences on Land use land cover (LULC) change and forms of urban growths, urban blight and applications of GIS and RS, and the significance of application or tools for analyzing the trends of urban growths, policies to contain rapid urban growth and urban blight of inner cities. Furthermore, this section also reviewed different methodological techniques/tools and finally summarizes the studies done by different researchers in the same area of the research and concluded the literature by identifying the research gaps'

2.2 Definition and Concepts

i. Urbanization

Urbanization is the process of urban expansion but, Different researchers define urbanization in various ways, some researcher defines, the urbanization process as mainly linked to economic growth, commercialization, and industrialization, as well as rural-urban migration and globalization, while other researchers define urbanization as the link of population growth and urban built-up area expansion(Wang, 2020).

ii. Urban Blight

Urban blight is a broad phrase with many characteristics, ranging from litter and vacant lots to decaying structures and abandoned residences(Ferreira, 2018). Its focus is on substandard housing, abandoned buildings(Leon & Schilling, 2017), and vacant lots.

According to (Leon & Schilling, 2017), Substandard housing refers to residential places having structural and other flaws that do not exceed fitness and protection standards, putting occupants' health and safety at risk. Abandoned homes confer with unoccupied houses and different residences which are in disrepair and pose a hazard to the health and well-being of the community(Leon & Schilling, 2017). Vacant masses talk to omitted and empty parcels of land in a community which might be used for dumping muddle and different waste materials(Dillon, 2014).

iii. Physical Blight

This type of urban blight specifically refers to the deteriorating or decaying physical environment of an urban settlement. The most obvious signs of such problems are frequently found in buildings and infrastructure. Factors such as aging cities, inadequate planning, abandonment, and neglect of buildings alongside poor maintenance of an area and its services often account for this form of blight, more especially in areas that have an ineffective urban design (Chetty, 2013; Galadima, 2021).

iv. Functional Blight

This form of blight particularly refers to the deficiencies in the functionality of an urban environment(Mzamo, 2018). Understandably, it exhibits itself out of existing land uses that fail to serve an urban environment in a sustainable manner. Herein, when the land uses tend to fail to cater to the needs of the community, the area itself ends up being neglected and deserted by the community, thus in turn leading to disinvestment in the area, which subsequently leads to this form of blight(Chetty, 2013).

v. Economic Blight

According to(Chetty, 2013); that is the shape of blight this is an final results of an economically unproductive area. Herein, groups which can be on the center of the area’s financial system near down as traders tend To withdraw their investments within side the location because of unprofitable returns, which can be themselves an end result of not having enough thresholds to sustain the businesses due to the migration of people from the area. Other elements that still yield financial blight consist of the improvement of highly large purchasing malls, which in a manner dents the smaller companies running with inside the identical vicinity as clients generally tend to select the department stores over the smaller companies presenting comparable merchandise and services(Mzamo, 2018).

2.3 Exploring the Concept of Urbanization: Growth, Impacts, and Perspectives

Urbanization refers to the growth of towns and cities, often at the expense of rural areas, as people move into urban centers in search of jobs with the expectation of a better life, enabling cities and towns to grow(Saguir & Santoro, 2018). It is also known as the gradual increase in the number of people living in towns and cities. It is heavily influenced by the idea that cities and towns have gotten more economic, political, and social mileage than rural places(Komikado & Morikawa, 2021). Urban growth is a spatial and demographic process that refers to the increased importance of towns and cities as a concentration of people within a particular economy and society (Komikado & Morikawa, 2021). In the urban and regional planning literature, there are at least three distinct and well-studied ideas of urban growth relating to population change, economic performance, and the spatial expansion of urban regions (Silva & Pinho, 2015). Urban growth's socio-demographic component is concerned with migration and demographic changes.

2.4 Urbanization in Africa: Trends, Challenges, and Prospects for the Future

According to (Jelili, 2012), Africa used to be, and perhaps is still, the least urbanized continent, with growth rates of cities close to, if not the fastest in the world. However, new cities have formed in nearly every section of the continent, while existing ones have expanded dramatically, some of which have become megacities. By 2030, for the first time in history, more of the continent’s people will be living in urban areas than in rural regions and by 2050 an estimated 1.23 billion people, or 60% of all Africans will be city dwellers Currently, even if the level of urbanization in Africa is low, the rate of urbanization is high due to the population growth, which is one of the most important driving forces of changes in any urban system. If the urban population swells, the city must expand upward or outward. Along with economic development and technologies (mainly transport and communication) revolution, rapid urban growth can be characterized by the development of suburban expansion and redevelopment in city centers(Wang, 2020) indicated that Africa’s urbanization faces four major challenges(Luo & Sun, 2020):

ities have significant prospects for social and economic development if they are governed correctly. Cities have long been hubs for economic development, innovation, and job creation(Cohen, 2006).

2.5 Urbanization in Ethiopia: Past, Present, and Future Trends

Although urbanization approaches passed off previous to the 20 the century in Ethiopia, maximum of the Ethiopian towns originated due to geographical, political, and economic factors(Solomon, 2022). However, it's miles one of the least urbanized international locations with inside the world, nicely under the Sub-Saharan Africa common of 37 percent(Dejene, 2018). According to Ministry of Urban Development and Housing State Report (MUDHS, 2015), Ethiopia's urbanization level remained low until recent decades, when the roads and telecommunications infrastructure expanded and the country's multi-faceted participation in the global arena. The country's level of urbanization was about 5% in the 1950s and only reached 10% in the 1970s(Dejene, 2018). However, with the aid of using 1984, whilst the primary census turned into conducted, the extent of urbanization turned into growing to 13%(Dejene, 2018). The level of urbanization was estimated at 19% in 2014, having grown by 6% between 1984 And 2014, reflecting a median boom of 2% with inside the stage of urbanization consistent with decade. However, that is set to alternate dramatically(MUDHS, 2015).

2.6 Urban growth theory

Urban development is a complicated and difficult to quantify emergent phenomenon of the urban system. Urban development phenomena can be divided into two different types: urban growth and urban redevelopment. However, Urban Growth Theory indicates a transformation of the vacant land or natural environment to construction of urban fabrics including residential, industrial and infrastructure development which mostly happens in the fringe of urban areas(Komikado & Morikawa, 2021).

2.7 Use of Remote Sensing and GIS for Land use Land cover Change

Remote sensing is defined as the use of electromagnetic radiation sensors to record images of the environment which can be interpreted to yield useful information(Shahid, 2010). Remote sensing and GIS are being increasingly used in combination with spatial analysis. GIS databases are used to improve the extraction of relevant information from remote sensing imagery, whereas remote sensing data provide periodic pictures of geometric and thematic characteristics of terrain objects, improving our ability to detect changes and update GIS databases(Carvalho, 2003). Both remote sensing (RS) and geographic information systems (GIS) have been widely applied and recognized as powerful and effective tools in detecting the spatiotemporal dynamics of land use and land cover (LULC). RS can provide researchers with valuable multi-temporal data for monitoring land-use patterns and processes and GIS techniques make possible the analysis and mapping of these patterns(Munthali & Botai, 2019).

2.8 The Economic meanings of Blight

a) Economic definitions of blight

In monetary studies, blight is narrowly examined(Report, 2015). For financial researchers, blight refers to one, some, or all of the following phenomena:

Tax delinquency(Perez-truglia & Chetty, 2015),foreclosed homes (Immergluck & Law, 2014), Properties on their way to auction or that have reverted to bank ownership(Ellen, 2011), violations of real property codes(Bartram, 2019), environmental contamination, abandoned or deficient sites and buildings(Thiel, 2019),vacancy in lots, homes, and buildings

It is important to note that abandonment and vacancy are not homogenous(Raleigh & Galster, 2015). Vacancy, which gets greater interest than different signifiers of blight in financial scholarship, describes a property that is not occupied but may still be maintained(Schilling, 2020). Abandonment, with the aid of using contrast, takes place whilst an assets now not has a steward.

b) Economic effects of blighted properties

By no means is the list of physical conditions comprehensive; these are the common variables that economic studies focus on in determining the economic impacts of blight.

Much of the economic research on blighted properties adhere to the unexamined belief that increased property values are good, just, and necessary. The idea that strengthening property markets will solve the problem of blighted properties and make better cities, is the dominant paradigm. In this popular framework, blighted properties are treated as market problems that need market solutions(Hackworth, 2014).

c) Economic effects of anti-blight policies

Recent scholarship on blight offers little data about which policies and programs work best to limit, eradicate, and/or correct blighted properties(Schilling, 2020).Part of the problem is that anti-blight policies, much like blight itself, vary greatly(Schilling, 2020). Anti-blight initiatives frequently use a piecemeal approach and aim to increase in a nebulous way.

Economic wealth for particular places or people(Report, 2015). "Cities seeking to redevelop large stockpiles of vacant land have struggled to resolve" social and spatial issues and where, how, and for whom to redevelop land(Schilling, 2020).These programs offer an impression of vacancy, abandonment, foreclosure, and other aspects of blight as problems in and of themselves. Much of the anti-blight policy and programmatic work engages the private sector to revitalize distressed neighborhoods(Lind & Schilling, 2016). Projects try to ready the land for the market, or, as in greening programs, reduce the appearance of neglect until developers return.

2.9 Social dimensions/meanings of blight

Some work shows how places that are blighted have low levels of employment opportunities(Costa & Ferreira, 2021). Youth violence, too, persists at high rates in blighted neighborhoods(Branas & South, 2018).This critical yet small body of research also includes analyses of social network strength in neighborhoods described as blighted. Blighted neighborhoods do not typically have strong social networks and have greater needs for city service intervention(Schilling, 2020).When blighted neighborhoods do have strong social ties, the residents who live in these places often possess little political power(Fullilove, 2011).

2.10 The environmental dimensions of blight

There are three topics of concern related to blight from the environmental standpoint. These topics include(Spiess & De Sousa, 2016): hose are Public health, green infrastructure and brownfields. It is important to note that vacant properties and brownfields are synonyms of blight in the environmental context.

A. Blight and public health

Concerns about public health are raised in nearby towns due to the presence of abandoned houses and decaying buildings. Research indicates an association between blight and the following three health threats(Garvin & Branas, 2013): 1) increased risk of fire, 2) increased presence of illness in the community, and 3) personal safety.

Illness: Blighted neighborhoods with large numbers of vacant properties can affect a community's health(South, 2018).Vacant properties are also associated with an increase in mosquito-borne diseases(Nguyen-Tien, 2021).(Becker, 2014) evaluated the association between roofless vacant houses and the presence of mosquitoes in two Baltimore neighborhoods. Results suggested that in dry conditions, blighted neighborhoods were at a lower risk of mosquito-borne diseases, despite the large presence of unmanaged trash that can hold water.

B. Blight and green infrastructure

Green infrastructure has been recognized as an alternative to improve water quality, reduce air pollution and the urban heat island effect, save energy, enhance urban aesthetics and safety, and promote green jobs(Dunn, 2008).It is important to note that the term "green infrastructure" has multiple definitions, depending on scale.

C. Brownfields

Vacant industrial properties, commonly referred as brownfields, are often seen as blight(Kotval-K, 2016). Many scholars have demonstrated that areas colonized by animals and plants can be of value for the enjoyment of the community, especially in areas that lack open space(Swanwick, 2009)

2.11 Creation of Blight Index

The operational definition of blight provided for Humanity was strictly adhered to and guided the creation of the Composite Blight Index to include physical quality of life indicators as well as socioeconomic indicators(Maghelal & Andrew, 2014). This definition emphasizes that neighborhood blight refers to situations that endanger the health and safety of local citizens, lower the quality of life in a community, and threaten its social and economic viability.

a. Physical urban blight indicators

Physical blight indicators refer to the visible signs of deterioration, neglect, and disinvestment in buildings and neighborhoods(South, 2018). These indicators can include a range of physical features, such as abandoned or vacant buildings, overgrown vegetation, broken or boarded-up windows and doors, graffiti and vandalism, and other signs of disrepair. Physical blight indicators not only detract from the visual appeal of a neighborhood, but they can also have negative impacts on the health and safety of residents(Galadima, 2021). For example, abandoned buildings can be a magnet for crime and vandalism, while overgrown vegetation can harbor pests and rodents. Additionally, vacant or abandoned properties can reduce property values and discourage investment and economic development in the surrounding area.

b. Socio-economic indicators

One's opportunity to reside in "neighborhoods possessing high-quality resources is differentially distributed across such characteristics as race and immigration status(Maghelal & Andrew, 2014). Studies on the locational attainment process have made use of Census-derived tract characteristics like the percentage of white residents, the median household income, and other quality of life variables like the crime risk.

The socio-economic measures selected were(Maghelal & Andrew, 2014):Poverty; renter household; unemployment; population; ethnicity; single-parent household and race.

2.12 Composite Blight Index

A Composite Blight Index Map was generated utilizing the different variables selected physical indicators and different variables selected socioeconomic indicators to better highlight this option for identifying and comparing the status of blighted neighborhoods at the Census tract level across the City(Maghelal & Andrew, 2014). The frequency distribution of the blight index by census tract for physical, socioeconomic, and integrated composite factors is shown (Maghelal & Andrew, 2014). This indicator was useful in concentrating blight reduction activities in specific communities within these census tracts and tracking good changes over time.

i. Urban decay classification schemes and indexing

The city program addressed the following components as basic for the inter-comparison of urban settlements. These include: Socioeconomic background, Housing conditions, Health conditions, Natural conditions, Natural environment, Land use, urban transport, Energy use, Air pollution, Water and sanitation, Solid and Hazardous wastes(Fabiyi, 2011).

Most of these elements are not measurable physically nor are they discriminated from the visual assessment of urban conditions. These make them subjective and thus difficult to use as a basis for inter comparison of the physical quality of the urban area. However utilized the principal component analysis to extract the components that can be discriminated from remote sensing images and can be used as elements of urban quality or housing quality measurement. We collapsed the responses of the people about the attributes of a standard good environment in the city and the places they would like to live if their income improves into six major subheads including Spacious environment; secured environment, good housing stocks; good road condition and functional urban utilities//facilities such as water, electricity, and sanitation

the perceived standard of the inhabitant, we extracted the visible parameters that can be measured from remote sensing data as a surrogate measure of urban quality(Fabiyi, 2011). The following parameters were eventually used to measure urban decay in the city:

a) **Urban accessibility**: Accessibility relates to the ease or difficulty to move around different components of the urban area. This is largely a function of urban highway corridors and connectivity levels and road conditions(Li & Gao, 2019).
b) **Urban density and congestion**: This relates to the level of clustering of buildings and urban land use in the city. This relates to the number of buildings per unit area(Engelfriet & Koomen, 2018).
c) **Building materials quality**: The roofing quality was used as a means of measuring urban building quality based on the age differentials of the buildings in the city
d) **Vegetal – impervious surface dichotomy**. The level of greenness in an urban neighborhood indicates some forms of planning and organized space which is used as a measure of urban quality(Lovell, 2013).

2.13 Empirical Literature review

2.14 A Historical and Contemporary Perspective on the Challenges of City

Urban blight dates back to the Renaissance, when cities experienced turmoil and adjustments(Mzamo, 2018). Urban blight was initially associated with substandard housing conditions, particularly in tenement housing, which caused diseases and fire hazards. Rapid suburbanization has resulted in increased traffic congestion, air pollution, and a loss of amenity benefits, undermining agglomeration economies and economies of scale(Zhang & Xie, 2019). Anti-sprawl policies and programmers are designed to limit urban growth and provide incentives to redirect population growth and investment away from the suburbs towards inner core areas. Urban blight is a result of socio-political factors, such as suburbanization, outmigration and disinvestment, and remedial measures vary from city to city. In all cases, urban blight has never been associated with city attractiveness, but rather "city unattractiveness(Mzamo, 2018)".

They are different factors that contribute to urban blight, including economic decline and disinvestment, population loss, crime and social disorder, inadequate public services and infrastructure, and environmental degradation. For example, a study by(Ellen & O'Regan, 2011) found that housing abandonment and blight in Baltimore was driven by a combination of economic decline, population loss, and weak housing markets.

Urban blight can have a range of negative consequences for individuals, communities, and the wider society. These can include reduced property values, increased crime and social disorder, reduced access to services and amenities, and negative impacts on physical and mental health. For example, a study by (Kondo & Fluehr, 2018)found that exposure to urban blight was associated with increased levels of depression and anxiety among residents of Philadelphia.

Solutions to urban blight proposed a range of strategies for addressing urban blight, including code enforcement, rehabilitation and renovation of properties, demolition and redevelopment, community engagement, economic incentives, and public-private partnerships. For example, a study by (Huxtable, 2005) found that a community development program in Syracuse, New York, that focused on rehabilitating and renovating blighted properties led to improvements in property values and reduced crime rates. Remote sensing and GIS technologies have been increasingly used to assess and monitor urban blight. Studies have used these technologies to identify physical blight indicators, such as vacant or abandoned buildings and overgrown vegetation, and to develop strategies for addressing blight. For example, a study by (Luo & Sun, 2020) used remote sensing and GIS techniques to map and analyze urban blight in Wuhan, China, and identified specific areas for targeted intervention. Overall, urban blight highlights the complex and multifaceted nature of this issue, and the need for integrated and collaborative approaches to address it.

2.15 The Research Gaps

Most of the studies were carried out in Ethiopia were focuses on assessing urban expansion and its socio-economic impacts on the livelihood of the farming community in the peri-urban areas(Girma, 2016; Yimam, 2017). Their focus is mainly on expansion of urban area and its impact on environment and socio-economic impacts on the livelihood of the farming community in the per-urban areas in relation to population growth. Therefore, they didn't show the detail studies about urban growths trend map and urban blight, and growth direction, measurement of spatial change rate and amount of land use land cover (LULC) change and its impact of inner city. Generally, in Ethiopia studies made on urban expansion and its impact using GIS and RS techniques particularly for different urban related studies are minimal and due to this there is a limited literature in the area.

Focusing on this area of field, this study has attempted to contribute to the limited literature in line with the major drivers of land use land cover (LULC) change, horizontal expansions measurement through spatial analysis functions of GIS and RS techniques to specify the urban blight characteristics in different span of time in the case of Ambo town including what are the factors and who are responsible for the blight of the town. The study focuses on measurement of the physical manifestation of urban decay from satellite remote sensing data. Lack of studies that comprehensively analyses urban blight in developing countries using remote sensing and GIS techniques. Most existing studies have focused on developed countries, and there is a need for more research in developing countries.

Most existing studies have focused on the physical aspects of urban blight, such as the condition of buildings and infrastructure. However, there is a need for more research on the social and economic impacts of urban blight on local communities, including its effects on health, safety, and economics. Traditional methods of identifying urban blight have been limited in their accuracy, as they typically rely on physical inspections and surveys that can be time-consuming and costly. However, new technologies such as remote sensing and GIS have shown promise in improving the accuracy and efficiency of blight analysis. Besides, there have been no extensive studies conducted related to urban growth and its impacts on urban blight in inner towns.

2.16 Conceptual frameworks

The thesis study also seeks to understand how, through urban renewal, it can address urban decay. This can be achieved by planning and addressing the issues of Arada, the inner part of Ambo town, with respect to its decayed environment. The aim of the study is to investigate urban decay problems in Ambo town and to propose plausible approaches and policy options towards its renewal to meet both current and future demands.

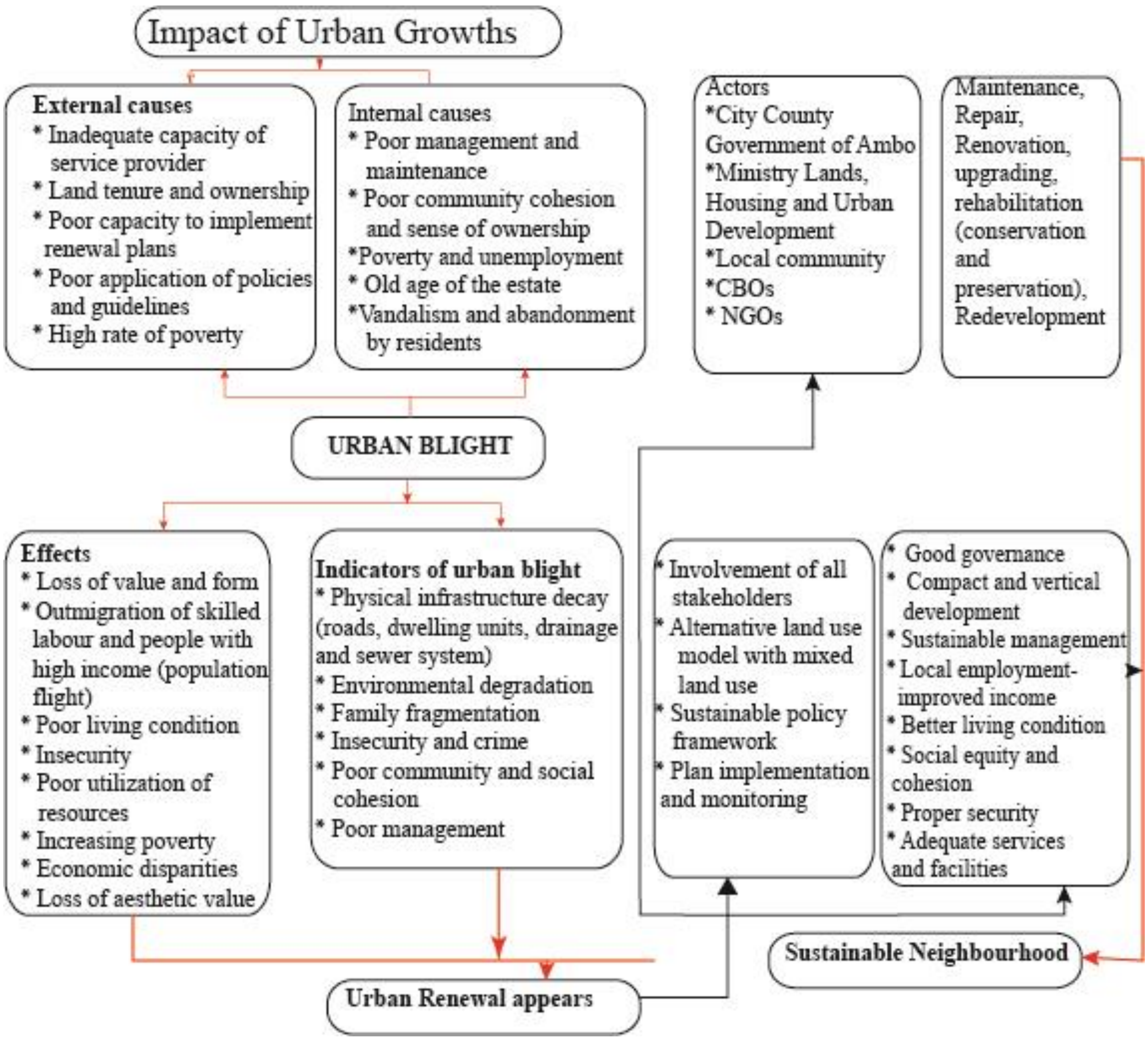

Figure 2.1 Research process diagram

CHAPTER THREE
METHOD AND MATERIALS

3.1 Introduction

This chapter outlines the methods by which the researcher was prepared to obtain and analyze data to assess the existing condition of urban blight and map the spatio-temporal pattern of urban decay in Ambo towns. In addition, it also discusses and describes the methods that were used to obtain fairly accurate data. The research techniques and procedures thus determine the quality of the data that was obtained from the study area. In order to collect data that provided the necessary information for the objectives and research questions, the study adopted a qualitative research design as well as a mixed-methods research approach. The research approach and design are discussed in depth in the data sources section of this chapter. Therefore, this section gives a research approach and design, discusses the sampling technique and research instruments, as well as the data analysis tools used.

3.2 Description of the Study Area

This research was conducted in Ambo Town, which was established in 1889. Ambo Town is among the few privileged towns of its time to have had its own municipal administration since 1931. They are faced with serious urban problems such as urban decay, the inefficiency of public transit, and the lack of proper distribution of social, cultural, and economic activities. Arada was one of the most important neighborhoods of Ambo from the past to the present because it is located at the heart of the city and includes the majority of commercial activities. As the primary nucleus of Ambo, Arada was one of the areas where urban decay was widely seen.

The town covers a total area of 83.912 km2, with an average elevation of 2100 m above sea level. Ambo Town is located in the West Shewa Zone of the Oromia National Regional State in central Ethiopia, and it is the capital town of the West Shewa Zone. Relatively, Ambo town is located 114 km west of Addis Ababa, 60 km north-west of Waliso town, and 12 km east of Guder town(Ambo Municipality, 2020). Ambo town's geographical location is roughly between 080 56’30’’N - 080 59’30’’N latitudes and 370 47’30’’E - 370 55’15’’E longitudes.

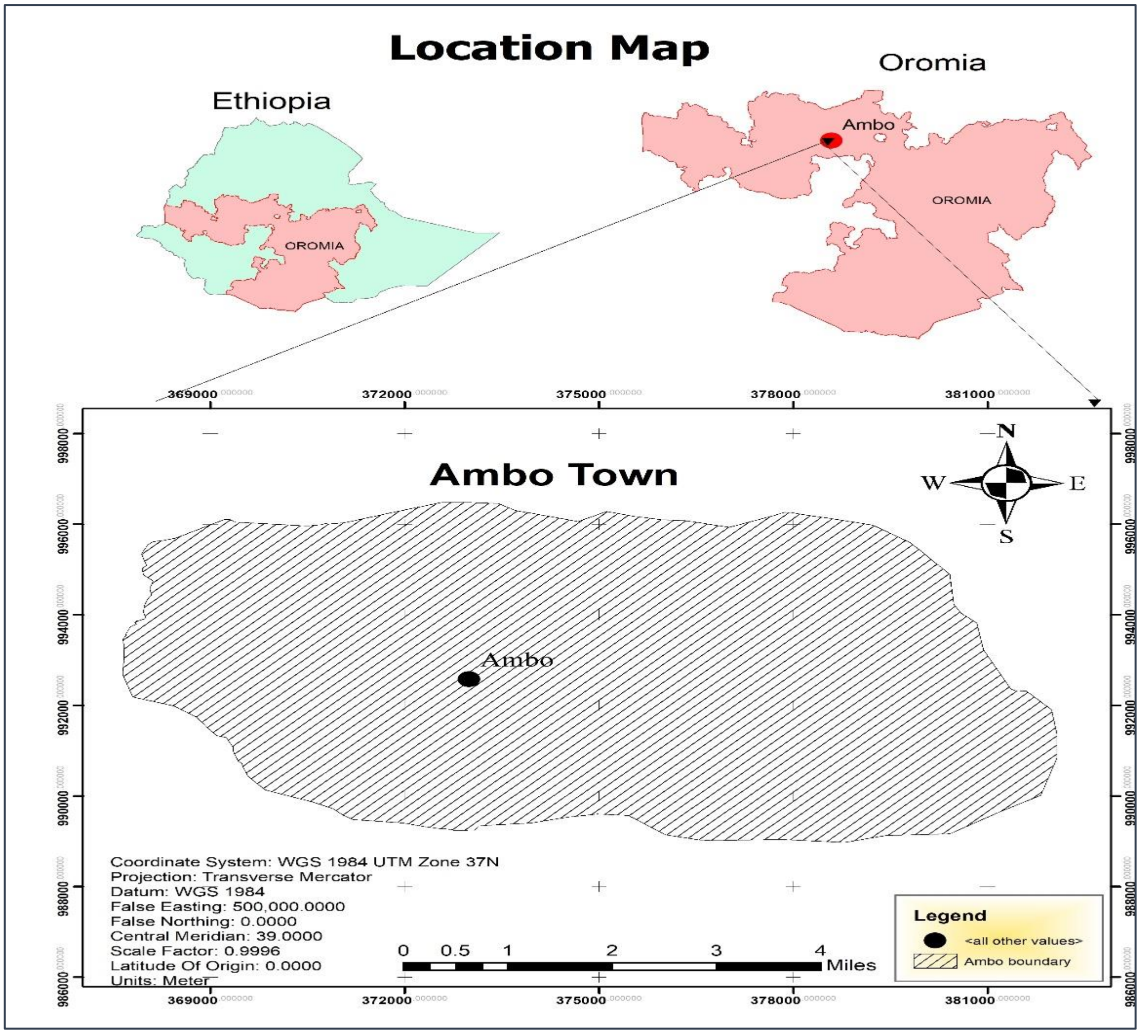

Figure 3.1: Geographic location of the study area. (Source: Organized by the author, (2023))

3.3 Population size

The population and housing censuses conducted in 1994/2002 and 2007/2016 by the Central Statistical Authority are considered here to see the trend of the population size of the town under study(Ambo Municipality, 2020). Ambo Town is the capital town of West Shewa Zone, with a population size of more than 67,514 in 2001/2009, including the population of expansion areas. According to the 1992 and 2007 population and housing censuses of CSA, the total population of the town was 27,636 and 50,267, respectively, and the population forecast for Ambo Town in 2022 was 128601.

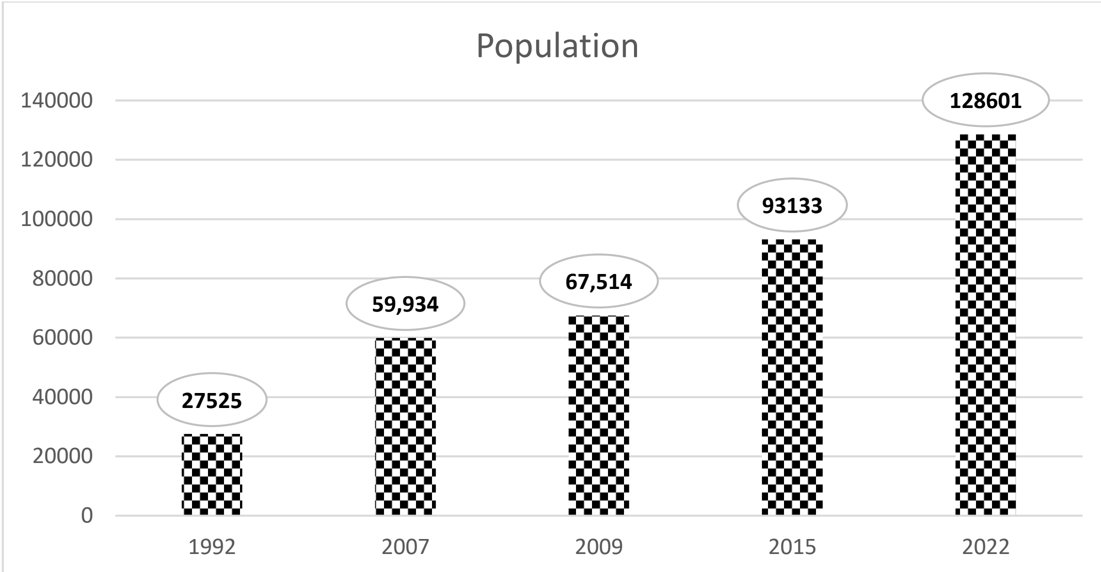

Figure 3.2 Population growth as Computed based on Census reports of 1994 and 2007

3.4 Research Design

The main objective of this study is to assess the extent of urban blight in Ambo towns using remote sensing and GIS techniques, identify the key factors and drivers of blight, and develop effective interventions. The spatial and temporal patterns of urban deterioration in the area were analyzed and mapped using GIS data. In addition, Field surveys, interviews with local residents and stakeholders, and community meetings were used to collect primary data. The remote sensing and GIS data were analyzed using various techniques, including supervised and unsupervised classification, change detection analysis, and spatial analysis. The primary data collected through surveys and interviews was analyzed using descriptive and inferential statistics, and thematic analysis.

The study's goal was to provide a comprehensive and accurate assessment of the extent and severity of urban blight in Ambo towns, as well as the underlying factors and drivers contributing to the problem. The study's goal was to provide a comprehensive and accurate assessment of the extent and severity of urban blight in Ambo towns, as well as the underlying factors and drivers contributing to the problem.

3.5 Methodological Design

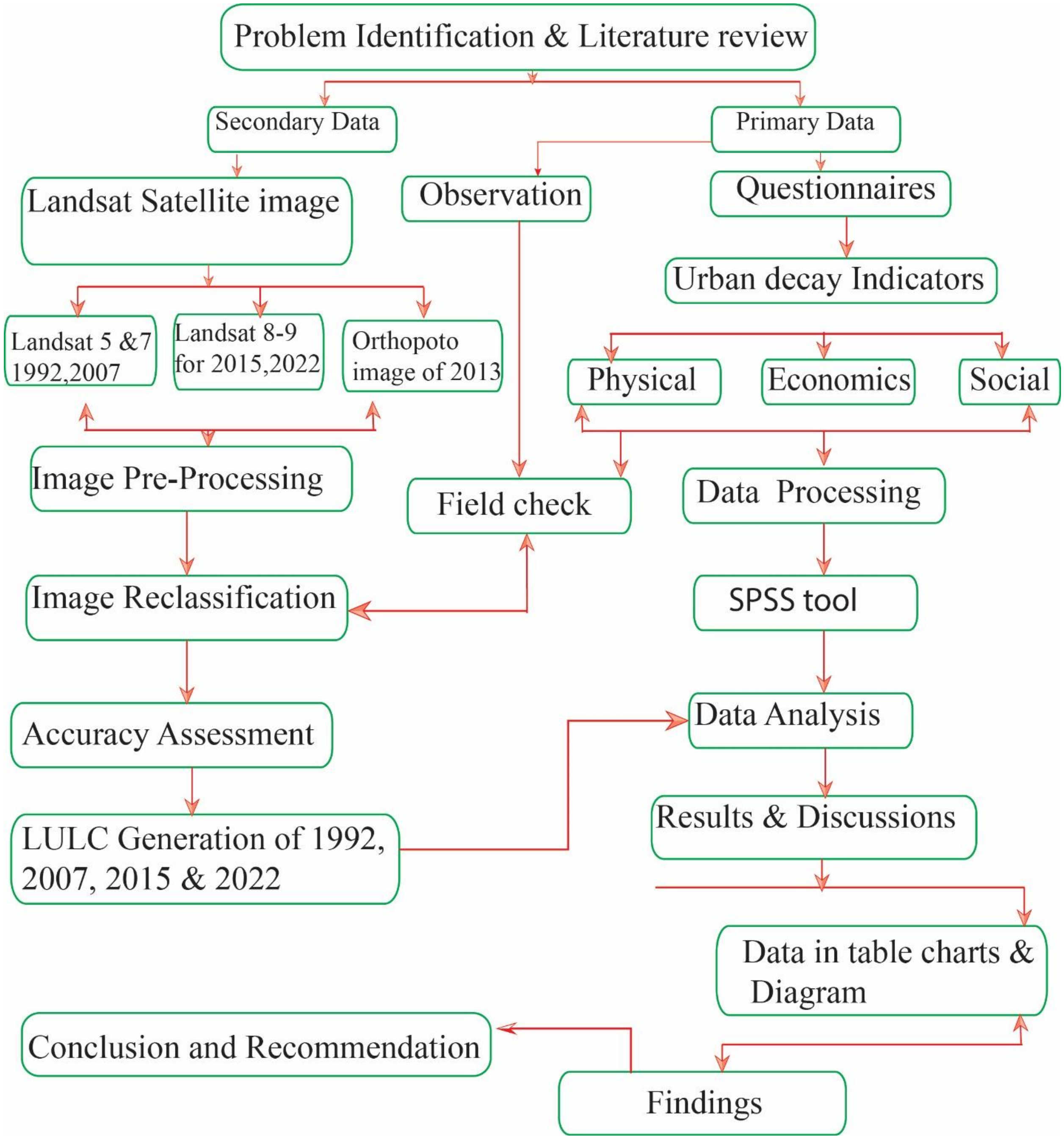

Figure 3.3 Methodological research design diagram

(Source: Organized by the author, (2023))

3.6 Research Approach

The research approach for studying urban blight in the context of Ambo town would involve a combination of quantitative and qualitative methods, as well as the use of remote sensing and GIS technologies. The reasons for this approach are that it enabled us to clarify urban growth trends through mapping in different periods of time and also how this has an impact on urban blight change. The study would involve collecting both primary and secondary data. Primary data would be collected through field surveys, interviews, and focus group discussions with local residents, officials, and stakeholders. Secondary data would be collected from various sources, including government reports, satellite imagery, and other spatial data. The collected data would be analyzed using statistical analysis and GIS-assisted spatial analysis. A blight level index would be developed based on the identified urban blight indicators. This index would help to quantify the severity of blight in different areas of the town and inform targeted interventions. Based on the study findings, an urban plan solution would be proposed that supports social cohesion, maintains the genuine character of the study area, and promotes local economic development. This solution would be developed in collaboration with local stakeholders and officials to ensure its feasibility and sustainability.

3.7 Data Type and Source

3.7.1 Primary Data Sources

This form of data was the main data source that informed the study. The Primary data sources were collected using frequent observations of the town and closed-ended and open-ended questionnaires for officials and experts of Ambo town Land Development and Management office, Community and each Kebele administrators (ya'i Gada kebele, Kisose kebele).

3.7.2 Secondary Data Sources

This data type was obtained through a literature review of existing publications relevant to the topic of study. This would aid in the understanding of the area of study and establish what was previously uncovered by others in the same area of study. This data type was sourced from journals, internet sources, government publications, articles, maps, and other sources Table 3.1

Table 3.1 Data types and Data sources from which they were obtained

No	Data	Year	Platform	Source	Data Type
1	Satellite Image	1992	Landsat TM	USGS web.	Secondary
2	Satellite Image	2007	Landsat TM	USGS web.	Secondary
3	Image from office	2013 E C	Orthopoto	OUPI	Secondary
4	Satellite Image	2015	Landsat TM	USGS web.	Secondary
5	Satellite Image	2022	Landsat TM	USGS web.	Secondary
6	Demographic Data			CSA/ATSAO	Secondary
7	Annual Reports			ATLDMO	Secondary
8	Ambo Town Structure Plan			OUPI	Secondary

(Source: Organized by the author, (2023))

3.8 Data Collection Methods

3.8.1 Data Collection Instruments

The urban growth detection characteristics were used for assessing the spatial and temporal land use and land cover (LULC) change in the study area. It is the identification of variations in land cover types by observing a specified area at different times using multi-temporal data sets from satellite images. Spatial temporal satellite images of a specified geographic area were processed and classified to produce thematic maps for 1992, 2007, 2015, and 2022 based Table 3.3 selection of years. The classified maps were then compared and overlaid to visualize the changes in the area over the span of time.

3.8.2 Major Data Collection Instruments

In order to generate information regarding the major urban blight, important data collection instruments used are questionnaires and observations.

3.8.2.1 Questionnaires

The questionnaire can include questions about the presence of physical blight indicators in the neighborhood, such as vacant or abandoned buildings, overgrown vegetation, and littered areas. Respondents can also be asked to rate the severity of blight in their neighborhood on a scale. Questions can be included to gather data on the social and economic conditions in blighted areas, such as poverty rates, crime rates, access to services and amenities, and perceptions of safety. The questionnaire can include questions designed to gather data on residents' perceptions and attitudes towards blight, such as their level of concern about blight in their neighborhood, their opinions on the causes of blight, and their willingness to participate in community efforts to address blight.

3.8.3 Secondary Data Collection Instruments

3.8.3.1 Satellite Imageries

The United States Geological Survey (USGS) was a gold mine of information and the known source of satellite image free of charge that covers wide areas(Hishe & Bewket, 2020). In order to investigate urban growth trends of Ambo town, Landsat imagery/Landsat Thematic Mapper (TM) for the years 1992, 2007, 2015, and 2022 was used as a source of data and acquired from earth explorer website.

3.9 Sampling Techniques

In order to study urban blight in Ambo town, several sampling techniques could be employed to collect data that is representative of the population. Some of the sampling techniques that could be used include: Stratified random sampling involves dividing the population into subgroups or strata based on certain characteristics, such as socio-economic status or land use. A sample is then selected from each stratum to ensure that the sample is representative of the population. It is important to ensure that the sample is representative of the population to ensure that the study findings are valid and reliable.

3.10 Sampling Method

When using remote sensing and GIS to determine the analysis of urban blight in Ambo town, a cluster sampling method may be appropriate. Cluster sampling involves selecting groups, or clusters, of study participants based on their geographic location or other criteria. For example, remote sensing and GIS data can be used to identify neighborhoods or areas in Ambo town that exhibit high levels of blight indicators, such as vacant or abandoned buildings, overgrown vegetation, or other signs of disrepair. Cluster sampling can be an efficient and cost-effective way to collect data on urban blight using once these clusters have been identified, a sample of study participants can be selected from each cluster for further analysis. This can involve collecting additional data on blight indicators in each cluster, as well as gathering qualitative data on residents' experiences and perceptions of blight in their neighborhoods.

Remote sensing and GIS, as it allows for data to be collected from multiple participants in a single location. However, it is important to ensure that the selected clusters are representative of the population of Ambo town, and that the sample size is sufficient to draw meaningful conclusions from the data.

3.10.1 Sampling Frame

The sampling frame was the population of interest from which the sample was selected. Accordingly, the respondents of this study were Ambo Town Land Administrators and Management Office Experts, Officials, Kebele Administrators, and the Community in the Town.

3.10.2 Sample Size Determination

There are several strategies for identifying the sample size. These include using a census for small populations, imitating the sample size of similar studies, and applying formulas to calculate a sample size. Using a similar study's sample size meant using the same sample size as studies similar to the one you planned. Using formulas to calculate a sample size was the application of one of several formulas that were needed to calculate the necessary sample size for a different combination of levels of precision, confidence, and variability.

In the process of the sample size selection, purposeful selection for the informants was used. Therefore, the first step is calculating the sample size of the total respondents (experts, officials, kebele administrators, and communities in the town). The strategy used for determining the sample size of this study was using a simplified formula to calculate a sample size because of small populations. The Yamane formula was used to determine the sample size. Yamane (1967:886) provides a simplified formula to calculate sample sizes.

Accordingly, the sample size for office employees and communities in the town at 95% confidence interval and ±5% precision were 23 and 369 respectively as computed and shown below.

$$n = N1 + N(e)2$$

Whereas: n = required sample size N = Study Population e = level of precision = 95% confidence i.e. e = 0.05%

<u>Office Employees</u>

$$n = N1 + N(e)2 \qquad n = 25/1 + 25(0.05)2 \; = (\frac{25}{1.1125}) = \mathbf{23}$$

Community

$$n = N1 + N(e)2 \qquad n = 4900/1 + 4900(0.05)2 \; = (\frac{4900}{13.25}) = \mathbf{369}$$

The details about the sample proportional respondents was computed as the total study population of each sampling frame divided to the total study population and then multiplied by a total calculated sample using the above formula and the results are summarized as shown in Table 3.2 .

Table 3.2 Summary of sample size

Proportional sample size determination for communities						
No	Sampling Units	Population Target		Sample Size	Research Technique	Data Collection Technique
1	Community	Kebele	Size	369	Systematic sampling	Questionnaire
		02	4900			
Total sample size of the survey from each target population						
1	Keble administrator		5	3	Purposive	Interview
2	Ambo townland development and management office Experts		12	6	Purposive	Both questioner and Interviews
3	Ambo townland development and management office Experts at the kebele level		6	3	Purposive	Both questioner and Interviews
	Total			**23**		

3.10.3 Sample Years for Trend Analysis

In order to map urban growth trends and measure their effects on the LULC change of Ambo town, four periods of 1992, 2007, 2015, and 2022 were selected because during those periods the town expansion was very high and those years were critical boom periods of change. For more clarification, the major reasons considered are specified in detail in Table 3.3.

Table 3.3 Criteria for the selection of years

No	Sample Year (GC)	Selection Criteria/Reason
1	1992	To measure and show the level of urban growth and land use land covers change before the town designation, the reason the population of Ambo has nearly doubled from 1992 (UN-Habitat, 2008).
2	2007	To measure and show the level of urban growths and land use land covers (LULC) change for 15years later, in 2007, it rose by 50 percent due to seeking for an urban job, educational opportunity for that the Ambo Agricultural College is upgraded to University level(UN-Habitat, 2008)
3	2015	To measure and show the level of urban growths and land use land covers (LULC) change within the development of various available facilities like education which attract people especially students from other places to attend high school, preparatory education and technical education in the town and government give attention because of political issues
4	2022	To measure and show the level of urban growth and land use land covers (LULC) change after a massive residential land delivery undertaken by a town because of expansion of the town is becoming irregular, uncontrolled, and often resulting in the creation of slums especially around the Arada inner town.

3.11 Study Variables

In order to meet the aim of the study, which is to investigate the existing condition of urban blight and map the spatio-temporal pattern of urban decay in Ambo using multi-date remote sensing data with a view to understanding the process that gives rise to urban blight in the town, Study variables such as the background of respondents, urban growth, land use and land cover characteristics, and rate of change were used. The status or background of town community and government office employees (experts and officials) was studied. Variables such as address, gender, age, place of birth, level of education, qualification background, occupation, workplace, work position, and year of service in this position were studied.

3.12 Types of Variables and Measuring Techniques

The types of variables were used for this study along with their analysis and measurement techniques are specified and presented in detail as shown in Table 3.4.

Table 3.4 Description of the study Variables

No	Variables	Types of variables	Measuring Techniques
1	Address, Gender, Age, Birth place, Level of educations, Qualification background, Occupation, Work place, Work position and Year of services	Independent	Descriptive statistics graphs will be used
2	Decrease in population size, lack of road infrastructure, slum, crime, poverty, etc. The prepared plans, Location of the town, Topography of the town	Independent	Descriptive statistics will be used to describe their results
3	LULC characteristics: Built-up area, water body Agricultural land, Green area, Bare land and Forest	Dependent	Map, graphs and charts will be used
4	Rate of change	Dependent	Graphs and charts will be used

3.13 Data Processing Method

I. Image Preprocessing

In preprocessing, satellite images were downloaded from the Earth Explorer website and the USGS Landsat archive website, and layers were tacked after extracting the compiled file. Image collection and favorite seasons are based on data availability and are free from cloud coverage. After data acquisition, image-to-image geometric rectification was done using satellite images acquired in 1992, 2007, 2015, and 2022, and using ArcGIS 10.8, images were re-projected and calibrated using projection UTM Zone 37N and Datum WGS 1984 to make them fit with Landsat images and the study area.

It is fundamental to geospatial technologies in general and geographic information systems (GIS) in particular. The primary goal of georeferencing was to connect a digital map's internal coordinate system, aerial photo, satellite image, or scanned map to the ground reality of geographic coordinates. All data used in this study was georeferenced in ArcMap 10.8 using a ground control point (GCP) to relate the data layer to ground reality and facilitate the spatial analysis.

II. Image Classification

After all the image preprocessing activities, one of the actual tasks of the study is image classification, which is the basis for change detection. There are two methods for image classification. The first is supervised image classification, which comprises picking pixels that characterize land cover classes that are accepted by the specialist. The second is unsupervised image classification, which is more computer-automated. It allows the specialist to specify some factors that the computer uses to reveal statistical patterns that are essential to the data. Due to related spectral features, the application of unsupervised classification might not have decent consequences. As a result, supervisory image classification was employed for this study. Supervised classification needs the selection of training areas to get precise classification output such as sampling points for each years 140; 260; 260 and 264 for four periods (1992; 2007; 2015 and 2022) respectively. It is strongly based on the quality and quantity of training samples to create decent-quality classification results.

III. Accuracy Assessment

To determine the accuracy of the classification, the number of reference pixels is an important factor. An equalized stratified random sampling approach is used to assess the accuracy of each of the two land cover classifications. The overall accuracy and a KAPPA analysis were used to perform a classification accuracy assessment based on error matrix analysis. Accuracy assessments was performed for the 1992, 2007, 2015 and 2022 LULC maps.

IV. Land Use Land Cover (LULC) Classes

During the classification process, it was rare to find clearly defined classes that one liked. Before collecting training samples, the land cover classes should be known so as to make the classification easier. This study has established its own classification scheme based on the visual interpretation of satellite images. Therefore, as the main objective of the study was change detection of land use and land cover and measuring urban blight in Ambo town, five (5) LULC main categories were selected for the purpose: built-up area, agricultural area, green area, bare land or open space, and forest, as shown in Table 3.5

Table 3.5: Land-use land-cover (LULC) categories applied for classification in the study

No.	Land use category	Description
1	Built-up Area	Areas covered by include all developed areas roads, buildings, housing units, commercial and resident areas, under construction areas, industries and manufacturing etc.(Kasanko, 2006).
2	Agricultural Area	Areas covered by include all areas employed for agricultural activities farmland and crop (grazing)(Bell, 2012).
3	Green Area	Areas covered by vegetation of any type, including vegetation and other pockets of green areas(Caiyan & Li, 2021).
4	Bare land	Areas covered by open spaces with little or no vegetation, sands, rocky areas and fenced land for investment purpose i.e., not built(Giorgis, 2013)
5	Water body	Consists of areas with surface water seized in the form of a river, lake, or pond, which may be permanent or seasonal
6	Forest	Areas covered by trees forming closed or nearly closed canopies(Hofton, 2003)

3.14 Data Analysis Methods

Data analysis methods such as trend analysis, LULC change detection analysis, spatial growths rate analysis and qualitative data analysis of analysis was used.

3.15 LULC Change Detection Analysis

It is the identification of variations in land cover types by observing a specified area at different times using multi-temporal data sets from satellite images(Hishe & Bewket, 2020).Spatial-temporal satellite images of a specified geographic area were processed and classified to produce thematic maps for 1992, 2007, 2015, and 2022. The classified maps were then compared and overlaid to visualize the changes in the area over time. It is also possible to compute the amount of increase or decrease of each category and see the change in percent in each year using the following formula(Assefa, 2022) as shown in (Equation 1).

$$\textbf{CHange in } \% = (\text{Total area in T2} - \text{Total area in T1} / \text{Total area in T1} * 100\% - - - - \text{eq. } 1$$

Where T1 is the earlier point of time and T2 is the later or recent point of time in the series

3.16 Urban decay index

An urban decay index is a tool used to measure the level of urban blight or decay in a particular area. It is often used to identify areas in need of intervention or revitalization and to monitor changes in urban blight over time. The specific indicators included in an urban decay index can vary depending on the context and the research question, but commonly used indicators may include: Physical deterioration of buildings and infrastructure, such as the presence of vacant or abandoned buildings, graffiti, or broken windows; Socio-economic indicators, such as poverty rates, unemployment rates, or crime rates; Environmental indicators, such as pollution levels or the presence of hazardous waste sites; Land use and zoning characteristics, such as the presence of vacant lots or the proportion of commercial versus residential properties.

The parameters were used to interpret and classify the remote sensing data into different urban quality scores. Each of these parameters was given a threshold score, through which all the zones were classified into good urban neighborhoods and blighted neighborhoods. The threshold serves as a value through which the city is measured on a monothetic Boolean scale of good (1) and bad (0)(Fabiyi, 2011).

3.17 Tools and Software Programs

The character of this study is analyzing urban growth trends and their impacts on land use and land cover (LULC) change detection, so mainly ArcGIS 10.8 software was used for data processing and spontaneous growth trend measurement in this study, and the details of the tools and software programs used are shown in Table 3.6.

Table 3.6: Tools and Software programs was used for the study

No.	Software & Tools	Function
1	ArcGIS 10.8	To create shape files, identify the path and row of the study area, data analysis, management, geo-referencing, image processing, enhancement, transformation, classification, delineation and clipping and make a layout for final mapping.

2	(RST) (QGIS 3.28.2)	To detection of land use land covers (LULC) change in different periods of time
3	USGS website	The source of satellite image free of charge
4	Google Earth Pro	Use as a base map in visual image interpretation, and generate coordinate points for the images geo-referencing
5	SPSS version 26	To process, manage and analyze the statistical data's collected
6	Micro-soft excel (2013)	To perform different statistical calculations.
7	Micro-soft word(2013)	To write the report paper
8	Adobe-Illustrator, Photoshop	To illustrate graphics

(Source: By author, (2023))

3.18 Validity of Methods and Materials

To ensure the validity of the methods and materials used in a study on urban blight in Ambo town, researchers should carefully select and design their data collection tools, such as questionnaires or surveys, to ensure that they are measuring the relevant constructs or content. The results obtained from the combined use of both quantitative and qualitative methods simultaneously increased the value of the conclusion. Referring to other researchers' work and discussions with advisors and experts on issues that require expertise and also cross-checking information and data was carried out through survey questionnaires with information gathered from the concerned offices and community of the town. Also, different Ambo town profiles were composed and published on the subject matter. In addition, researchers should use established and validated methods for data analysis, such as statistical tests or GIS-assisted spatial analysis, to ensure the accuracy and reliability of the study findings. Finally, researchers should carefully consider the limitations and potential biases of their study design and findings and communicate these transparently in their research report.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Description of the Respondents Profile

a) Gender, Age, Marital Status and Household Size Characteristics of the Respondents

In order to analyze and explain the socio-economic status of the people in the slum area, study variables such as; gender, age, family size, level of education, marital status, occupation, and monthly income per household (HH) were collected and explained in the survey through questionnaires and semi structured interviews. According to the survey conducted, Figure 4.1 shows that out of the 350 participants in the research, 55.7% are males and 44.3% are females; 5.1% of the respondents interviewed were of age between 18 and 30 years, 23.7% were between 31 and 40 years of age; 58.5% were between 41 & 60 years of age; and 12.6% were greater than 60 years of age are 12.6%. This shows that most of the respondents are between the ages of 31-40 years of age.

On the other hand, based on the below, Figure 4.1, concerning marital status, experimental findings on the respondents indicate that the majority (52%) of the respondents are married, while only 17.4% are single. The 6% difference is comprised of the widowed, with 24.6% divorced and the household size of the respondents within the study was examined. The results show that 5.7% of the households in the study area comprised 1person another 10.0% of the households comprised of 2 members. Another 30.0% of households comprised of 3 to 4 members, while 41.4% comprised of 5 to 7 members and another 12.9% of the households comprised members above eight (8) in number. Critical observation into the household size shows that over 80% of the households had a size of between 2 and 7members.

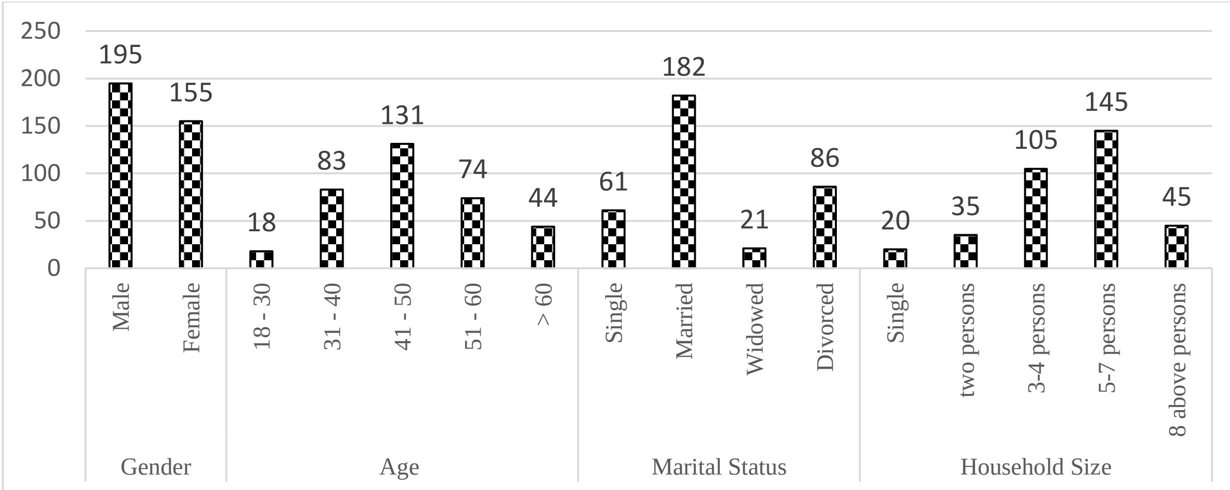

Figure 4.1 Demographic variable of respondent (Source: By author, (2023))

b) Education Level of Respondent

Concerning to the level of education Figure 4.2, 20% of them have never attended schools; 32% of them have attended schools up to grade eight. Whereas, 25.14% of them have attended schools up to secondary school; 3% of them have completed grade 12th and 7.14% of them have attended TVET; 6% have went to higher educational diploma, 6% have first degree and 3.14% have reached masters and above educational level.

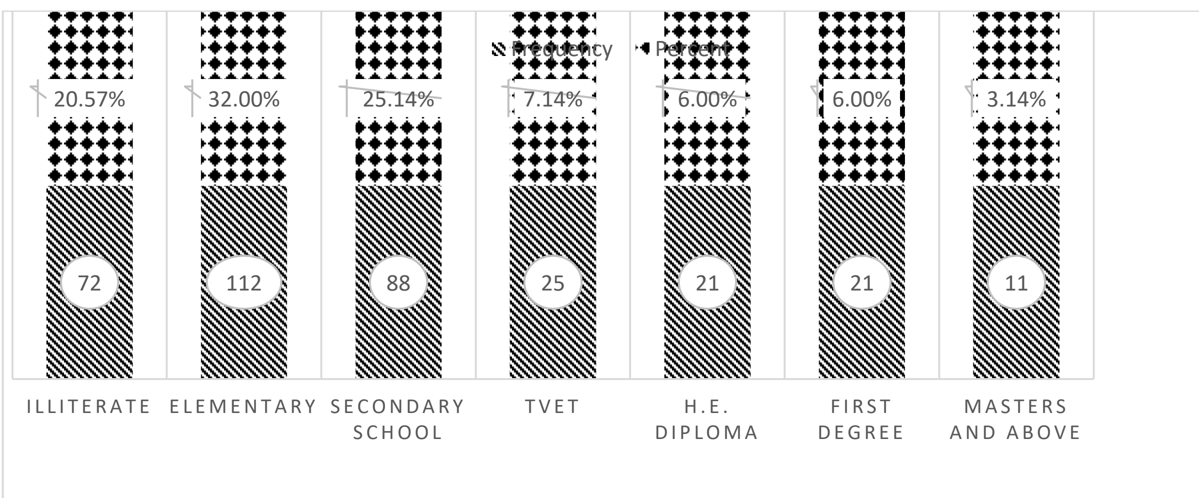

Figure 4.2 Level of education of respondent (Source: By author, (2023))

c) Employment Status of Respondent

According to Figure 4.3, the other socioeconomic variable of the actors in the market is job and source of income where most of them are private workers with 48.86%; 25.14% of the government employer; Home maker accounts for 7.14%; whereas 18.86 % of them are unemployed and students.

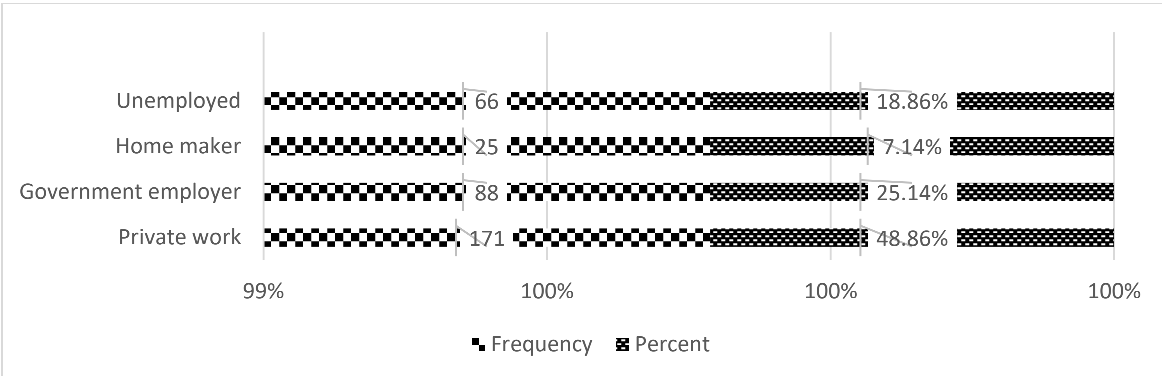

Figure 4.3 Employment status of respondent (Source: By author, (2023))

d) Income status of respondent

According to Figure 4.4, 42% of the participants are categorized as having poor economic status by earning less than 800 (5.43%) or 800–2,000 (26%). whereas 16.57% are labeled as low-income by earning 2,000–4,000 birr per month. The middle-income earners account for 12% and 11.14% by earning 4,000–6,000 and 6,000–8,000 birr monthly. The upper middle income covers 6% by earning 8,000–10,000 birr monthly, and the high incomers that earn more than 10,000 birr monthly account for only 9.14% and not data (missed) 13.71% according to the category of CSA (2007).

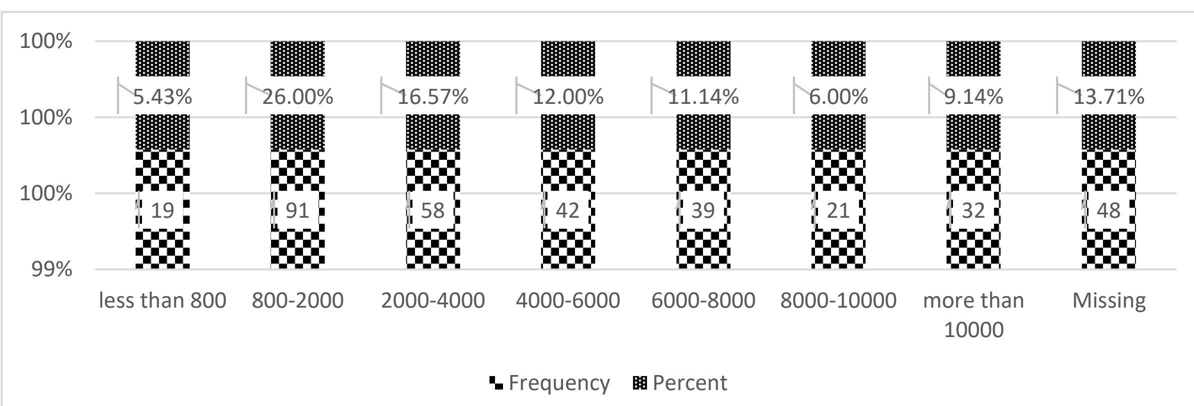

Figure 4.4 Income status of respondent (Source: By author, (2023))

4.2 Un-Supervised Change Detection of Ambo town LULC of 1992-2022

Image preprocessing or unsupervised land use land cover (LULC) change of Ambo town maps was produced for the periods of 1992, 2007, 2015, and 2022, as presented in Figure 4.5. Unsupervised satellite images of Ambo town at different years to assess urban growth and changes were obtained using remote sensing from the Earth Explore USGS Landsat web site. Accordingly, Landsat 4 and 5 images of 1992, Landsat 7 of 2007, and Landsat 8 and 9 images of 2015 and 2022 were used based on their availability. Image selection and preference of seasons were based on two factors: the free availability of the data and the absence of cloud coverage. Activities such as image clipping by the study area, re-projection, and image resolution merging were done for all images.

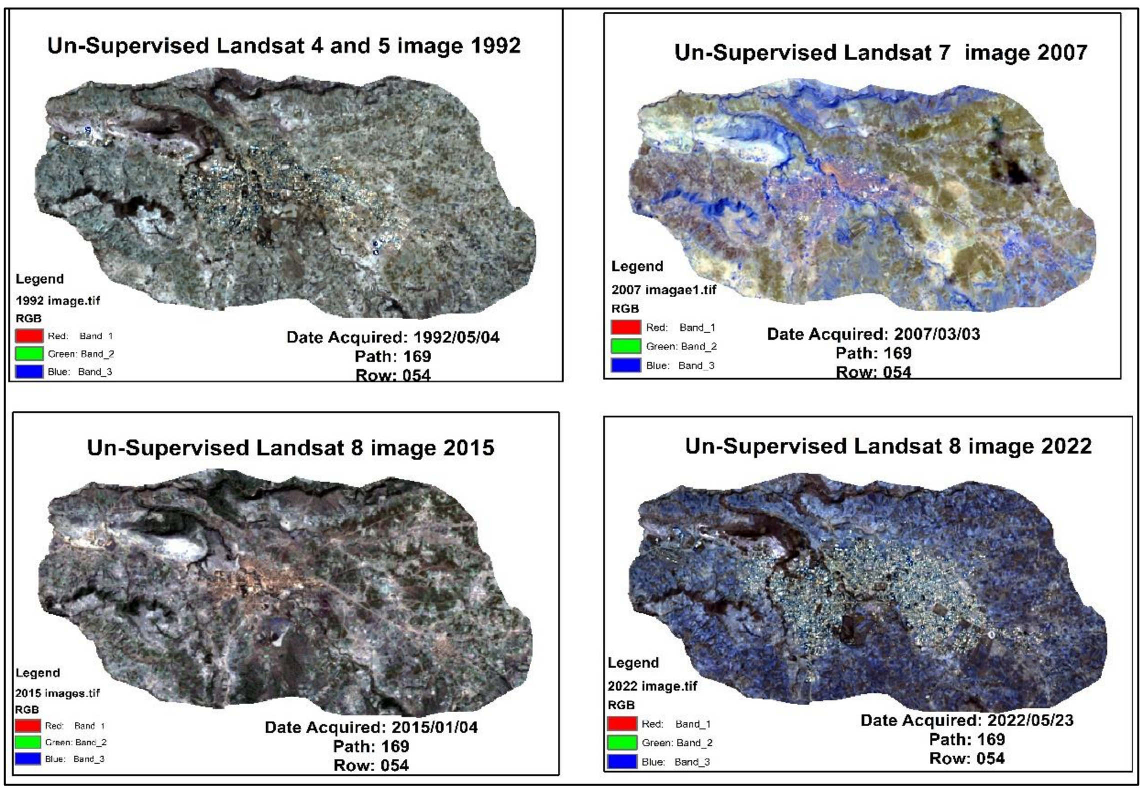

Figure 4.5 Un-Supervised Change Detection of Ambo town LULC of 1992-2022 (Source: By author, (2023))

4.3 Land Use Land Cover Classification

Each image was classified into a set of spectral classes using the Support Vector Machine (SVM) algorithm in ENVI software. SVM is a non-parametric classifier. Unlike parametric classifiers such as maximum likelihood, which assume that the data is normally distributed, non-parametric classifiers do now no longer base class on a normality assumption or statistical parameters(Bulti, 2020). Training samples for every magnificence had been amassed from every image. (e.g., urban areas) are unlikely to be normally distributed, the distribution of land cover surfaces is associated with various uncertainties that prevent their description based on data distribution. In this respect, non-parametric classifiers offer higher effects compared to parametric classifiers in complicated landscapes. Accordingly, the classified image of Landsat and the sentinel image are classified into six major classes (agricultural land, barren land, built-up area, forest area, grassland, and water bodies) based on the major class land of Ambo town. The accuracy assessment for each image was calculated, and the result of all LULC is in an acceptable range. The selection of the entire year was based on the availability and quality of data, as the study area resulted in a very severe shortage of spatial data.

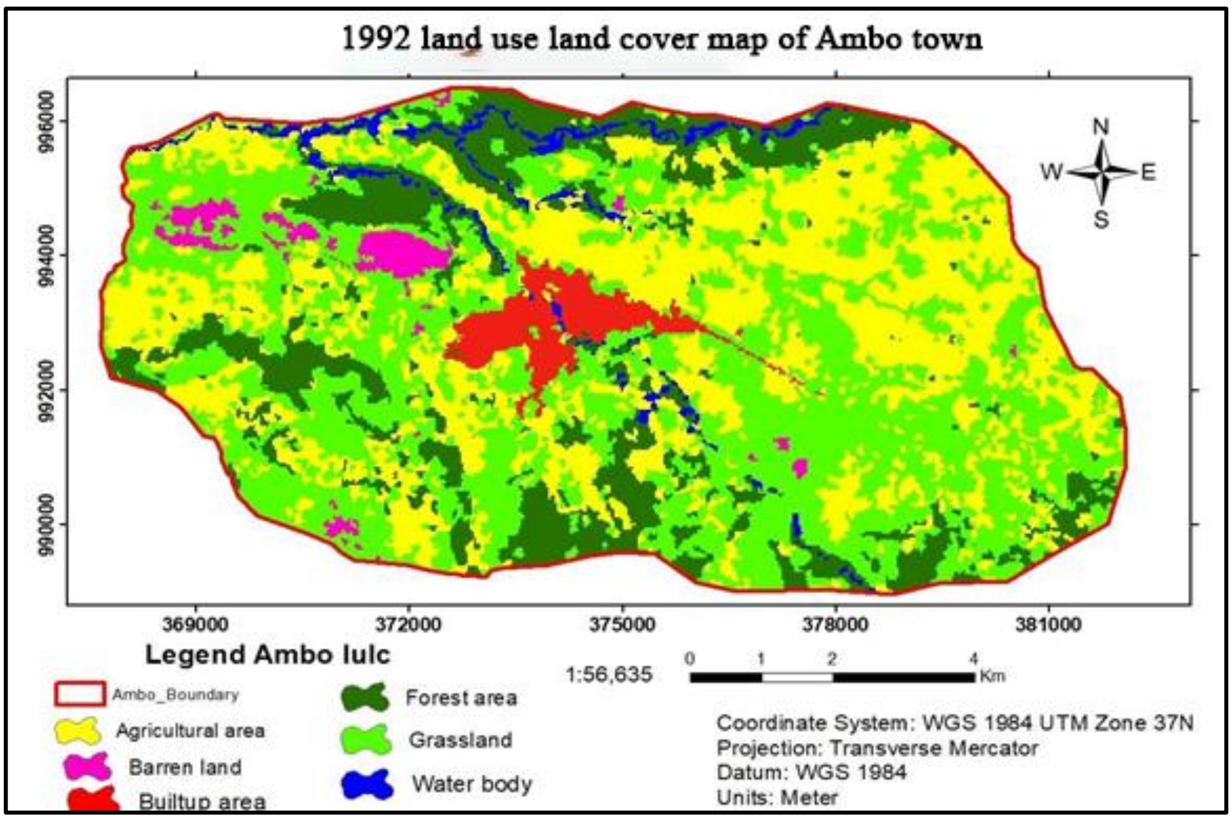

Figure 4.6 Land use land cover map of 1992 (Source: By author, (2023))

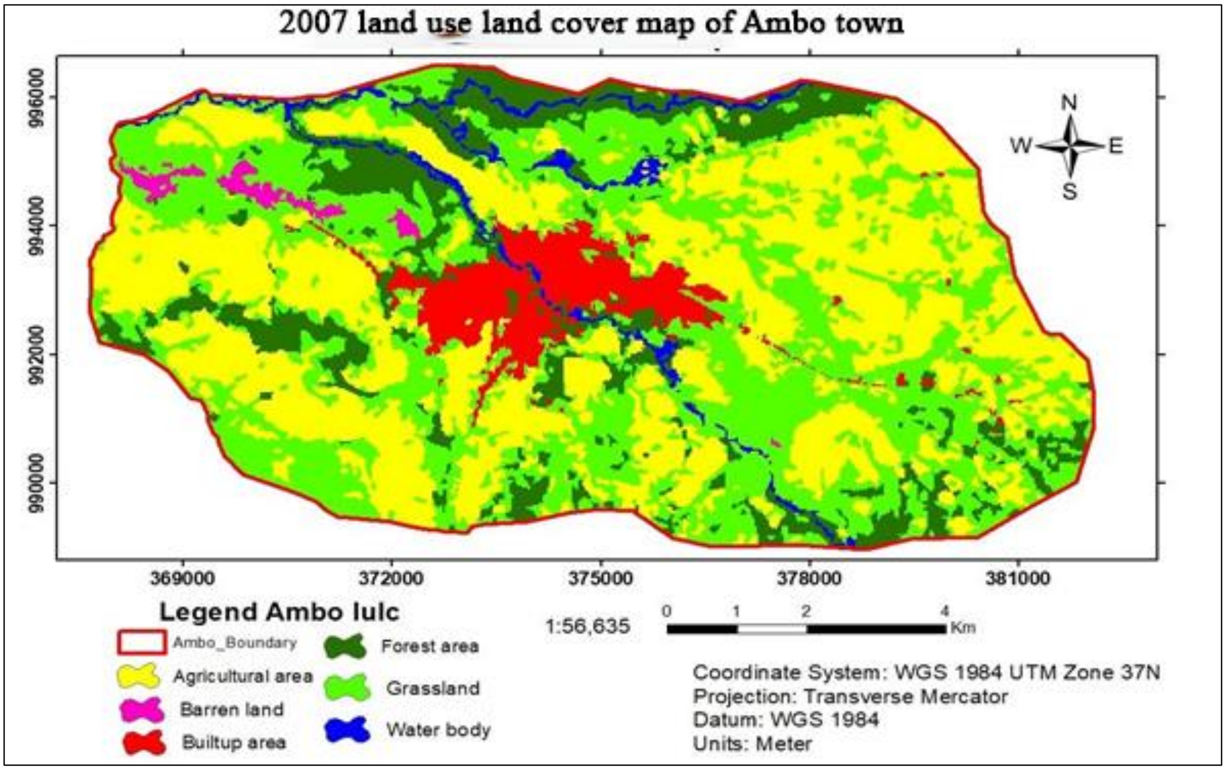

Figure 4.7 land use land cover map of 2007 (Source: By author, (2023))

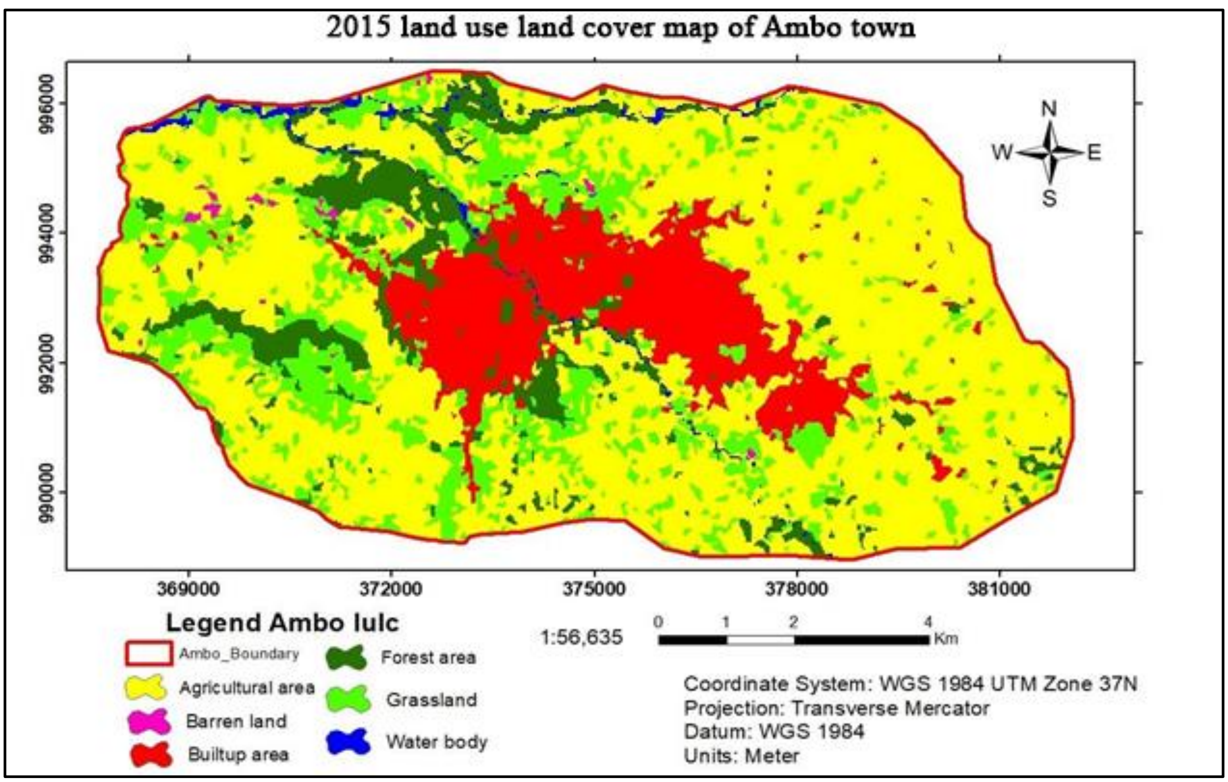

Figure 4.8 land use land cover map of 2015 (Source: By author, (2023))

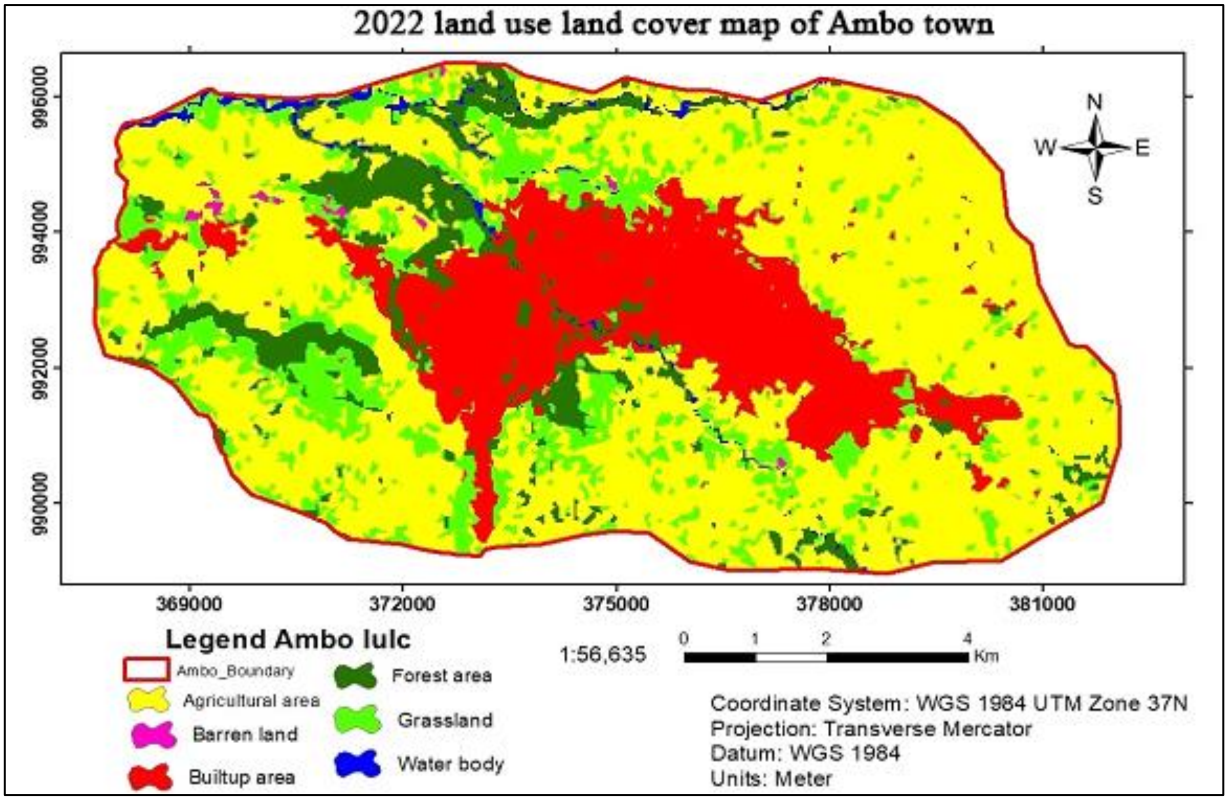

Figure 4.9 Land use/land cover map 2022 (Source: By author, (2023))

4.4 Accuracy Assessment for Land Use / Land Cover Image

LULC classification accuracy was assessed quantitatively using an error matrix, which is the commonly used method in LULC classification accuracy assessment (Built, 2019). Accuracy assessment in this study revealed overall accuracies of 85.92%, 90%, 92%, and 93% were calculated for 1992, 2007, 2015, and 2022, respectively. This implies that all classifications are in the acceptable range because the overall accuracy of each year is greater than 85% and the kappa coefficient greater than 0.80 represents strong (almost perfect) agreement (Rwanga, 2017)was an indicator for a strong accuracy. The details of the error matrix table results are shown in Table 4.1; Table 4.2; Table 4.3; Table 4.4.

Table 4.1 Landsat 5 classification accuracy for 1992

		Reference map							
	LULC	Agricult.	Barren	Buildup	Forest	Grass land	Water	Total	user Acc.
Classifie d LULC	Agriculture	**51**	0	2	2	2	1	58	21.01%
	Barren	2	**17**	0	1	2	0	22	7.14%
	Buildup	2	1	**23**	1	0	0	27	9.66%

Forest	2	0	0	**45**	3	0	50	18.91%
Grass	4	0	0	3	**51**	0	58	21.43%
Water	0	0	0	0	0	**25**	25	10.50%
Total	61	18	25	52	58	26	**240**	
producer acc.	21.01%	7.14%	9.66%	18.91%	21.43%	10.50%		
Overall Accuracy		**88.66%**		**Random Accuracy**			**19.45%**	
Kappa coffiencient					**85.92%**			

(Source: Organized by the author, (2023))

Table 4.2 Landsat 7 (2007) classification accuracy assessment

		Reference map							
	LULC	Agricu.	Barren	Buildup	Forest area	Grass land	Water body	Total	user Acc.
Classified LULC 2007	Agricult.	56	2	0	0	3	1	62	21.09%
	Barren	0	19	1	0	0	0	20	7.42%
	Buildup	1	0	37	1	2	0	41	14.45%
	Forest	2	0	0	45	2	1	50	17.58%
	Grass land	4	0	0	1	55	0	60	21.48%
	Water	0	0	0	0	0	25	25	9.77%
	Total	63	21	38	47	62	27	260	
	producer	21.09%	7.42%	14.45%	17.58%	21.48%	9.77%		
	Overall Accuracy		**91.80%**		**Random Accuracy**			**18.89%**	
	Kappa coffiencient					**89.89%**			

(Source: Organized by the author, (2023))

Table 4.3 Landsat 8 Image 2015 classification accuracy assessment

		Reference map							
	LULC	Agricul	Barren	Buildup	Forest	Grass	Water	Total	user Acc.
Classified LULC 2015	Agriculture	65	0	0	2	3	1	71	25.00%
	Barren land	0	17	2	0	1	1	21	6.54%
	Buildup	1	0	47	0	2	0	50	18.08%
	Forest area	2	0	0	45	2	1	50	17.31%
	Grass land	3	0	0	1	41	0	45	15.77%
	Water	0	0	0	0	0	25	25	9.62%
	Total	71	17	49	48	49	28	**260**	
	producer	25.00%	6.54%	18.08%	17.31 %	15.77 %	9.62%		
	Overall Accuracy		**92.31%**		**Random Accuracy**			**19.30%**	
	Kappa coffiencient					**90.47%**			

(Source: Organized by the author, (2023))

Table 4.4 Landsat 8 Image 2022 classification accuracy assessment

		Reference map							
	LULC	Agricu.	Barren	Buildup	Forest	Grass	Water	Total	user Acc.
Classified LULC 2022	Agriculture	61	0	0	2	3	1	67	23.11%
	Barren land	0	19	2	0	1	0	22	7.20%
	Buildup area	1	0	57	0	2	0	60	21.59%
	Forest area	2	0	1	39	2	1	45	14.77%
	Grass land	2	0	1	1	41	0	45	15.53%
	Water/River	0	0	0	0	0	25	25	9.47%
	Total	66	19	61	42	49	27	264	
	producer	23.11%	7.20%	21.59%	14.77%	15.53%	9.47%		
	Overall Accuracy			**91.67%**		**Random Accuracy**		**19.04%**	
		Kappa coffiencient				89.71%			

4.5 Change Analysis

After the preparation of land use and land cover maps, the changes that occurred during the studied periods in each land cover were detected. Over the past decades, land covers in study areas such as forest areas, grassland, water bodies, and barren land were in continuous decline, while agricultural land showed a varying pattern. In general, out of the six LULC types identified in the study area, only one, namely the built-up area, showed continuous increment over the past 30 years. The extent of change within the study area of the individual land cover categories in hectares and the percentage they occupied for 1992, 2007, 2015, and 2022 are presented in Table 4.5.

Table 4.5 Area statistics and percentage of land use land cover percentages units from 1992 – 2022

LU/LC	**1992**		**2007**		**2015**		**2022**	
Type	**Ha**	**%**	**Ha**	**%**	**Ha**	**%**	**Ha**	**%**
Agriculture	2895.85	33.94%	3388.2	39.71%	5023.9	58.89%	4734.2	55.49%
Barren	168.7	1.98%	89.24	1.05%	35.42	0.42%	35.38	0.41%
Buildup	283.5	3.32%	533.28	6.25%	1265.3	14.83%	1703.6	19.97%
Forest area	1473.09	17.27%	1171.11	13.73%	746.62	8.75%	736.02	8.63%
Grass land	3536.11	41.45%	3164.75	37.09%	1380.11	16.18%	1244.13	14.58%
Water	174.16	2.04%	184.88	2.17%	80.06	0.94%	78.1	0.92%
Total	8531.53	100%	8531.53	100%	8531.53	100%	8531.53	100%

(Source: Organized by the author, (2023))

In 1992 the study area was dominated by grassland covering 41.45% followed by agricultural land covering 33.94% of the study area. Forest area, buildup area, waterbody, and barren land shared 17.27%, 3.32%, 2.04%, and 1.98% of the total area respectively. Those areas, which are close to the built-up areas and urban centers, were subjected to a significant loss in the last three decades.

Table 4.6 Over all amounts and percentage of land use land cover change (1992 - 2022)

LU/LC Type	**1992 - 2007**		**2007 - 2015**		**2015 - 2022**		**1992 – 2022**	
	Ha	**%**	**Ha**	**%**	**Ha**	**%**	**Ha**	**%**
Agriculture	492.42	5.76	1635.65	19.16	-289.71	-3.40	1838.33	21.54
Barren land	-79.55	-0.93	-53.81	-0.63	-0.04	0	-133.4	-1.56
Buildup area	249.76	2.93	732.1	8.58	438.31	5.14	1420.17	16.65
Forest area	-301.99	-3.54	-424.49	-4.98	-10.6	-0.12	-737.08	-8.64
Grass land	-371.36	-4.35	-1784.64	-20.92	-135.98	-1.59	-2291.99	-26.86
Water/River	10.72	0.13	-104.82	-1.23	-1.96	-0.02	-96.06	-1.13
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

(Source: Organized by the author, (2023))

The main types of land use and land cover have changed noticeably across the studied time periods. From 1992 to 2007, the built-up environment increased by approximately 249.76 ha (88 %), while forest area decreased by 301.99 ha (20 %), water bodies increased by 10.72 ha (6.15%), and grassland and barren land decreased by 371 ha (10 %) and 79.56 ha (47 %), respectively.

During the second period between 2007 and 2015, the built-up environment increased drastically by 732.10 ha (137 %), while forest area decreased by 424.49 ha (36 %), grassland continuously converted and decreased by 1784.64 ha (56 %), and water bodies and barren land decreased by 104.82 ha (56 %) and 53.81 ha (60 %), respectively. During the third period, 2015–2022, all LULC decreased except the buildup area. Buildup area increased by 438.31 ha (34.64%), while agriculture land, barren land, forest area, grassland, and water bodies decreased by 6%, 0.11%, 1.42%, 9.85% , and 3 %, respectively.

Table 4.7 Overall amount, extent, and rate of land cover change (1992 - 2022)

LU/LC	1992 - 2007			2007 - 2015			2015 – 2022		
	Change (Ha)	Extent (%)	Rate (%)	Change (Ha)	Extent (%)	Rate (%)	Change (Ha)	Extent (%)	Rate (%)
Agriculture	492.43	17	1.13	1635.66	48.27	4.83	-289.72	-5.77	-0.96
Barren land	-79.55	-47.13	-3.14	-53.81	-60.3	-6.03	-0.04	-0.11	-0.02
Buildup	249.76	88.09	5.87	732.1	137.28	13.7	438.31	34.64	5.77
Forest area	-301.99	-20.5	-1.37	-424.49	-36.25	-3.62	-10.6	-1.42	-0.24
Grass land	-371.36	-10.5	-0.7	-1784.6	-56.39	-5.64	-135.98	-9.85	-1.64
Water	10.72	6.15	0.41	-104.82	-56.7	-5.67	-1.96	-2.45	-0.41

(Source: Organized by the author, (2023))

From the above Table 4.7 agricultural area reveal increment from 1992 to 2015; then decreases from 2015 to 2022. Built-up increases throughout the entire study period. Forest area and grassland continuously decreases from 1992 to 2022. Barren land and water body also decrease throughout the all study period.

4.6 Land use/land cover change during 1992– 2007

Table 4.8 Post classification matrix, losses, gains, persistence and net change 1992 – 2007

		Land class 2007						
	LULC class	Agricult	Barren land	Built up	Forest	Grassland	waterbody	Total
Land class 1992	Agriculture	1995.93	1.28	118.87	73.12	673.31	31.85	2894.36
	Barren land	1.73	31.1	1.46	3.22	131.13	0	168.64
	Built up	2.46	0	266.7	7.14	4.4	2.82	283.52
	Forest	151.18	0.01	6.33	830.97	431.41	50.38	1470.28
	Grassland	1230.39	51.85	137.64	183.81	1898.98	27.66	3530.33
	waterbody	5.24	0	2.28	71.75	22.77	71.87	173.91
	Total	3386.93	84.24	533.28	1170.01	3162	184.58	8521.04

1992– 2007								
	Losses		Gains		Persistence		Net-change	
LU/LC	Ha	%	Ha	%	Ha	%	Ha	%
Agriculture	900.51	26.24	1395.65	40.66	1990.7	68.74	495.15	14.43
Barren land	138.79	4.04	52.52	1.53	31.58	18.71	-86.27	-2.51
Buildup area	17.24	0.5	268.28	7.82	264.95	93.45	251.05	7.31

Forest area	639.08	18.62	340.84	9.93	833.91	56.61	-298.24	-8.69
Grassland	1633.98	47.61	1264.54	36.84	1900.37	53.74	-369.44	-10.76
Water	102.6	2.99	110.36	3.22	75.17	43.16	7.76	0.23
total	3432.19	100	3432.19	100	5096.67	59.74	0	0

(Source: Organized by the author, (2023))

From Table 4.8, the built-up area increased by about 249.76 ha (88 %) between 1992 and 2007, while the area covered by trees decreased by 301.99 ha (21 %), the area covered by water bodies increased by 10.72 ha (6 %), and the area covered by grassland and barren land decreased by 371.36 ha (11 %) and 79.55 ha (47 %), respectively. For instance, grassland has lost its predominant position to agricultural land, forest area, buildup area, and barren land, but has maintained its position as the second largest LULC class with 37 % area cover. Revealed that forest area has been on the decline, recording a reduction of 1633.98 ha in the first period. During the same period, agricultural land showed a net positive charge of 14.43%, with substantial gains from grassland. Likewise, notable expansion in the 268 Ha gain buildup area from total LULC types was observed.

4.7 Land use/land cover change during 2007 – 2015

The second stage involved the transformation of various LULC types into diverse land covers. The area of grassland declined continuously to 2215 ha in the second period. Likewise, forest area, water body, and barren land declined by 697.5 ha, 135.4 ha, and 78.2 ha, respectively. In contrast to the first-period cropland, the second-period cropland increased by a positive net change of 1627.7 ha. The most striking change in this period is an increase in the built-up area, which revealed a net change of 709.6. The trend of changes in the second period of land use revealed a general trend of destruction that was considered except for the buildup area and agriculture land cover, which showed extensive changes, and Figure 4.9, shows the comparison of the net change of land cover during the second period (2007–2015). Generally, the land encroachment between 2007 and 2015 indicates built-up area gain from agriculture land (347 ha) and 376 ha from grassland.

Table 4.9 Post classification matrix, losses, gains, persistence and net change 2007 - 2015

	2007 – 2015			
	Losses	Gains	Persistence	Net change

LU/LC	Ha	%	Ha	%	Ha	%	Ha	%
Agriculture	970.623	21.82	2598.3	58.41	2415.7	59.20%	1627.66	36.59
Barren land	78.148	1.76	20.214	0.45	5.9559	0.15%	-57.93	-1.3
Buildup area	50.8954	1.14	760.45	17.09	482.33	11.82%	709.56	15.95
Forest area	697.466	15.68	277.04	6.23	477.28	11.70%	-420.43	-9.45
Grassland	2515.99	56.56	755.49	16.98	648.92	15.90%	-1760.5	-39.58
Water/ River	135.36	3.04	36.998	0.83	50.174	1.23%	-98.36	-2.21
Total	4448.4824	100	4448.48	100	4080.39	100.00%	0	0

	Land class 2015							
	LU/LC	Agriculture	Barren	Buildup	Forest	Grassland	Water	Total
Land class 2007	Agriculture	2413.55	0.54	347.17	41.12	582.64	1.03	3386.05
	Barren land	61.7	5.47	0	3.56	13.45	0	84.18
	Buildup area	20.74	0	489.34	18.15	4.83	0.23	533.29
	Forest area	521.78	0.07	41.73	490.35	100.8	13.9	1168.63
	Grassland	1947.21	18.37	376.5	159.57	640.59	14.84	3157.08
	Water/ River	53.95	0.01	10.64	33.35	36.61	49.86	184.42
	Total	5018.93	24.46	1265.38	746.1	1378.92	79.86	8513.65

(Source: Organized by the author, (2023))

From, Figure 4.9, losses, gains, persistence, net change, and land encroachment between 2007 and 2015 are clearly presented. Accordingly, the land encroachment result indicates all land classes converted to built-up area from 2007 to 2015: agriculture contributed 347.2 ha, forest area 41.7 ha, grassland 376.5 ha, and water bodies contributed 10.6 ha.

The losses, gains, and persistence results indicate agricultural positive net change of 1627.7ha, barren land negative net change of 58 ha, built-up area positive net change of 709.6 ha, forest area negative net change of 420.4 ha, grassland negative net change of 1760.5 ha, and water bodies negative net change of 98.4 ha.

4.8 Land use/land cover change during 2015 – 2022

Table 4.10 Post classification matrix, losses, gains, persistence and net change 2015- 2022

LU/LC Type	**2015 – 2022**							
	Losses		Gains		Persistence		Net change	
	Ha	%	Ha	%	Ha	%	Ha	%
Agriculture	323.51	66.88	36.64	7.57	4677.51	93.10	-286.87	-59.31
Barren land	0.00	0.00	0.00	0.00	25.45	71.85	0.00	0.00

Buildup	6.68	1.38	442.81	91.55	1256.05	99.26	436.13	90.17
Forest area	10.11	2.09	0.00	0.00	742.50	99.45	-10.11	-2.09
Grassland	141.14	29.18	4.24	0.88	1255.69	90.98	-136.89	-28.30
Water	2.26	0.47	0.00	0.00	81.40	101.67	-2.26	-0.47
Total	483.69	100.00	483.69	100	8038.59	94.22	0.00	

	LULC class	**Land class 2022**						
		Agriculture	Barren land	Built up	Forest	Grassland	waterbody	Total
Land class 2015	Agriculture	4690.97	0.13	323.03	1.58	8.16	0.07	5023.94
	Barren land	0.34	24.21	0	0	0	0.03	24.58
	Built up	5.28	0	1255.36	2.01	2.7	0	1265.35
	Forest	4.21	0	10.4	731.76	0.25	0	746.62
	Grassland	33.36	0.03	113.13	0.5	1232.85	0.18	1380.05
	waterbody	0.05	0	1.77	0.16	0.17	77.82	79.97
	Total	4734.21	24.37	1703.69	736.01	1244.13	78.1	8520.51

(Source: Organized by the author, (2023))

Form, Table 4.10 and **Error! Reference source not found.**, LULC dynamics dominated the third period, which was marked by a fall in the net change of previously intensifying land cover classes such agriculture land, forest area, and grassland by -59%, -2%, and -28%, respectively. The built-up area reveals rapid change with a net positive increase of 436 ha (90 %). Hence, the expansion of built-up areas had resulted in a negative change in forest, grassland, and agricultural land.

4.9 Land use/land cover change during 1992– 2022

Table 4.11 Land use land cover change matrix during 1992 – 2022

	LULC class	**Land class 2022**						
		Agriculture	Barren land	Built up	Forest	Grassland	waterbody	Total
Land class 1992	Agriculture	1876.04	0	612.69	71.18	323.89	10.33	2894.13
	Barren land	101.53	12.66	8.85	14.18	31.51	0	168.73
	Built up	0.06	0	272.91	10.54	0	0.01	283.52
	Forest	814.02	0.4	33.85	432.36	173.7	14.04	1468.37
	Grassland	1898.49	11.3	769.42	146.31	690.86	9.55	3525.93
	waterbody	39.73	0	5.97	61.11	23.28	43.77	173.86
	Total	4729.87	24.36	1703.69	735.68	1243.24	77.7	8514.54

(Source: Organized by the author, (2023))

Agriculture land: In the 30 years between 1992 and 2022, almost 612.69 ha of buildup area were obtained from agricultural land. During the entire study period (1992–2022), the conversion of forest area into agricultural land accounted for 814.02 ha. In the same period, grassland, water, and barren land accounted for 1898.49 ha, 39.73 ha, and 101.53 ha, respectively.

Barren land: Within the 30 years, 1992–2022, almost 101 ha of barren land were obtained, mainly from agricultural land. During the overall period (1992–2022), the conversion of forest area and grassland into barren land accounted for 0.4 ha and 11.3 ha, respectively.

Buildup area: During the entire study period (1992–2022), the conversion of grassland into buildup area accounted for 769.42 ha. In the same period, forest area, agricultural land, barren land, and water bodies accounted for 33.85 ha, 612.69 ha, 8.85 ha, and 5.97 ha, respectively.

Forest area: During the entire study period (1992–2022), the conversion of grassland into forest area accounted for 146 ha. In the same period, forest area, buildup area, barren land, and water bodies accounted for 10.5 ha, 71 ha, 14 ha, and 61 ha, respectively.

Grassland: During the entire study period (1992–2022), the conversion of agricultural land into grassland accounted for 323 ha. In the same period, forest area, buildup area, barren land, and water bodies accounted for 173 ha, 0 ha, 31.51 ha, and 23.28 ha, respectively.

Waterbody: During the entire study period (1992–2022), the conversion of forest area into water bodies accounted for 14.04 ha. In the same period, agricultural land, buildup area, barren land, and grassland accounted for 10.3 ha, 0.01 ha, 31.5 ha, and 9.6 ha, respectively.

Table 4.12 Losses, gains, persistence, and net change of study area from 1992 - 2022

LU/LC Type	**1992-2022**							
	Losses		Gains		Persistence		Net change	
	Ha	%	Ha	%	Ha	%	Ha	%
Agriculture	1025.76	19.75	2849.06	54.86	1865.08	64.41	1823.30	35.11
Barren land	157.20	3.03	12.27	0.24	13.18	7.81	-144.93	-2.79
Buildup	10.47	0.20	1427.15	27.48	271.71	95.84	1416.68	27.28
Forest area	1038.66	20.00	310.07	5.97	432.43	29.36	-728.60	-14.03

Grassland	2830.56	54.51	560.39	10.79	699.54	19.78	-2270.1	-43.71
Water	130.49	2.51	34.20	0.66	47.20	27.10	-96.29	-1.85
Total	5193.14	100.00	5193.14	100.00	3329.14	244.28	0.00	0.00

(Source: Organized by the author, (2023))

Over the past 30 years (1992–2022), the magnitude and directions of LULC change have become more dynamic. The net change for forest and grassland is negative, with varying levels of deforestation and removal of grassland during the first and second distinct study periods.

This shows a heightened level of deforestation during these periods due to the expansion of built-up areas and agricultural land. Due to its small size, the water body did not show significant change, but the second and third periods marked a decline compared to the first period. A 1416 68 ha (27.28%) net change of built-up and 1823.30 ha (35.11%) were possibly triggering factors causing LULC change in the study area, mostly gaining areas from forest land, grassland, and barren land since the 1992s.

The continuous destruction of grassland and forest areas. Also, it indicates the decrease in water bodies and barren land. Built-up area and agriculture land reveal increments with positive net changes of 27.28% and 35.11%, respectively. The negative net change of grassland is -2270.10 ha, and the forest area is -728.60 ha.

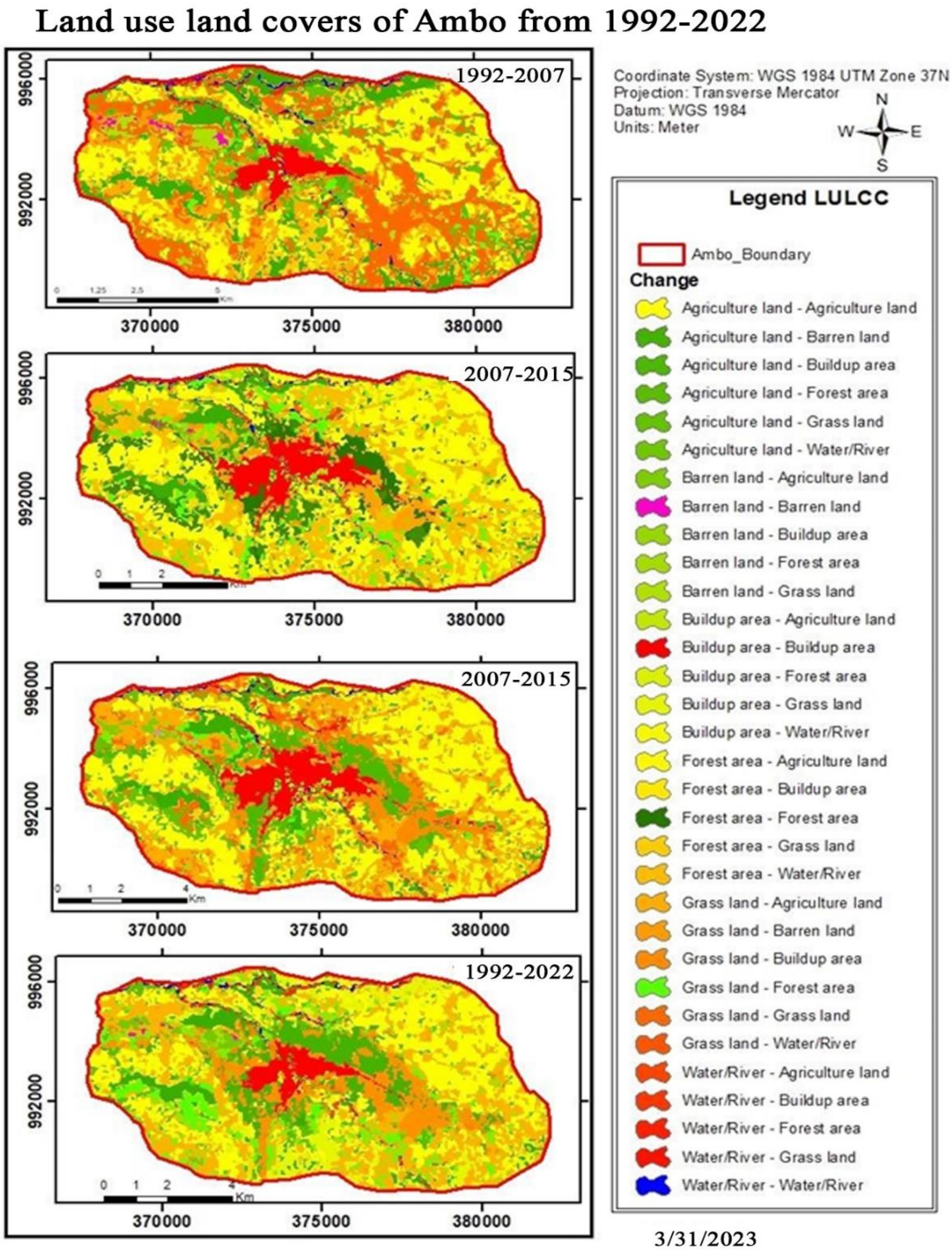

Figure 4.10 Land use/land cover change map 1992- 2022 (Source: the author, (2023))

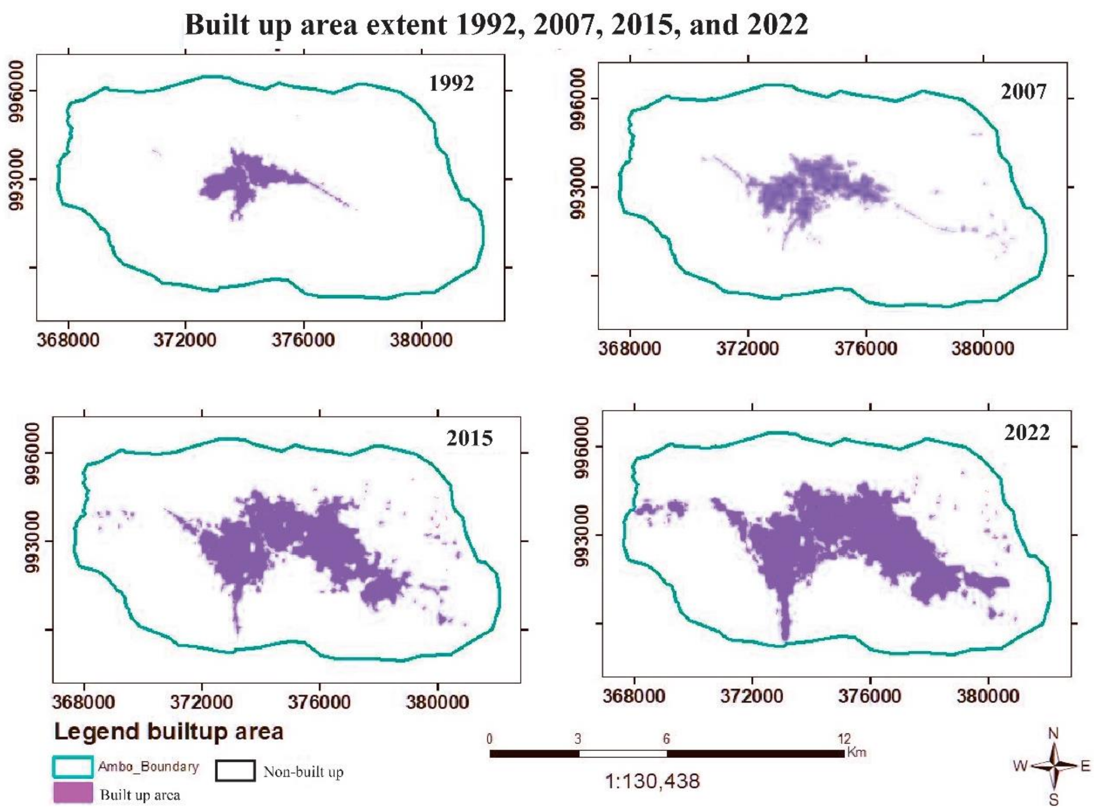

Figure 4.11 Classified image to the built-up area and non-buildup area. (Source: the author, (2023))

Table 4.13 Buildup area and non- built-up area 1992 - 2022

LU/LC type	1992		2007		2015		2022	
	Ha	%	Ha	%	Ha	%	Ha	%
Buildup area	283.54	3.32%	533.28	6.25%	1265.38	14.83%	1703.69	19.97%
Non build up	8248.01	96.68%	7998.25	93.75%	7266.15	85.17%	6827.84	80.03%
Total	8531.	100.%	8531.53	100.00%	8531.53	100.00%	8531.53	100.00%

(Source: the author, (2023))

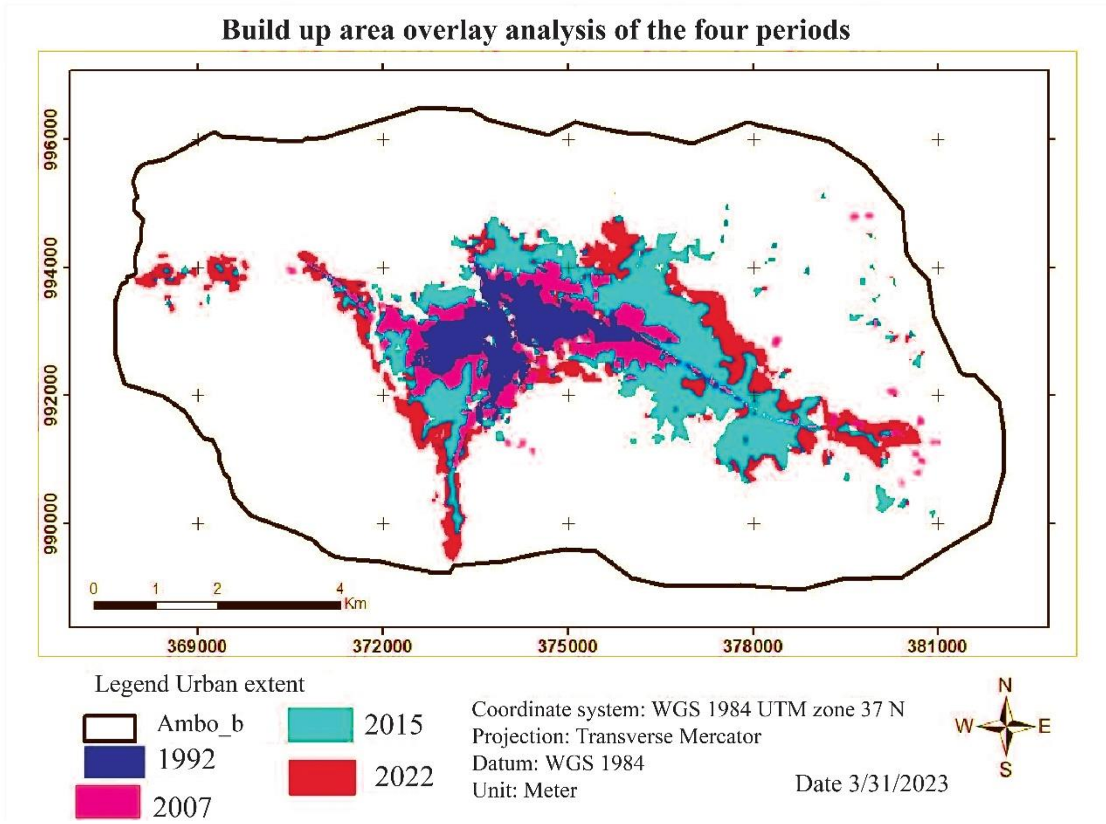

Figure 4.12 Buildup area overlay analysis 1992, 2007, 2015 and 2022
(Source: Organized by the author, (2023))

4.10 Urban blight indicators based on Physical of Ambo town

The General existing land use of the town includes Residential both pure and mixed, Commerce & Business, Administration, Services, Environment, Manufacturing & Storages, Road Network and Transport, and others (water bodies, projects under construction and gorges); and the coverage of land use is 8558.37 category.

4.11 Residential Blight Indicator of Town

From, Figure 4.13, the existing general land use of the city, the residential land use, is about 11.85% of the study area. When it is compared with the standards, which are about 40%–50% of the total existing land use area, it is obviously taken as below the standard.

In many of the housing land uses, there are squatter settlement areas that have been observed at the periphery of the town, which are characterized by scattered housing units and, in the inner city, slum houses, inadequate infrastructure, inaccessibility, and a lack of open spaces. Furthermore, some incompatible land uses have been identified while updating the existing land uses of the town. Identify and study problems associated with the location, distribution, structure, and condition of existing residential areas and the extent of shortages and lacks regarding residential and use-related issues.

In addition, some residential areas are developed in environmentally sensitive areas like quarry sites, gorges, inadequate residential open space, inadequate play grounds, inadequate social services, and inaccessibility.

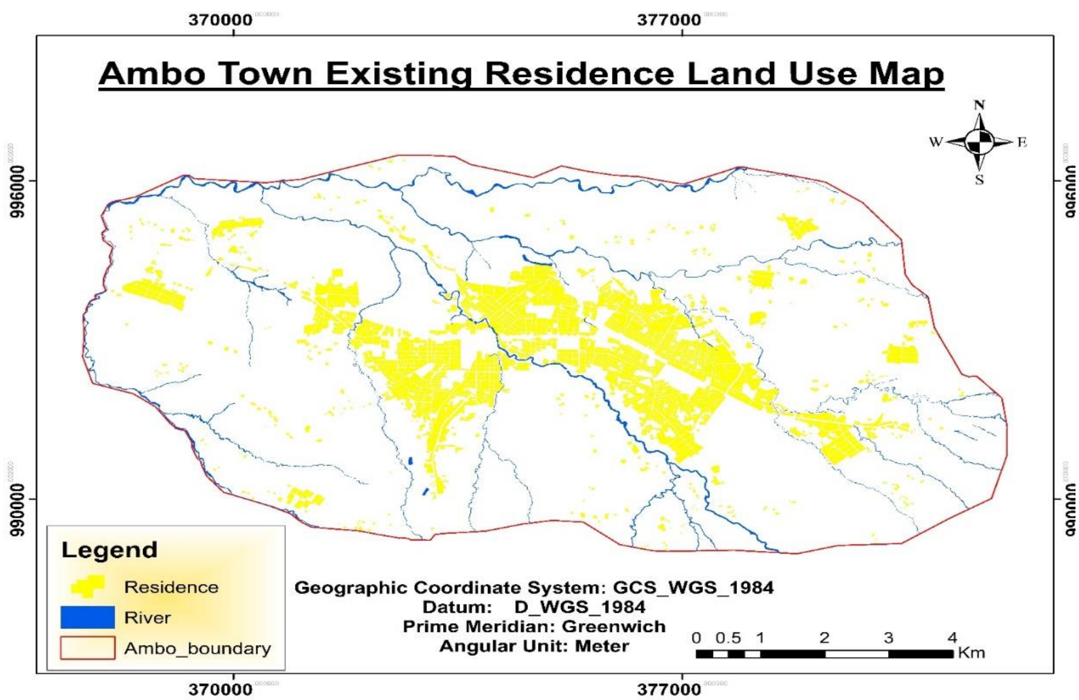

Figure 4.13 Existing Residential land use map (Source: the author, (2023))

4.12 Commerce & Business Blight Indicator of Town

The analysis of commercial area is therefore done with centers, corridors and residential areas. According to the land use survey made, commercial areas exhibit two basic characters in the city core and peripheral areas Figure 4.14.

Table 4.14 Existing Business & Commercial Land Use of Ambo town

No	Details of Commerce & Business Land Use Category	Code	Area (m2)	Area (Ha)	%
1	Shops and Super Market	CBA-1	2318.22	0.23	0.92
2	Hotels, bars, restaurants	CBA-2	99065.25	9.90	39.41
3	Banks and Insurance	CBA-3	8535.56	0.85	3.39
4	Business Center	CBA-4	118961.11	11.89	47.32
	Sub total		***228880.14***	***22.88***	***91.04***
4	Markets	CBA-5			
	a. General market	CBA-51	15712.71	1.57	3.39
	b. Cattle market	CBA-52	4057.99	0.40	1.61
	c. Guilt	CBA-53	2694.77	0.26	1.07
	Sub total		***22464.70***	***2.24***	***6.07***
	Grand Total		251345.64	25.13	100

(Source: Computed from the existing land use of the town, 2023))

According Table 4.14, to the land use survey made, commercial areas exhibit two basic characters in the city core and peripheral areas. Commerce needs basic infrastructure to flourish, and requires a minimum population threshold to sustain it. Nearly all commercial and related activities are concentrated at the center of the town. The fringe and intermediate parts of the town lack sufficient commercial facilities.

The existing trend shows that commercial activities are concentrated along corridors and boulevards. This is the reality, even within the center. It is an indication that commercial activities could easily flourish in more accessible areas. Even though this type of commercial development is good for creating a vibrant street scene, it also requires parking spaces, which are currently unavailable or limited at best. It also requires an adequate connection to mass transportation services so that street activity will not be overloaded with vehicle traffic. This does not preclude the need for block-based commercial development.

Identify and study problems associated with the location, distribution, structure, and condition of such uses and the general structures of centrality functions as related to the settlement structure and development pattern of the urban area.

In general, Ambo Town is a monocentric town. This is the main center, where most of the daily activities take place. The area is characterized by poor quality, lack of necessary services and facilities, lack of focus, and hierarchical organization and locations as per the service order that was provided. Also, it needs additional functions like a cultural center, a convention hall, a cinema and theater hall, etc.

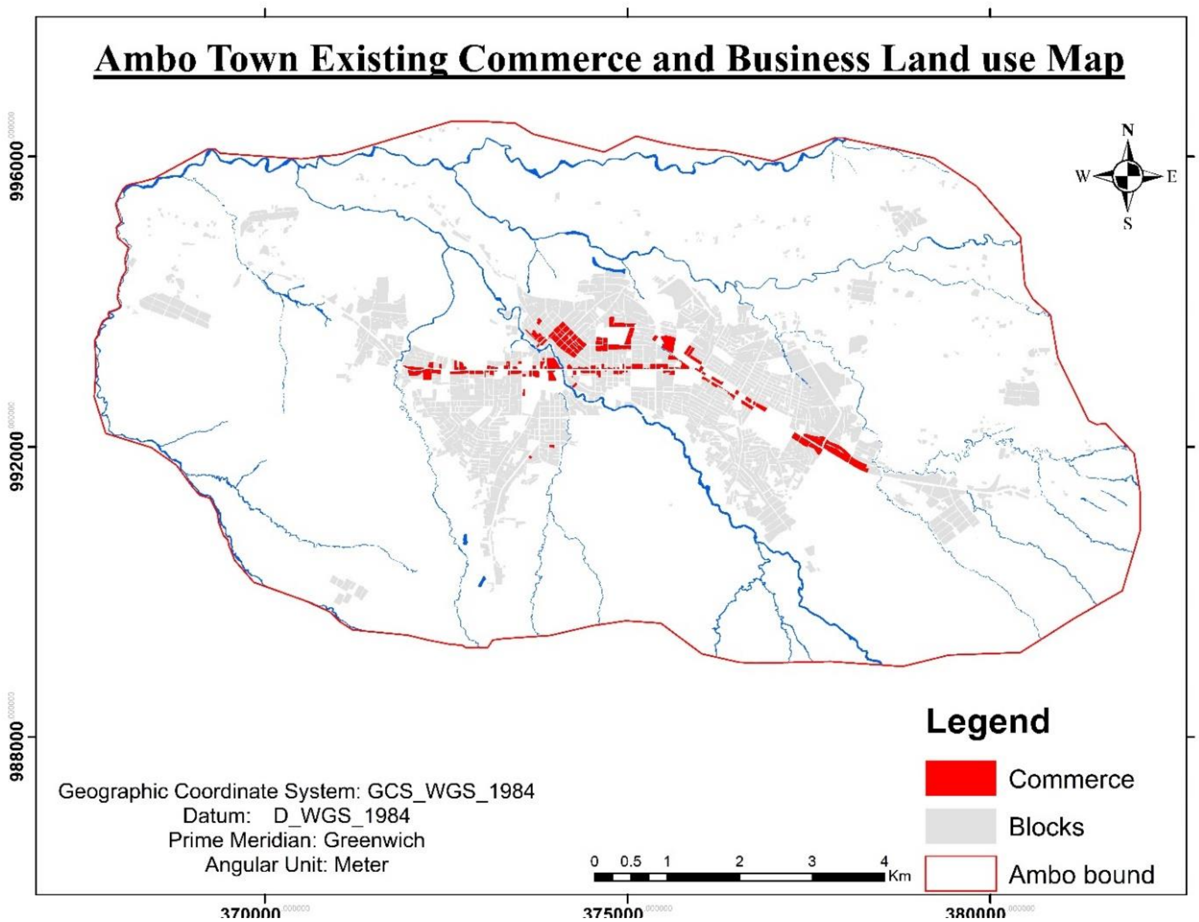

Figure 4.14 Existing Commerce and business land use map (Source: by Author, (2023))

4.13 Administration Blight Indicator of Town

Being that Ambo town is the capital and seat of West Shewa Zone as well as the Ambo district administrations, this land use category includes them in addition to the town administration. Most zone and town administrative offices are concentrated in the town's main center. But due to the space shortage and under capacity to accommodate all sectoral offices, new administration offices are flourishing on the eastern side of the town. The area and location required for establishing governmental and non-governmental institutions should be studied case by case in accordance with the specific nature of each institution. Administration is one of the general existing land uses that are supposed to be identified during the assessment of the existing situation of land use in the city or town.

Industries and workshops should not be located in proximity to or in the compound of administrative activities. Table 4.15, It is about 58.7 hectares, which accounts for 0.71% of the total existing land uses that could not conform to the already set standard for this land use class by the nation. The details of this land use category include government offices, nongovernment offices, police offices, correctional institutions, political organizations, and justice offices.

Table 4.15 The details of Administration land use

No	Details of Administration Land Use Category	Code	Area (Ha)	Area (m2)	%age
1	Government Office	AD-1	103090.32	10.30	17.55
2	Non-Government Office	AD-2	4732.33	0.47	0.80
3	Police Office	AD-3	424738.49	42.47	72.30
4	Correctional institution	AD-4	29932.05	2.99	5.09
5	Political organization	AD-5	7460.11	0.74	1.27
6	Justice Office	AD-6	17432.55	1.74	2.96
	Total		587385.88	58.73	100

(Source: Organized by the author, (2023))

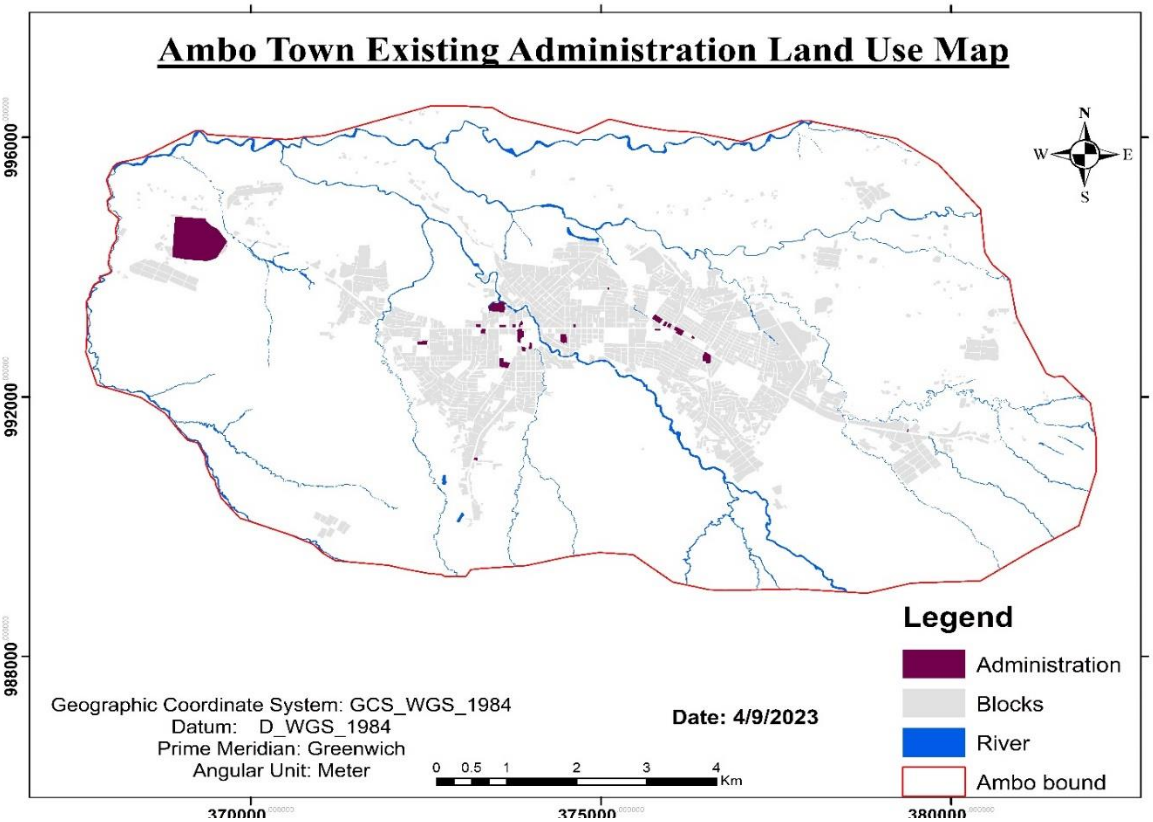

Figure 4.15 Existing Administration land use map (Source: by Author, (2023))

4.14 Social Service Blight Indicator of Town

This sector includes numerous social and cultural facilities and services, as well as municipal services that are established at different levels in different places in urban areas to provide residents and non-residents with the necessary services. Form Figure 4.12, the social service land use category covers 423.50 hectares, or about 5.12% of the total existing land use of the town. This land use is said to be below the standard when compared to the standard set, particularly for the social service land use category. Among the major subtypes of this particular land use, education and worship are the dominant ones, which alone cover about 89.02% and 5.29%, respectively. Most of these services are fairly distributed over all parts of the city, and some incompatible land uses are observed, especially in the cases of lower-level education and religious services.

Table 4.16 The Details of Social Service Land Use

No	Details of service Land Use Category	Code	Area (Ha)	Area (m2)	%
1	Education	S-1	3770209.87	377.02	89.02
2	Health	S-2	144731.23	14.47	3.42
3	Community and cultural facilities	S-3	16885.89	1.68	0.39
4	Municipal services	S-4	19857.24	1.98	0.46
5	Special functions	S-5	59057.08	5.90	1.39
6	Worship Places	S-6	224310.94	22.43	5.29
	Total		**4235052.27**	**423.50**	**100**

(Source: Organized by the author, (2023))

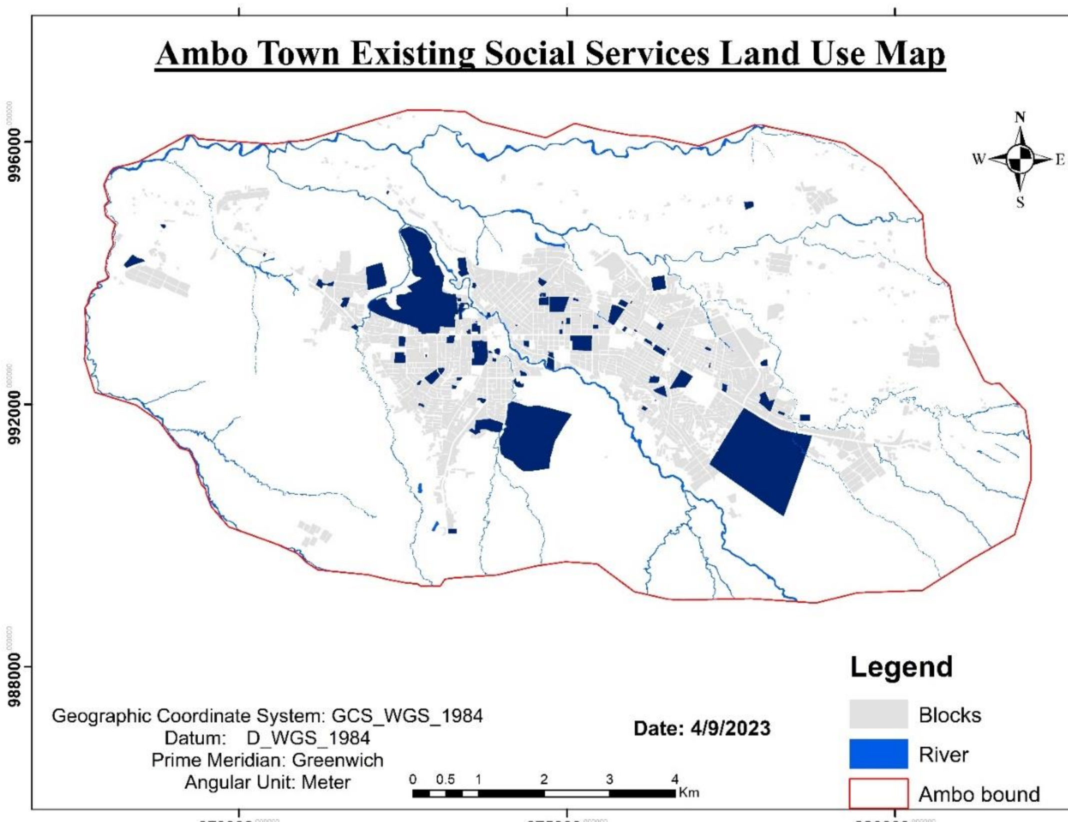

Figure 4.16 Existing social service land use map (Source:by Author, (2023))

The selection of the location of each service is made depending on the following: the specific nature and characteristics of the service; the catchment area for which the service is provided; the location area of the users or serviced population; and the availability of an appropriate area of land or site (topography).

4.15 Open Space and Environmental Blight Indicator of Town

Environment is one of the existing land use categories identified so far, which covers about 79.47% of the total existing land use. Green area (buffer, roadside green, nursery, and mountain green frame) is the dominant land use category concerning its coverage. As compared to the environmental land use standards, this is much better than the coverage. Identify and study problems associated with urban agriculture, green areas, forests, parks, gardens, solid and liquid waste management, sanitation, quarry sites, conservation areas, and fragile areas. During site analysis, observe a lack of roadside greenery, a nursery, and a median tree, but there is natural greenery.

Table 4.17: The details of Environmental land use

No	Details of environmental Land Use Category	Code	Area in (m^2)	Area (Ha)	%age
1	Open spaces	EA-1	71141.20	7.11	0.10
2	Urban agriculture and horticulture	EA-2	53358019.43	5335.80	81.09
3	Quarry and mineral site	EA-3	516045.01	51.60	0.78
4	Solid waste	EA-4	9857.91	0.98	0.01
5	Green area	EA-6			
	❖ Buffer	EA-61	1537159.49	153.71	2.33
	❖ Road side green	EA-62	58908.66	5.89	0.08
	❖ Mountain green frame	EA-64	9458521.96	945.85	14.37
	❖ Parks	EA-65	63162.93	6.31	0.09
Subtotal					***16.91***
7	Cemetery	EA_68			
	a. Orthodox Cemetery	EA-681	56523.63	5.65	0.08
	b. Protestant Cemetery	EA-682	14579.36	1.45	0.02
	c. Muslim Cemetery	EA-684	15577.75	1.55	0.02
Sub total					***0.12***
8	Sport and recreation	EA-8			
	a. Play lot	EA-81	2488.11	0.24	0.00
	b. Neighborhood play ground	EA-82	13182.25	1.31	0.02
	c. Swimming pool	EA-84	36167.18	3.61	0.05
	d. Stadium	EA-86	37586.90	3.75	0.05
	e. Sport center	EA-88	122307.10	12.23	0.18

Sub Total					***0.32***
10	Farm Land	EA_9	346810.21	34.68	**0.52**
11	Vacant Land	VP	64510.42	6.45	0.09
Total					***100.00***

(Source: Organized by the author, (2023))

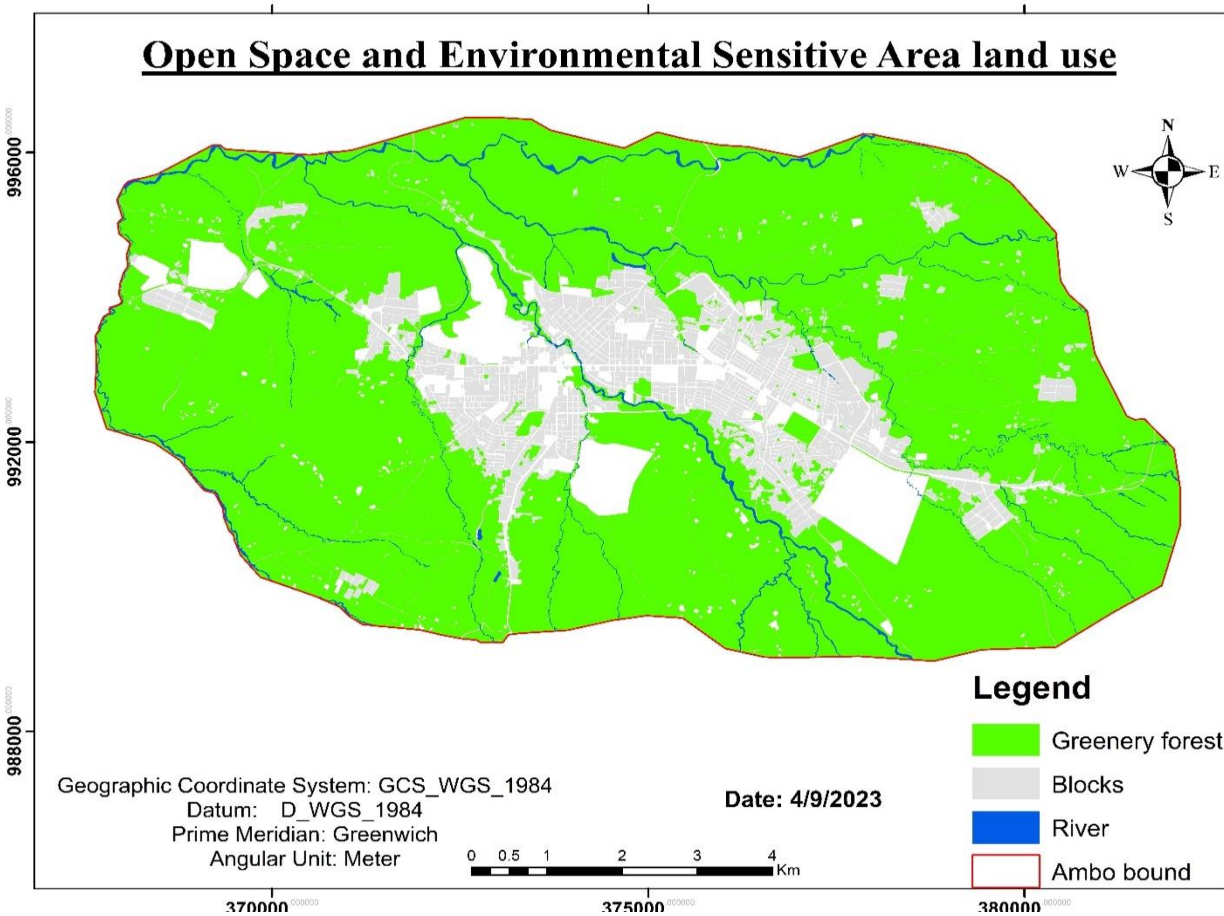

Figure 4.17 Existing Environmental land use (Source: by Author, (2023))

4.16 Manufacture & Storage Blight Indicator of Town

Manufacturing and storage are two of the existing land uses that have been identified so far. From Table 4.18, its area is about 38.81757 hectares of land, which accounts for 0.47% of the existing land use of the town. There are some gypsum factories and warehouses scattered here and there within the residential area. Resulted in incompatible land uses. This implies, therefore, that there shall be some rearrangement of such incompatible land uses by the forthcoming land proposals of the town.

Table 4.18:-The details of Manufacturing and storage land use

No	Details of Manufacturing & Storage Land Use Category	Code	Area (Ha)	Area (m2)	%age
1	Industry and manufacturing	P-1	282200.22	28.22	72.69
2	Warehouse and depots	P-2	55977.99	5.59	14.42
3	Workshops	P-3	16455.57	1.64	4.24
4	Micro and small scale enterprises	P-4	20672.06	2.06	5.32
5	Fuel station	P-5	12869.92	1.28	3.32
	Total		5167373.02	516.73	100

(Source: Organized by the author, (2023))

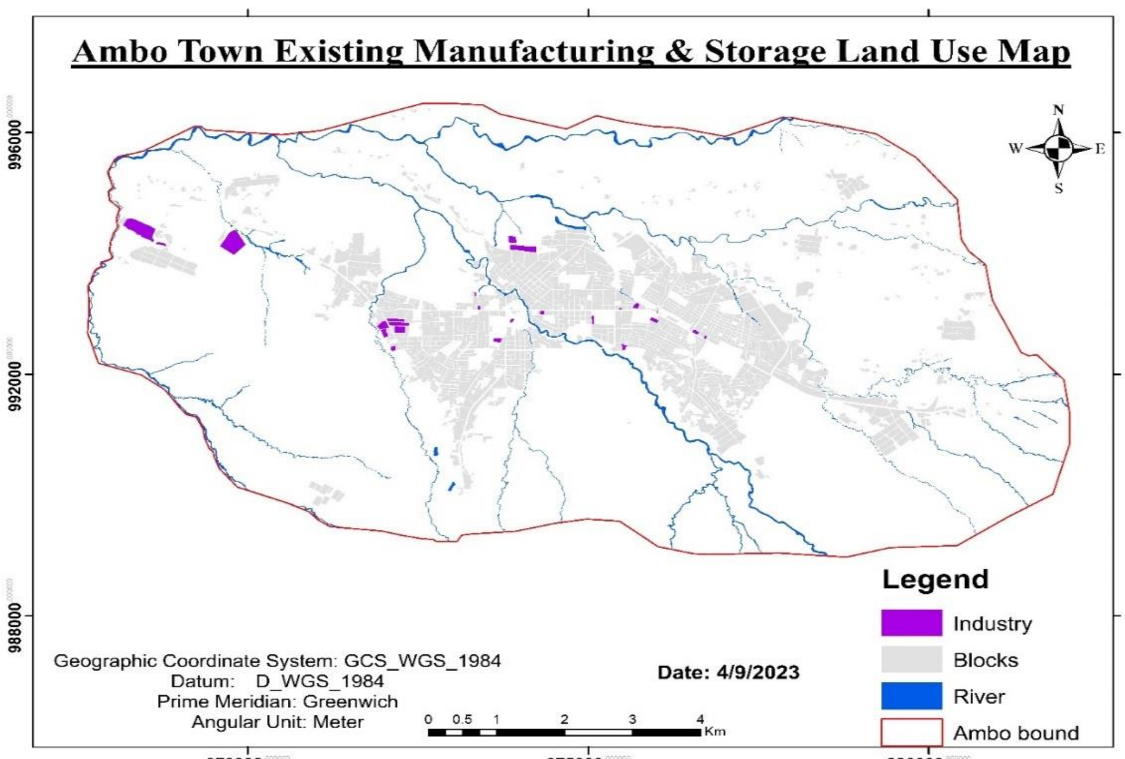

Figure 4.18 Existing Manufacturing and storage land use

4.17 Road Network, Transportation & Utilities Blight Indicator of Town

Within the town, these roads also lack arterial streets. Alternative linking roads that distribute traffic and at the same time collect traffic from different parts of the town There are also earthen streets that connect Ambo to the countryside. These include Ambo-Goromti to the southeast, Ambo-Boji to the southwest, and Ambo-Xule to the northeast, and others are all used as local roads for the adjacent rural population of Ambo town. It is earthen and only provides services by foot. The current capacity of the road space network is severely hampered by inadequate quality and standard, a shortage of pedestrian walkways, and misuse of and encroachment on the available road space.

A. Road Network by Hierarchy

Depends on the purpose and the width the street has different hierarchy. Those are: -

Express way: It provides for expeditious movement of large volumes of thorough traffic between areas and across the city not intending to provide land access.

Arterial Street: It provides for the through traffic movement b/n areas and across the city and divert access to the abutting property subject to necessary control of entrance exit and curbs.

Collector Street: It provides traffic movement between major arterial and local street system and direct access to the abutting property.

Local Street: It provides direct access to the abutting property.

The team classified the road network system in the Ambo town by hierarchy and carried out detail analysis to identify gaps in organization, and flow of traffic. Depending on width, function, and service level of the roads are considered.

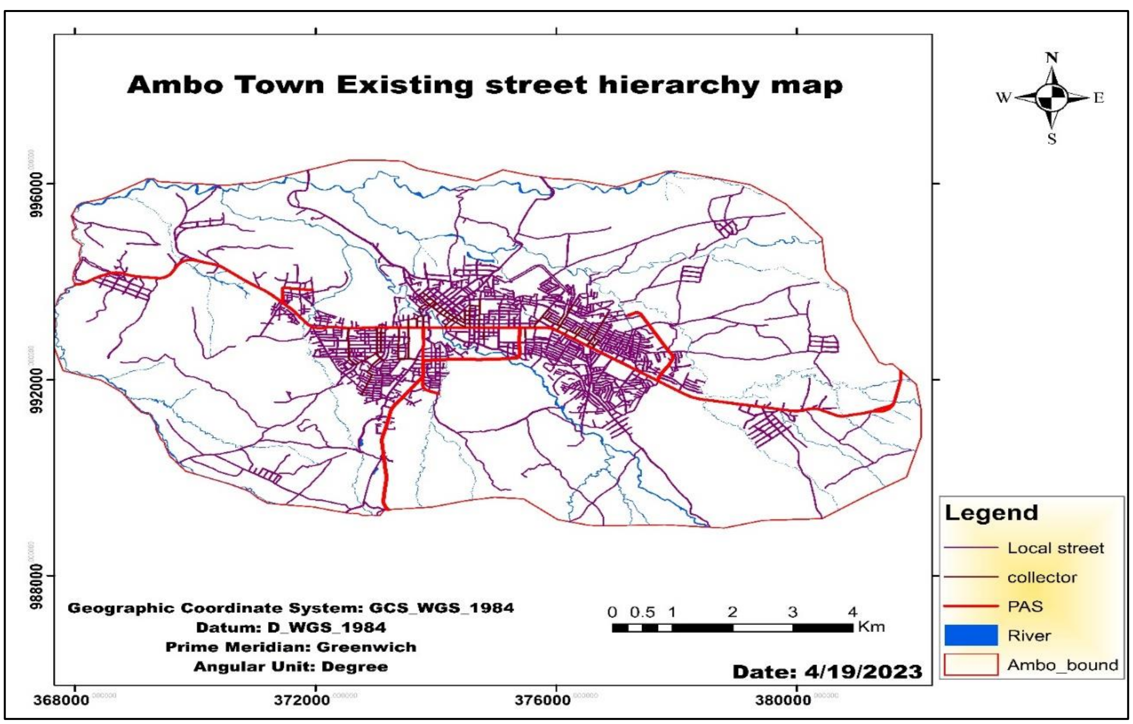

Figure 4.19 Existing street hierarchy map

B. Road Network by pattern

In case of Ambo town mainly three types of patterns are distributed through the city. Those areas: - Grid pattern or rectangular, organic pattern and radial pattern of roads. The grid or rectangular is the dominant street pattern in the town and new developing area, the organic pattern occurs in unplanned area.

General problems of the street network in Ambo town: some roads have bottleneck connections; there is missing link street connectivity; absence of street furniture and traffic signs; absence of a formal Bajaj station; no alternative Arterial Street; organic road in an unplanned area.

4.18 Overall of Existing Land Use Analysis of Ambo town

Their detail analysis was conducted exclusively under each category in the above sub topics and their proportion is summarized by the tableTable 4.19.

Table 4.19:- Existing Land Use Summary of the town

No	General Land Use	Land Use Code	Area (m2)	Area (Ha)	%age
1	Residence	R	9810694.61	981.07	11.85
2	Commerce and Business	CBA	248254.68	24.83	0.29
3	Service	S	4235052.28	423.51	5.12
4	Green, Open Space/Reserved Areas, Recreation and Environmental Sensitive Area	EA	65793658.40	6579.37	79.47
5	Administration	AD	587385.88	58.74	0.71
6	Industry and Manufacturing, Ware House, Depots and Workshop	P	388175.79	38.82	0.47
7	Road, Transport, Utilities and Infrastructure	RTU		286.60	3
8	Water Bodies	WB	1636485.826	163.60	1.97
9	Vacant & Farm Land		19783.28786	1.98	0.02
	Total		**85583499.201**	**8558.37**	**100**

(Source: Organized by the author, (2023)).

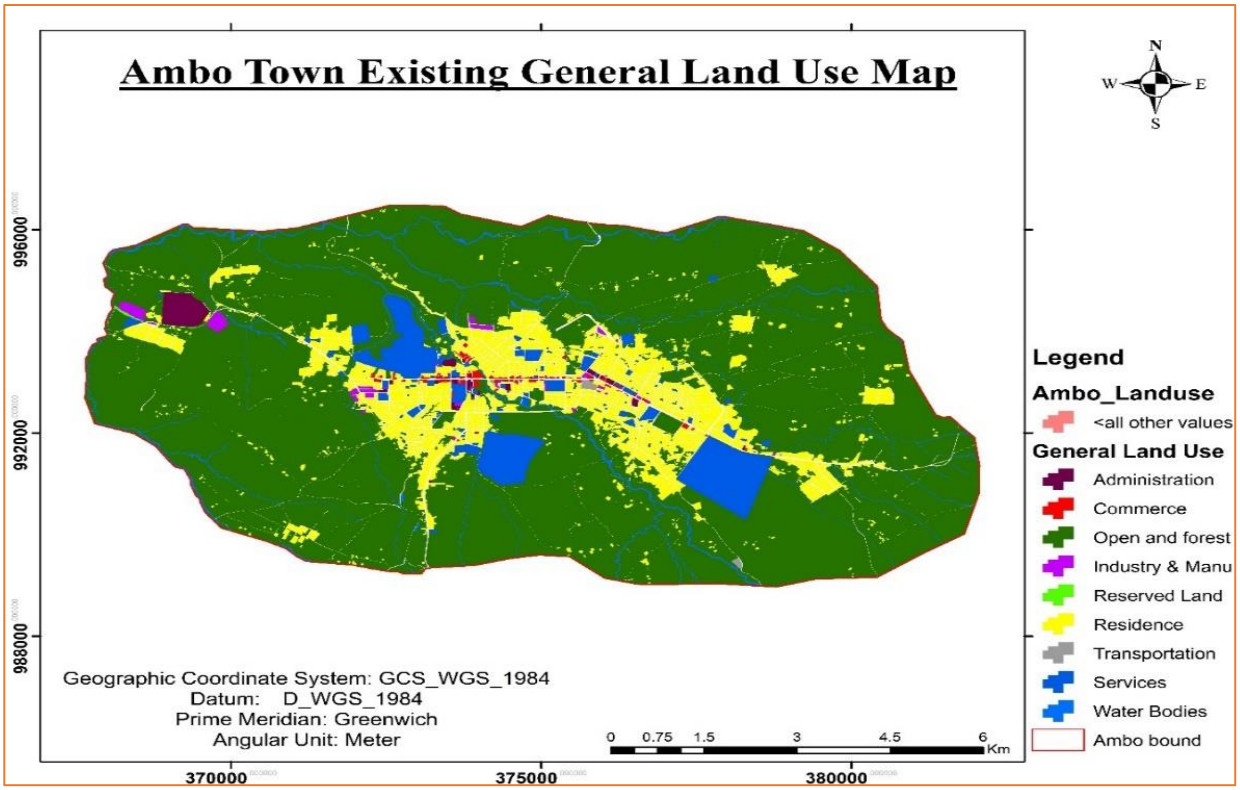

Figure 4.20 Existing General Land use map

4.19 Intra urban Transport blight indicator

Ambo transport service was available within Ambo town in addition to the nearby city. Lada and Toyota small taxis, Bajaj taxis, and minibus taxis are serving the town regularly from 12:00 in the morning to 3:00 (local hours) in the evening. They are serving the community along the main asphalt road, only doing trips between the water treatment plant station, which is located at the eastern part of the town along Addis Ababa-Ambo road, and the Ambo Health Station, which is located at the western part (Farisii or Pan Africa Village) of the town along Ambo-Welega road. Because of the inconvenient gravel roads for vehicles in the town, Lada and Toyota small taxis, Bajaj taxis, and minibus taxis are limited to only the main (asphalt) road to provide transport services to the community.

In addition to motorized transport services in the town, there are also non-motorized transport services in Ambo town. Carts, which transport only goods from market to home along the main asphalt road and gravel roads, are the other means of transportation in Ambo town in addition to human portages. Both carts and human portages provide good services within the town, especially during the market days.

Many people in the Ambo town also walk on foot from their home to office or from office to their home, from the colleges to their home and from home to colleges and universities, from home to business areas and from business areas to their home for work, learning, shopping, and recreation.


Figure 4.21 Motorized and non-motorized transport in Ambo town

(Source: photo by the author, 2023))

Problems identified are that taxis are limited to a short distance from west to east or east to west along the main asphalt road; collectors and appropriate transport routes are not convenient for taxi trips; carts that load and unload commodities appear on the main asphalt roads; and there are no specified taxi parking lots in the town.

4.20 Ambo town drainage issue

The drainage problem in Ambo town is mainly due to urbanization, which is changing the surface properties without properly covering the drainage lines. Many of the city's steam and sewage flows are formed by receiving effluent from inflow and distribution lines and diverting it into outflow sewers, thereby removing flood hazards and water stagnation from adjacent storm water catchments. However, storm water flowing through roads, rooftops and compacted land poses a threat to habitats due to increased water velocity and surface runoff.

i. Existing drainage line coverage

The present drainage line coverage is so inadequate that only the federal arterial road, Jibat hotel to Ambo agricultural research institute collector road, a collector road from Alems hotel to Arada around the market site, and a few other roads have a side ditch.

ii. Storm water drainage facilities

A shortage of drainage facilities is one of the key challenges facing Ambo Town today. Most road networks in the town are without drainage facilities; as can be seen in table 70 above, the total length of roads with drainage lines does not exceed 25 km; the total road length amounts to 171.83 km. This means only 15% of the road networks in the town have drainage facilities. Even existing drainage lines are not up to the required standard; this can be seen in the Table 4.20, presented below.

Table 4.20 Type, dimension and condition of drainage facilities in Ambo town

No	**Type**	**Dimensions (cm)**			**Material of construction**	**Condition**
		Top width	Bottom width	Depth		
1	Trapezoidal	70	30	50	Masonry	fair - bad
2	Rectangular	60	60	variable	Cast-in-situ concrete	good
3	Circular	diameter 60 cm			cement pipe	fair

(Source: organized by the author, 2023)

Existing drainage lines are either filled with solid materials or the water way is blocked by various obstructions. As a result, blocked water creates ponds along roadsides; which in turn pose high health risks to residents walking, working and living in these areas.

4.21 Waste Disposal and Urban Environment

Due to the increasing number of population from year to year the urban environment of Ambo has been deteriorating from time to time and from year to year.

i. Solid Waste

There are solid waste disposal sites in the town. The solid wastes are disposed in landfills, which are located in Ganda 02 and 03 along the bank of Hulluuqaa River. These waste disposal sites are located at incompatible area because they are found just near the edge of Hulluuqaa River.

Trucks used for solid waste collection and disposal are not always running due to spare parts issues, and most of the time they go to the workshop for maintenance. When the truck is serviced and becomes normal, it serves the town three days a week with respect to the three Ganda (kebele) in the town. Since the municipality does not have trash bins at the garbage collection corners, each household must collect their garbage in bags or baskets and load it onto Genda 01, 02, or 03 trucks. Monday, Wednesday, and Friday. Otherwise, the municipality will incinerate the waste on its own. For now, however, the people are using hand-operated two-wheeled containers procured by workers with WHO support to collect and transport solid waste.

Figure 4.22 Ditches filled with silt and solid wastes and rain water collected in parking's and walkways (Source: photo by the author, 2023)

Existing drainage lines are either filled with solid materials or the water way is blocked by various obstructions. As a result, blocked water creates ponds along roadsides; which in turn pose high health risks to residents walking, working and living in these areas.

Problems identified are that solid wastes are disposed of in the town in different places by the community here and there, which means that there are critical solid wastes in the Ambo town; Almost all of the solid waste is not properly collected; the truck is so old that it does not function; the municipality has no strong financial resources and capacity to solve this critical problem; the existing solid waste disposal sites found in both kebele 02 and kebele 03 are located in incompatible areas because they cause water pollution in the Hulluuqaa River; there are no private sectors or other organizations that are involved in waste disposal management except the municipality.

ii. **Liquid Waste**

There is no specified or formal liquid waste disposal site for the town. Liquid waste was dumped or disposed on the farmers plot on their request. The farmers were requesting the municipality to dump liquid waste on their plots before crop seasons. During the crop season or in the summer (Locally called Kermit or rainy season), however, the farmers are not interested the waste to be disposed on their farm plots.

The old suction truck or evacuating truck of the municipality which was giving collection and transportation service for the town similar to that of solid waste transporting truck is also most of the time enters in garage for maintenance. Hence there is a serious problem of liquid waste collection and transportation to the dumping place. In the town there are 4 communal toilets and 29 public toilets, which are distributed throughout in the CBD. But with the increasing number of the population and the expansion of the town these numbers of toilets are very small.

Problem Identified are there is no liquid disposal site in the fringe of the town; the municipality has no normal & modern suction truck; there is no organizations which are involved in the disposal of liquid the same to that of solid; no enough number of communal and public toilets in the town; There is sanitation problem in the town; the farmers are exposed to health problems.

4.22 Wall materials

Table 4.21 Ambo housing stock by types of construction material and story

Story		Type of Construction Materials					
		Wall		Roof		Floors	
Type	%	Type	%	Type	%	Type	%
Non-storied detached	72.3	Wood &Mud	91.4	Corrugated iron sheet	90.5	Mud	65.2
Non-Storied Attached	25.5	Stone & Cement	3.5	Thatch	7.3	Cement/ Concrete	28.2
One story or more	0.4	others	4.2	Others	1.3	others	4
Not stated	0.1		0.9	Not Stated	0.9	Not Stated	2.6

As can be seen in the Table 4.21, 98% of the housing stock in Ambo was non-storied; the walls of 91.4% houses were made of mud and wood; and 65% of the stock had mud floors. The structure of existing housing stock at present doesn't look different from what is depicted in table above, since no major renewal and upgrading work is done in Ambo during the last decade. Almost all housing units taken in the 1994 Census are still surviving with the same structure, but probably in worse condition due to further obsolesce.

4.23 Environmental Condition

a) Availability of Infrastructural Facilities in the Study Area.

Table 4.22, shows the available infrastructural facilities in the study area. 80% of the houses had access to electricity while 20% did not have, they relied on other sources of power like generators and solar energy. 60% of the houses did not have access to pipe borne water from the water board, wells and water vendors for the supply of water while 40% had access to pipe borne water. The findings revealed that the major sources of water for domestic use in the study area was through water vendors who sourced from private borehole owners.

From Table 4.22, 70% of the houses had no access to improved sanitation facilities in the study area, while 30% of the houses had access because the houses were situated along major roads and waste bins were provided by the Ambo municipality for easy collection. Most of the residents dump refuse by the roadside and inside drainages. The majority of the houses (60%) were accessible, while 40% were not accessible due to the bad road conditions. The houses (30%) were well drained, while 70% lacked drainage. The houses with the drainages are mostly along major roads, and the drainages are blocked by refuse. From personal observation, one can deduce that though most of the infrastructure is available, 35% of the neighborhoods sampled within the study area Most of the neighborhoods did not have recreational facilities. As presented in Table 4.22, only 10% of the respondents had access to recreational facilities or open spaces within their neighborhoods, while 90% had no recreational facilities.

Table 4.22 Availability of Infrastructural Facilities in the Study Area.

Type	Available		Not Available	
	Count	N %	Count	N %
Electricity	280	80.00%	70	20.00%
Water Facilities	140	40.00%	210	60.00%
Access to improved sanitation	105	30.00%	245	70.00%
Neighborhood security	123	35.10%	227	64.90%
Recreational facilities	35	10.00%	315	90.00%
Road	210	60.00%	140	40.00%
Drainage	105	30.00%	245	70.00%

b) Conditions of Infrastructural Facilities in the Study Area

Figure 4.23, shows that the condition or state of the physical infrastructural facilities was either fair or bad. They were either not functioning well or not functioning at all. Roads, drainages, water supply and neighborhood security seemed to be the greatest problems.

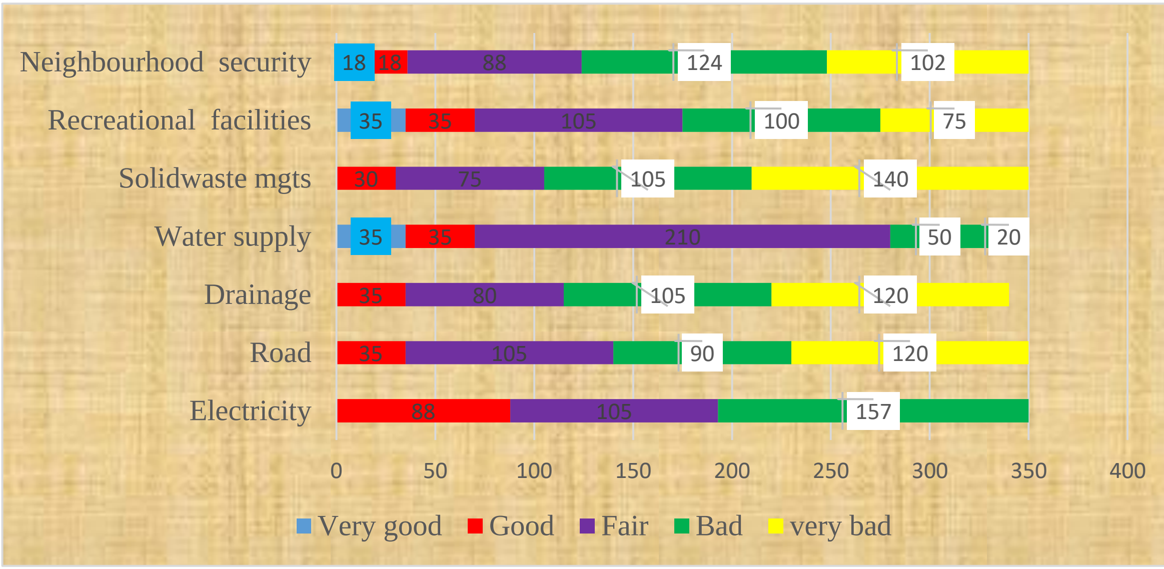

Figure 4.23 Conditions of Infrastructural Facilities in the Study Area

4.24 Socio-economic blight indicators

a) Tenure status in the study area

The findings, as revealed in Table 4.23, show that 31.4% of the respondents, which was the majority in the study area, privately rented the buildings they resided in. This implies that the majority of the respondents were tenants in the study area. Those occupied by their private accounted for 19.4%, which implies that only 8.6% of the respondents were the original owners of the buildings they occupied, that is, they were landlords. Others accounted for 14.9%, and those were the respondents who inherited their property.

Table 4.23 Tenure status in the study area

	Type	Frequency	Percent (%)
Valid	Private	68	19.4
	Rented private	110	31.4
	Kebele	90	25.7
	Landlord	30	8.6
	Family house	52	14.9

	Total	350	100

(Source: organized by the author, 2023)

b) Age of building of study area

Table 4.25, age of the building where some residents live may serve as a determinant of their housing condition. The age of buildings in the study area varied. Buildings below 10 years old accounted for 8.6%, and 20.0% of the residents resided in buildings that were between 40 and 50 years old. Finally, the majority of the respondents resided in old buildings that were between 20 and 30 years old; this accounted for 58.9%, while buildings that were 50 years old and older accounted for 12.6%. This implies that the majority of the buildings in the study area were old. It further shows the poor living conditions of the area as a result of the natural aging of the buildings, a lack of maintenance and neglect, and the low living standards of the people.

Table 4.24 Age of building of study area

	Types	**Frequency**	**Percent (%)**
Valid	Below 10 years	30	8.6
	20-30 years	206	58.9
	40 -50 years	70	20.0
	50 years and above	44	12.6
	Total	350	100.0

(Source: organized by the author, 2023)

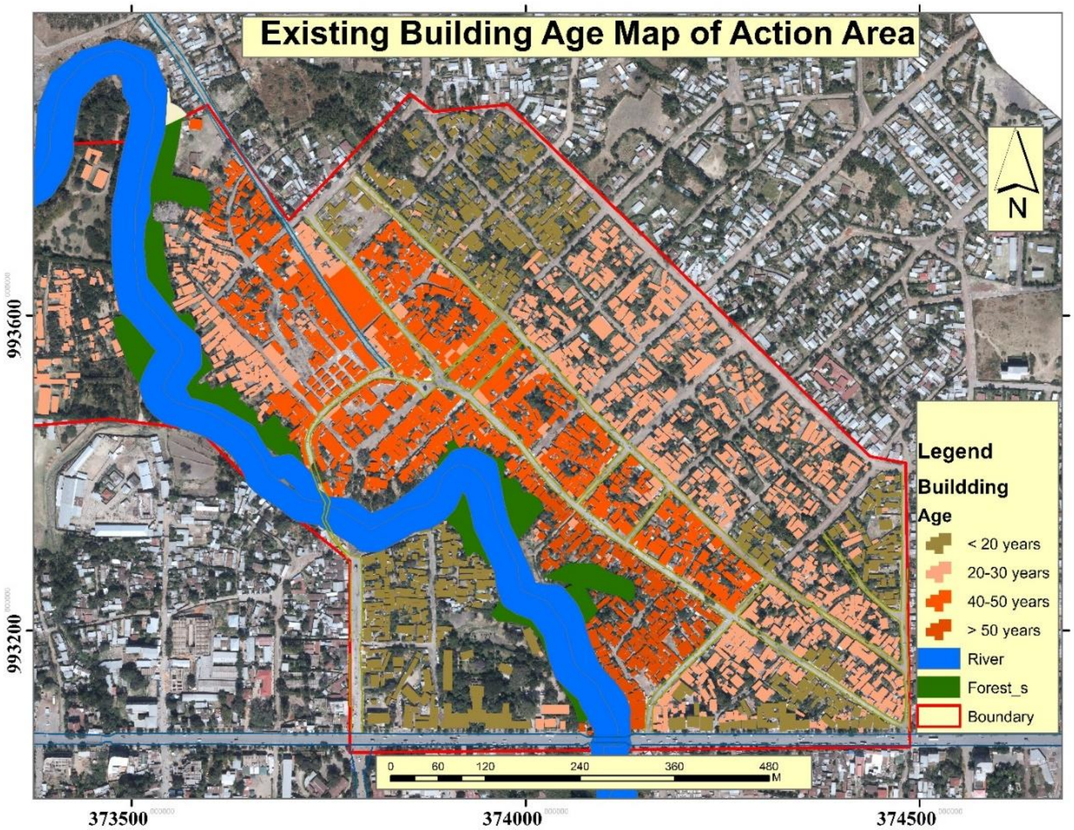

Figure 4.24 Building age in Slum area around Arada most slum area of Ambo town

c) Conditions of the Building.

To assess, the general housing condition in the study area, the condition was classified as being good, fair or bad.

Table 4.25 Conditions of the Building

Type	N	Maximum	Mean	Std. Deviation
1,Structure	350	2	1.04	0.203
2,Finishing	350	3	1.7	0.618
3,Aesthetics	350	2	1.01	0.119
4,Accessibility	350	2	1.2	0.401
5,Open space	350	3	1.93	0.835
6,Material used	350	2	1.22	0.417
7,Type of wall	350	3	1.84	0.764
8,Type of floor	350	3	1.59	0.788
9,Toilet	350	2	1.45	0.499
10,Kitchen	350	2	1.48	0.5
11,Bathroom	350	2	1.01	0.075

12,Water supply	350	4	1.75	1.152
13,Electricity	350	3	1.33	0.609
Overall of Housing condition level				**1.42**

Note: {1=bad, 2= fair, 3= good, 4 = very good}   (Source: organized by the author, 2023)

The 5-point Likert scale is considered an interval scale. The means are very significant. Form 1–1.75 is bad; from 1.76–2.5, it means fair; 2.6-3.25, it means good; and 3.25–4, it means very good. According to the Table 4.25, the overall mean is 1.42. It falls between 1 and 1.75; according to the table above, the majority of participants' housing conditions are bad.

Figure 4.25 Bad housing condition and bad toilet   (Source: photo by the author, 2023)

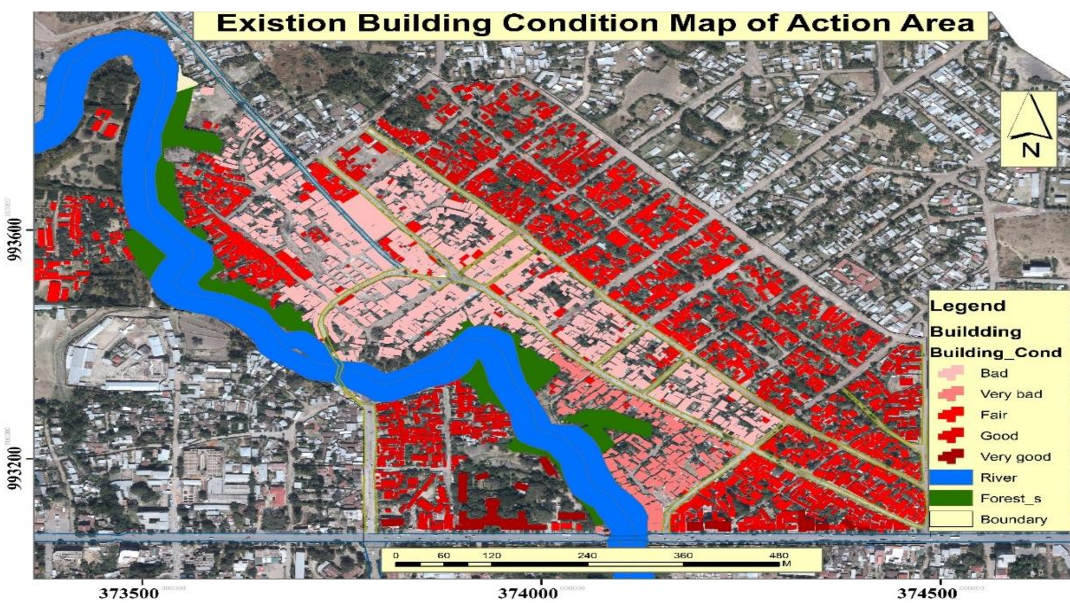

Figure 4.26 Existing building condition of Slum area (Arada sefer)

Condition of Window

From, Table 4.26, the study revealed that 57.4% of the windows in the study area were intact, 37.7% were cracked or broken, and 4.9% were removed, as presented in Table 4.26. This means that there were houses without windows. Mats, sacks, or corrugated iron sheets were used as window materials in these houses.

Table 4.26 Condition of Window

	Type	Frequency	Percent
Valid	Intact	201	57.4
	Cracked/Broken	132	37.7
	Removed	17	4.9
	Total	350	100.0

(Source: organized by the author, 2023)

4.25 Main Social Problems

i. Existing Water Demand

According to the Ambo WSSSO, the average daily domestic demand, public demand, and industrial demand are 793 m3/day, 543 m3/day, and 7 m3/day, respectively. Therefore, the total daily demand is 1343 m3/day, but with a 70 m3/hour production rate, the total daily production is 1680 m3/day. But due to high losses and leakage of water distributed throughout the town in terms of coverage, there is a shortage of water.

In addition, the average consumption of water per person per day is 0.02 m3, and the current population of the town is 67514 since 2008. With this average consumption, the total daily consumption of the population of the town is 1350.28 m3/day. The population in 2019 was 104112, and the current average consumption of water per person is constant; the average daily water consumption of the population of the town is 2082.24 m3.

Table 4.27 frequency of water interruptions

	Types	Frequency	Percent
Valid	Once every day	34	9.7
	Two to three times per week	181	51.7
	Once a week	20	5.7
	Once in two weeks	52	14.9
	Once a month	14	4

	Once in two months	7	2
	No interruption	10	2.9
	Other	32	9.1
	Total	350	100

(Source: organized by the author, 2023)

The water interruption shown in Table 4.21 confirms how serious the water interruption problem is in the study area. Out of 350 interviewed households, the largest portion, 181 (51.7%), claimed that water interruptions occurred two to three times per week. The next large number, 52 (14.9%), have experienced daily water interruptions, and 34 (9.7%) are other households that have no access to water all day. Subsequently, 14 (4%) households have faced monthly water interruptions, and these people are those who have been leaving in the center of the town and connected to the primary line. Next to this, 20 (5.7%) households stated that water interruptions occurred once a week. Besides, 54 (14.9%) of the respondents said that water interruptions occur once every two weeks. And only 10 (2.9%) reported there was no water interruption except when the tube was washed.

Problems identified are inadequate water supply; during the dry season, there is no sustainable water supply; and there is an old system of water treatment plants that is not able to respond to the demand created by the increasing population and expansion of the town.

4.26 Crime

A crime is an act that violates a political, religious, or moral command and prevailing norms or cultural standards prescribing how humans ought to behave and is considered important in protecting the interests of the state or the welfare of its citizens or subjects. According to the data obtained from the Ambo Town Administration Police Office, crime is one of the most serious social problems in the town.

Table 4.28 Trends of Crimes Committed by Year and Sex 2010-20011E.C

	Type of Crime	**Number of Crimes Committed**					
		1010 EC			2011 EC		
		Male	Female	total	Male	Female	total
1	Violation of Law	41	5	46	20	1	21
2	Theft	100	10	110	55	5	60
3	Physical attack	111	14	125	63	18	81

4	Dishonesty	12	8	20	7	5	12
5	Cheating	7	1	8	5	-	5
6	Rape	5	-	5	4	-	4
7	Homicide	5	-	5	3	-	3
8	Attempt to kill	3	-	3	3	-	3
9	Snatching	16	-	16	8	-	8
10	Hiding of lost properties	8	1	9	-	-	-
11	Dispossession of virginity	9	4	13	5	2	7
12	Adultery	2	1	3	-	-	-
13	Illegal weapon	9	-	9	5	-	5
14	Various Social crimes	90	23	113	56	16	72
	Total	418	67	485	234	47	281

(Source: Ambo Town Administration Police Office, 20012 and organized by author, 2023))

According to Table 4.28, during the previous years (2010 and 2011), there were 766 crime cases reported to the police. The most common crimes were 206 cases of physical attack or assault causing disabilities (26.8%), followed by 185 cases of different social crimes (24.2%), 170 cases of theft (22.2%), 66 cases of violation of law (8.6%), 32 cases of dishonesty (4.2%), 4.8%, 24 instances of snatching (3.2%), 20 cases of statutory rape (2.6%), 14 cases of using or carrying an illegal weapon (1.8%), 13 cases of cheating (1.7%), 9 cases of rape and hiding lost materials each (1.2%), 8 cases of homicide (1.0%), etc.

4.27 Causes of Urban Blight by physical, social-economic and political indicators

The results of the analysis carried out to identify the causes of urban blight in the study area were assessed using mean score analysis. Twelve components were adopted in determining the causes of urban blight. These include: housing shortage; lack of affordable housing; high incidences of urban poverty; high incidences of rural or urban-urban migration; poor enforcement of planning laws; lack of a planning or development plan; inadequate development control by planning agencies; inadequate provision of sites and services; eviction and poor resettlement programming by the government; high density of development and overcrowding; inadequate neighborhood facilities and services were also considered.

Table 4.29 Descriptive Statistics of physical, social-economic and political indicators

Descriptive Statistics					
Cause of urban blight	**N**	**Sum**	**Mean**	**Std. Dev.**	**Rank**
Inadequate sanitation	350	607	1.73	0.903	1st
Lack of planning /development plan	350	601	1.72	0.865	2nd
Lack of affordable housing	350	589	1.68	0.849	3rd
High incidences of urban poverty	349	575	1.65	0.867	4th
Poor enforcement of planning law	350	562	1.61	0.852	5th
High density of development and overcrowding	350	526	1.5	0.828	6th
Inadequate neighborhood facilities and services	350	524	1.5	0.832	7th
Housing shortage	350	478	1.37	0.744	8th
High incidences of Rural or Urban– Urban Migration	350	460	1.31	0.523	9th
Inadequate development control by planning agencies	350	459	1.31	0.522	10th
Inadequate provision of site and services	350	437	1.25	0.483	11th
Eviction and poor resettlement programmer by the government	350	380	1.09	0.309	12th
Valid N (list wise)	350				

Note, {1: Most Significant; 2: Very Significant; 3: Significant; 4: Insignificant; 5: Very Insignificant} (Source: organized by the author, 2023)

The 5-point Likert scale is considered an interval scale. The means are very significant. Form 1-1.8 is the most significant; from 1.9-2.6, it means very significant; 2.7-3.4, it means significant; 3.5-4.2, it means insignificant; and 4.3-5.0, it means very insignificant.

According to Table 4.29, presents the result, and it shows Inadequate sanitation was ranked 1st (MS = 1.72), and lack of affordable housing was ranked 2nd (MS = 1.68). Eviction and poor resettlement programming by the government were considered to be the least important causes of urban blight (ranked 12th, MS = 1.09). The average mean score for the overall causes of urban blight was 1.47, which corresponded to “very significant” of the causes.

4.28 Blight Composite Index of Ambo town

a) Physical Urban Blight indicators

Physical indicators of urban blight are indications of deterioration, abandonment, and underinvestment in urban areas, which may be a factor in the general decline in a community's quality of life. The data for analyses were gathered from online public sources, including publicly available databases and news reports, as well as face-to-face conversations with key personnel from various government offices, including the Ambo municipality office, the Ambo police office, the Ambo Affair office, etc., and most importantly, obtained through numerous Open Record requests. These were merged at the Census Block/Tract level along with the towns. The physical indicators were aggregated (counted) for each census tract in the Ambo towns and mapped to create a “physical index.

The physical indicators selected and mapped were: residential blight indicator; commerce and business blight indicator; unfair distribution administration; social service blight indicator; open space and environmental blight indicator; manufacture and storage blight indicator; road, transport, utilities, and infrastructure; wall material; high density development and overcrowded; drainage and sewage (bad condition); built-up for 30 years old; Environmental Degradation Over 30 Years.

Table 4.30 The list physical indicators selected and mapped were:

No	Types physical indicators	Exist %	Standard	Gap
1	Residential Blight Indicator	11.85%	40-50	28.15
2	Commerce & Business Blight Indicator	0.29%	8-10	7.71
3	Unfair distribution Administration	0.71%	20-30	19.29
4	Social Service Blight Indicator	5.12%	10-20	14.88
5	Open Space and Environmental Blight Indicator	79.47 %	15-20	59.47
6	Manufacture & Storage Blight Indicator	0.47%	10-15	14.53
7	Road, Transport, Utilities and Infrastructure	3%	15-25	23
8	Wall material	91.4%	Materials	91.4
9	High density development and overcrowded	71.4%	150 per/ha	71.4
10	Drainage and sewage (bad condition)	60.0%	1.5 m	60
11	Built-up for 30 years old	19.97%	65%	45.03
12	Loss of Environment over 30 years	74.51%	-	74.51
12	Poor accessibility zones(based available road)	60.0%	-	60

Note, the Gap of residence; commerce; administration; social service; manufacture and storage; built-up; road based on the standard, while change to 100%.

$$CBI = \sum_{i=0}^{n} (RB + CB + Ad + Ss + Ob + Mb + Ro + Wb + Hb + Bu + El + Acc)/1200$$

$$CBI = (70.38 + 96.45 + 99.2 + 59.47 + 96.8 + 92 + 91.4 + 71.4 + 60 + 69.2 + 74.51 + 60)/1200$$

$$\underline{\mathbf{CBI = O.78}}$$

If the value of CBI is greater than 0.5, the city is classified as highly blighted, which is mostly slum, when the value is lower than 0.5, the city is a non-decay area, which is urban decay that is localized and less significant. A value of CBI = 1 represents a complete slum city, while CBI = 0 represents a slum-less city. The physical composite blight index is a measure that is often used to assess the physical condition of a given area or town. It calculates an overall score based on a range of physical indicators, such as the condition of buildings, streets, and public spaces. A score of 0.78 for the physical composite blight index of Ambo town would indicate that the town is experiencing a relatively high level of physical blight.

b) Socio-economic Blight indicators

(Maghelal & Andrew, 2014) suggest that one's opportunity to reside in "neighborhoods possessing high-quality resources is differentially distributed across such characteristics as race and immigration status…" (pg. 626). Studies on the locational attainment process have used Census derived tract characteristics such as the proportion of whites, median household income, and other quality of life indicators such as the risk of crime. Thus, based on the review of literature and socio-economic blight measures in Ambo town, a selection of relevant socio-economic indicators was made to capture household attainment levels. The socio-economic indicators were downloaded from the households of Ambo towns and mapped to create a "Socio-economic Index".

The list of socio-economic measures selected were in the Table 4.31 : housing shortage; unemployment; tenure status; age of buildings; condition of buildings; frequency of interruptions of water; split family households; crime; inadequate neighborhood and services; recreational facilities; lack of affordable housing; high incidences of urban poverty; high incidences of rural or urban migration.

Table 4.31 Trends of urban decay in Social-Economic indicator

No	List of variable of socio-economic indicators	Percentage of decay
1.	Housing shortage	74.3%
2.	Unemployment	51.1%
3.	Tenure status	76.5%
4.	Age of buildings	91.5%
5.	Condition of buildings	48.74%

6.	Frequency of interruptions of water	78.3%
7.	Split family household	30%
8.	Crime	51.2%
9.	Inadequate neighborhood and services	67.8%
10	Recreational facilities	80%
11	Lack of affordable housing	82.3%
12	High incidences of urban poverty	57.9%
13	High incidences of Rural or Urban– Urban Migration	71.4%

$$CBI = hs + Ue + Ts + Ba + Bc + Wf + Fs + C + In + Rf + Ah + Po + Mur/N(100)$$

$$CBI = 74.3 + 51.1 + 76.5 + 91.5 + 48.74 + 78.3 + 30 + 51.2 + 67.8 + 80 + 82.3 + 57.9 + 71.4/1300$$

$$\underline{\boldsymbol{CBI = 0.66}}$$

Therefore, the Socio-economic composite blight index of Ambo town was 0.66, the socio-economic composite blight index is a measure that is often used to assess the socio-economic conditions of a given area or town. It calculates an overall score based on a range of socio-economic indicators, such as poverty rates, unemployment rates, Condition of buildings, and access to basic services. A score of 0.66 for the socio-economic composite blight index of Ambo town would indicate that the town is experiencing a relatively high level of socio-economic blight.

c) Political Blight indicators

Based on the respondent's suggestion in the Table 4.32, the political blight indicators are: poor enforcement of planning laws; lack of a planning or development plan; inadequate provision of sites and services; eviction and poor resettlement programming by the government; inadequate neighborhood facilities and services; and neighborhood security.

Table 4.32 Political Blight indicators

No	List of Political Blight indicators	Percentage of decay
1)	Poor enforcement of planning law	60.0%
2)	Lack of planning /development plan	51.7%
3)	Inadequate provision of site and services	92.3%
4)	Eviction and poor resettlement programmer by the government	92.3%
5)	Inadequate neighborhood facilities and services	71.7%

6)	Neighborhood security	64.6%

$CBI = (Pp + Dp + Is + Er + Nf + Ns)$/100*6

$$CBI = (60 + 51.7 + 92.3 + 92.3 + 71.7 + 64.6)/600$$

$$\underline{\boldsymbol{CBI = 0.72}}$$

Therefore, the political composite blight index of Ambo town was 0.72, the political composite blight index is a measure that is often used to assess the political conditions of a given area or town. It calculates an overall score based on a range of political indicators, such as the poor enforcement of planning law, lack of planning /development plan, and the inadequate provision of site and services in the area. A score of 0.72 for the political composite blight index of Ambo town would indicate that the town is experiencing a relatively high level of political blight.

$$Overall\ CBI = \frac{0.78 + 0.66 + 0.72}{3} = \mathbf{0.72}$$

Over all of Composite blight index = **0.72,**

The Composite Blight Index appears to be a measure of the degree of blight in Ambo town, with a value of 0.72 signifying a moderate amount of blight. While there are some indications of blight in Ambo town, according to a score of 0.72, the degree is not severe. It is crucial to remember that the Composite Blight Index's meaning can change based on the situation and the precise indications that were used to generate it.

4.29 Composite blight index Map of Ambo Town

The composite blight index is a measure that is often used to assess the overall level of blight in a given area or town. It takes into account a range of different factors, such as the physical condition of buildings and infrastructure, the socio-economic conditions of the area, and the political and governance conditions.

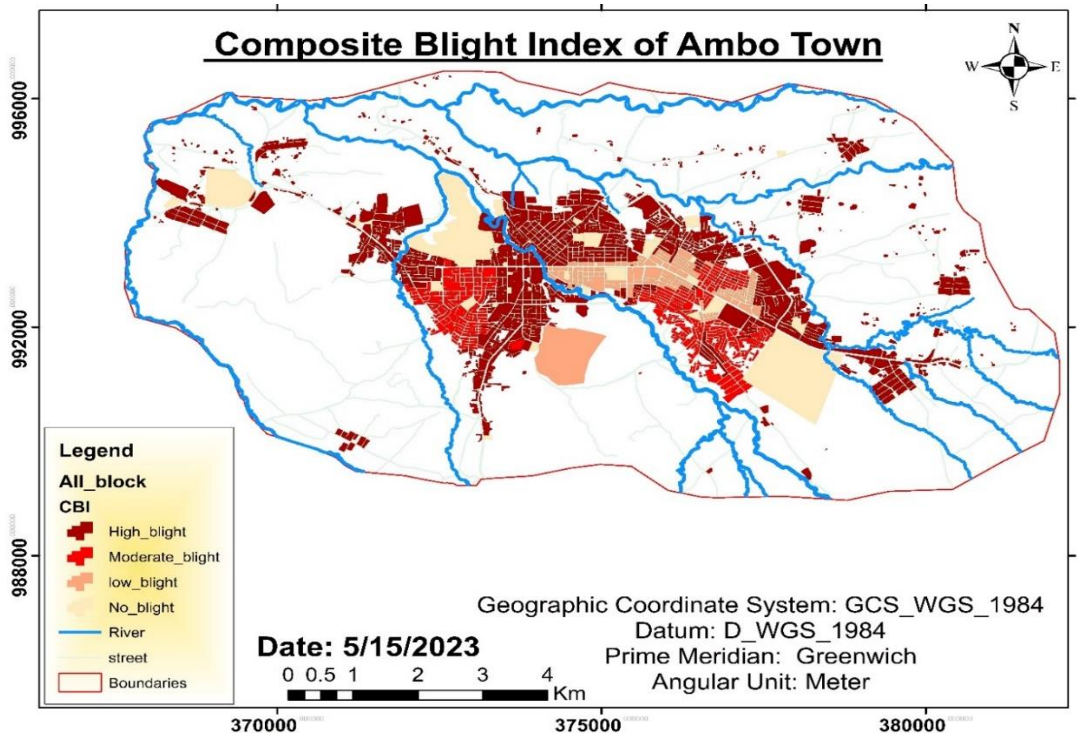

Figure 4.27 Composite Blight Index.(Source: organized by authors, 2023)

4.30 Discussion

Subjective dimensions were executed to analyze the urban blight of inner city of Ambo. Among 350 respondents, 55.7% are males and 44.3% are females; 5.1% of the respondents interviewed were of age between 18 and 30 years, 23.7% were between 31 and 40 years of age; 58.5% were between 41 and 60 years of age; and 12.6% were greater than 60 years of age are 12.6%.

Most of the respondents are between the ages of 31-40 years of age. , concerning marital status, experimental findings on the respondents indicate that the majority (52%) of the respondents are married, while only 17.4% are single.

The classified image demonstrates overall classification accuracies of 89%, 90%, 92%, and 93% for the years 1992, 2007, 2015, and 2022, respectively. The values of Kappa statistics for classified images are greater than 0.8, indicating strong agreement between the classified LULC classes and ground truth; hence, the maps satisfied the accuracy criteria for LULC change detection analysis. The information summarized in Table 4.11 shows the spatial extents, percentage changes over time, and annual average growth of the six land use/land cover classes (agriculture land, barren land, buildup area, forest area, grassland, and water bodies) in Ambo town between 1992 and 2022. Overall, the results show extensive LULC changes in Ambo town over the study period. During the investigation periods, distinct changes have occurred in the major land use and land cover types. From 1992 to 2007, the buildup environment increased approximately 249.76 ha (88.09%), while forest area decreased 301.99 ha (20.50%), water bodies increased 10.72 ha (6.15%), and grassland and barren land decreased 371.36 ha (10.50%) and 79.55 ha (47.13%), respectively.

During the second period between 2007 and 2015, the built-up environment increased drastically by 732.10 ha (137.28%), while forest area decreased by 424.49 ha (36.25%), grassland continuously converted and decreased by 1784.64 ha (56.39%), and water bodies and barren land decreased by 104.82 ha (56.70%) and 53.81 ha (60.30%), respectively. During the third period, 2015–2022, all LULC decreased except the buildup area. Buildup area increased by 438.31 ha (34.64%), while agricultural land, barren land, forest area, grassland, and water bodies decreased by 5.77%, 0.11%, 1.42%, 9.85, and 2.45%, respectively.

The third period was characterized by advanced LULC dynamics where previously intensifying land cover classes such as agriculture land, forest area, and grassland declined their net change by – 59.31%, -2.09%, and -28.30% respectively. The built-up area reveals rapid change with a net positive increase of 436.13Ha (90.17%). Hence, the expansion of built-up areas had resulted in a negative change of forest, grassland, and agricultural land.

The General existing land use of the town includes Residential both pure and mixed, Commerce & Business, Administration, Services, Environment, Manufacturing & Storages, Road Network and Transport, and others (water bodies, projects under construction and gorges); and the coverage of land use is 8558.37ha.About 11.85 % of the study area is currently used for residential purposes, which is the city's usual land use. When it is compared with the standards, which are about 40%–50% of the total existing land use area, it is obviously taken as below the standard. Industries and workshops should not be located in proximity to or in the compound of administrative activities. It is about 58.73 hectares, which accounts for 0.71% of the total existing land uses that could not conform to the already set standard for this land use class by the nation.

The social service land use category covers 423.50 hectares, or about 5.12% of the total existing land use of the town. This land use is said to be below the standard when compared to the standard set, particularly for the social service land use category. Among the major subtypes of this particular land use, education and worship are the dominant ones, which alone cover about 89.02% and 5.29%, respectively. Most of these services are fairly distributed over all parts of the city, and some incompatible land uses are observed, especially in the cases of lower-level education and religious services.

From the study, 70% of the houses had no access to improved sanitation facilities in the study area, while 30% of the houses had access because the houses were situated along major roads and waste bins were provided by the Ambo municipality for easy collection. Most of the residents dump refuse by the roadside and inside drainages. The majority of the houses (60%) were accessible, while 40% were not accessible due to the bad road conditions

The 6% difference is comprised of the widowed, with 24.6% divorced and the household size of the respondents within the study was examined. The results show that 5.7% of the households in the study area comprised 1person another 10.0% of the households comprised of 2 members. Another 30.0% of households comprised of 3 to 4 members, while 41.4% comprised of 5 to 7 members and another 12.9% of the households comprised members above eight (8) in number. Critical observation into the household size shows that over 80% of the households had a size of between 2 and 7members**.**

A score of 0.78 for the physical composite blight index of Ambo town would indicate that the town is experiencing a relatively high level of physical blight. The specific factors that were taken into account in the calculation of the physical composite blight index for Ambo town may vary depending on the study or assessment that was conducted. However, some common indicators that might be included in such an index could include the percentage of vacant or abandoned buildings, the level of disrepair of buildings and infrastructure, the amount of litter and debris on streets and public spaces, and the level of crime or vandalism in the area.

It calculates an overall score based on a range of socio-economic indicators, such as poverty rates, unemployment rates, educational attainment levels, and access to basic services.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

Urban blight is a complex problem that can severely impact the quality of life in urban areas. The use of remote sensing and GIS techniques can provide valuable insights into the extent and severity of urban blight. In this essay, we will explore the use of these techniques for analyzing urban blight, their potential benefits, and their limitations. The first benefit of using remote sensing and GIS techniques for analyzing urban blight is the ability to collect data from large areas quickly and accurately. Identifying the complex interaction between changes and their drivers GIs and remote sensing technology provide vital and accessible information about the land cover change that may occur within a given time frame.

According to the image we analyzed, from 1992 to 2007, the built-up environment increased by approximately 249.76 ha (88.09%), while forest area decreased by 301.99 ha (20.50%), water bodies increased by 10.72 ha (6.15%), and grassland and barren land decreased by 371.36 ha (10.50%) and 79.55 ha (47.13%), respectively. During the second period between 2007 and 2015, the built-up environment increased drastically by 732.10 ha (137.28%), while forest area decreased by 424.49 ha (36.25%), grassland continuously converted and decreased by 1784.64 ha (56.39%), and water bodies and barren land decreased by 104.82 ha (56.70%) and 53.81 ha (60.30%), respectively.

Urban growth is associated with population growth, economic development, and the expansion of infrastructure and services, while urban blight is associated with economic decline, population loss, and neglect.As physical markers of urban decay, 12 elements were used. The physical composite blight index for Ambo Town was 0.78, indicates that there is a relatively high level of physical deterioration and blight in the urban area. Since the index ranges from 0 to 1, a value of 0 would indicate no physical deterioration or blight, while a value of 1 would indicate severe physical deterioration and blight. The social-economic indicator for urban deterioration trends was composed of 13 variables. Ambo Town has a socioeconomic composite blight score of 0.66, which is considered to be a slum area by the standards of the index. As indices of political blight, six variables were used. The political composite blight score for Ambo Town was 0.72; based on the index's criteria, these areas are slums. The composite blight index, which takes into account physical, sociological, economic, and political variables, is 0.72 overall. As a result of traffic issues, non-compliance, urban decay, and poor-quality cities, No services for the center, no market hierarchy, inefficient and uncoordinated use of potential space and resources, insufficient routes, inefficient transport, Sanitation emergencies associated with a lack of waste collection systems and disposal sites for both solid and liquid waste, illegal settlements, fences, and unplanned "kiosks" in the streets, mines, and deforestation, and a lack of attention to the renewal and upgrading of urban rehabilitation districts, including primary housing estates and the inner city, are in a difficult situation. This reflects a worrying situation for local elected officials and planners. Effective planning and the proper management of urban systems are essential requirements; otherwise, the urban era's problems could get even worse in the near future.

Overall, the use of remote sensing and GIS techniques to analyze urban blight has the potential to greatly improve our understanding of the spatial distribution and intensity of blight in urban areas. This information can be used to inform policy decisions related to urban renewal, rehabilitation, and redevelopment, with the goal of creating more sustainable and livable urban environments

5.2 Recommendation

The findings of this particular study have demonstrated the value of GIS, remote sensing, and land change models as tools for studying changes in land use, land cover, and urban blight. Therefore, based on the findings of this study, the following are recommended as future research directions:

- The results of the study indicated that the pace of urban expansion in Ambo town is very rapid, particularly in the last few decades with a growth rate of 16.65 %, and this will continue in the coming decades. The study also showed that the LUP and SP prepared by OUPI so far to guide development activities were not properly implemented on the ground. So as to achieve the required balanced development, government officials, experts, and communities are expected to plan ahead for sustainable utilization of natural resources and cope with the pace of urban expansion.

- The town is expanding from year to year because of various reasons. Hence, expanding areas suffer from a lack of adequate urban infrastructure, and the burden of providing this urban infrastructure falls on the municipality. It is recommended that the municipality form partnerships between sectors to alleviate the problem.
- Use a comprehensive approach: Urban blight is a complex issue that is influenced by a variety of factors, including economic, social, and environmental factors. Policymakers should use a comprehensive approach that addresses these factors in order to effectively reduce urban blight. This may include policies related to economic development, affordable housing, and access to basic services.
- Foster community engagement: Community engagement is important for the success of interventions aimed at reducing urban blight. Policymakers should work to engage residents and community organizations in the development and implementation of interventions, as they have first-hand knowledge of the issues facing their communities.
- The creation of high-quality land cover maps requires the use of high-resolution imageries like IKONOS and Quick Bird. High-resolution imaging maps urban areas, which contain complex and heterogonous features, to provide superior information. Additionally, using auxiliary data as ground truth improves the classification accuracy of images.
- Develop targeted interventions: Using the information gathered from remote sensing and GIS analysis, policymakers should develop targeted interventions to address areas of high blight. These interventions may include rehabilitation and renovation programs, zoning changes, or incentives for private investment.
- Future research should focus on improving the accuracy and accessibility of remote sensing data and using GIS tools in conjunction with other data sources to develop a holistic understanding of the root causes of urban blight.

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APPENDICES

This questionnaire on the topic: **"Analysis of Urban blight by using Remote sensing and GIS technique: The case of Ambo Towns, Ethiopia"** is an ASTU research work and has been designed to obtain relevant information for academic purpose only. You are also assured that, all information you provide will be strictly used and kept confidential. Please, kindly complete the blank spaces and tick (√) the appropriate boxes where applicable. Thank you very much for your anticipated cooperation and sincere response.

Annex 1: Questionnaires for Community Survey date Survey

Place_______ who collected the survey____________

1) Age___________________(years)
2) Sex (1) Male ☐ (2) Female ☐
3) Marital Status

   Married (☐) Single (☐) Separated (☐) Widower (☐) divorced (☐)
4) Are you the household head (1) Yes___ (2) No______
5) Household size______________________________
6) Level of education: Illiterate Elementary☐(1-8) Secondary School☐(9-10) Preparatory ☐ (11-12) TVET Higher Educational Diploma☐ First Degree Masters /PhD☐
7) What are employment status of study area?
   a. Formal employment ☐ (2) not employed ☐ (3) self-employed☐ (4) retiree ☐ (5) other(specify)☐
8) Do you have an additional source of income?
   a. Yes ☐ (2) No☐

If yes explain____

Total household income___________________. (Ksh)

(1) 1-5,000 ☐ (2) 5,001-10,000 ☐ (3) 10,001-15,000 ☐ (4) 15,001-20,000 ☐

Annex 2: Physical blight indicators (Ambo Municipality data and Field Survey)

1. How do we determine the residential blight indicator of the town?
2. What factors contribute to the commerce and business blight indicator of the town?
3. What is the administration blight indicator of the town?
4. How do we determine the social service blight indicator of the town?
5. What is the open space and environmental blight indicator of the town?
6. How do we determine the manufacture and storage blight indicator of the town?
7. What are the road network, transportation, and utilities blight indicators of the town?
8. What is the intra urban transport blight indicator?
9. How do traffic accidents contribute to the intra urban transport blight indicator?
10. What is the existing water demand in Ambo town?
11. How often do water interruptions occur in Arada sefer?
12. What are the drainage issues in Ambo town?
13. How are waste disposal and urban environment related in Ambo town?
14. Can you describe solid waste and liquid waste disposal in Ambo town?
15. How is liquid waste disposal handled in Ambo town?

Annex. 3: Questionnaire Format for Respondent regarding for Socio-economic

A) socio-economic blight indicators

I. Housing Condition

1) What is the Tenure status in the study area, and how does it affect urban blight?

   A, private ☐ B) Rented private ☐ C) Kebele ☐ D) Landlord ☐

   E) Family House☐

2) Age of building (A) below 10 years ☐ B) 20-30 years ☐ C) 40 -50 years☐
   (D) 50 years and above ☐
3) Conditions of the Building.

S/N	Building	Very good	Good	Fair	Bad
i.	Structure	☐	☐	☐	☐
ii.	Finishing	☐	☐	☐	☐
iii.	Aesthetics	☐	☐	☐	☐
iv.	Accessibility	☐	☐	☐	☐
v.	Open space	☐	☐	☐	☐
vi.	Material used	☐	☐	☐	☐
vii.	Type of wall	Stone (☐)	Brick (☐)	Wood and stone ☐	Mud and wood ☐

viii.	Type of floor	Bear floor (☐)	Concrete (☐)	Tiled (☐)	mud (☐)
ix.	Toilet	☐	☐	☐	☐
x.	Kitchen	☐	☐	☐	☐
xi.	Bathroom	☐	☐	☐	☐
xii.	Water supply	☐	☐	☐	☐
xiii.	Electricity	☐	☐	☐	☐

4) How condition of window of in the Arada?

A) Intact☐ B) cracked/broken☐ C) Removed ☐

5) What the wall materials of in Arada?

A) Concrete☐ B) Brick☐ C) HCB ☐ D) wood and mud☐ E mud and block☐ F) other ☐

II. Social Blight Indicator

6) How does crime contribute to urban blight in Ambo town?

____

7) What are the reasons for people joining the sex business?

____

III. Environmental Condition

8) Availability of Infrastructural Facilities in the Study Area?

S/N	Facilities	Available	Not Available
i.	Electricity	☐	☐
i.	Water Facilities	☐	☐
ii.	Access to improved sanitation	☐	☐
iii.	Neighborhood security	☐	☐
iv.	Recreational facilities/Open space	☐	☐
v.	Road	☐	☐
vi.	Pedestrian lane	☐	☐
vii.	Drainage	☐	☐

9) Conditions of Infrastructural Facilities in the Study Area.

S/N	Facilities	Condition and states of the services			
		Very good	Good	Bad	Very bad
I.	Electricity	☐	☐	☐	☐
ii.	Road	☐	☐	☐	☐
iii.	Drainage	☐	☐	☐	☐
iv.	Pedestrian lane	☐	☐	☐	☐

v.	Water supply	☐	☐	☐	☐
vi.	Sewer system	☐	☐	☐	☐
vii.	Solid waste management	☐	☐	☐	☐
viii.	Recreational facilities/Open space	☐	☐	☐	☐
ix	Neighborhood security	☐	☐	☐	☐

10) Causes of Urban Blight in the Study Area. Below are the probable causes of urban blight. Please rate according to their significance: where:-1 = Most Significant, 2 = Very Significant, 3= Significant, 4= Insignificant and 5= Very Insignificant

S/N	Causes of Urban Blight	(VIS) 1	(IS) 2	(S) 3	(VS) 4	(MS) 5
1)	Housing shortage	☐	☐	☐	☐	☐
2)	Lack of affordable housing	☐	☐	☐	☐	☐
3)	High incidences of urban poverty	☐	☐	☐	☐	☐
4)	High incidences of Rural or Urban– Urban Migration	☐	☐	☐	☐	☐
5)	Poor enforcement of planning law	☐	☐	☐	☐	☐
6)	Lack of planning /development plan	☐	☐	☐	☐	☐
7)	Inadequate development control by planning agencies	☐	☐	☐	☐	☐
8)	Inadequate provision of site and services	☐	☐	☐	☐	☐
9)	Eviction and poor resettlement programmer by the government	☐	☐	☐	☐	☐
10)	High density of development and overcrowding	☐	☐	☐	☐	☐
11)	Inadequate neighborhood facilities and services	☐	☐	☐	☐	☐
12)	Inadequate sanitation	☐	☐	☐	☐	☐

Annex 4, Slum Evaluation Criteria

No	Indicators for intervention	UN standards	UN standards for Ambo Cities level	Study area
1	Access to improved water consumption per person per day distance to the nearest point	20 - liters//per/day -NA	-max 150m	
2	Access to improved sanitation access to toilet with reasonable number of users distance to the nearest solid waste	2house holds per toilet NA	-3HH/Toilet Max 250m	

	collection points			
3	Low density level population per hectare available open spaces	NA	500p/ha 1m2/p	
4	The durability of buildings /structure quality of buildings /structure quality types of building materials for Floor, Wall, Roof	Cement screed, HCB or stone, CIS	Cement screed HCB or stone CIS	
5	Security of tenure	Acquire title deed	Any formal Recognition	
6	Availability of access street	NA	access to the plot	
7	Conformity with the land use of the city plan	NA	Confirm	
8	Availability of social facility and utility kg ,primary school, health /centers/posts and electricity	NA	As per the 1.5km- 2km	