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STUDIES

URBAN SPRAWL AND OF INFORMAL SETTLEMENTS IN
WOLKITETOWN: CENTRAL ETHIOPIA

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URBAN SPRAWL AND OF INFORMAL SETTLEMENTS IN WOLKITE
TOWN; CENTRAL ETHIOPIA

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Declaration

I, AdaneMengist, do hereby declare to Jimma University Department of Geography and Environmental Studies that this thesis is a product of my original research work, and it has not been submitted to any other university for any academic degree. Any materials and information in a report other than my own are duly acknowledged.

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This is to certify that the thesis prepared by Adane Mengist entitled 'Urban Sprawl and Informal Settlements in Wolkite Town, Central Ethiopia' is defensible and can be submitted for the partial fulfillment of the requirements for the Degree of Master of Arts in Geography and Environmental Studies. It complies with the regulations of Jimma University and meets the accepted standards with respect to originality and quality.

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List of Acronyms

CBD	Central Business District
BoFED	Bureau Of Finance and Economic Development
CEF	Conserve Energy Future
CSA	Central Statistical Authority
EMA	Ethiopian Mapping Agency
ETB	Ethiopian Birr
ETM+	Enhanced Thematic Mapper
FCC	False Color Composite
GIS	Geographic Information System
GPS	Global Positioning System
GZDCTGA	Guraghe Zone Department of Culture Tourism and Government Affairs
INSA	Information Network Security Agency
KII	Key Informants Interview
RS	Remote Sensing
SNNPR	Southern Nations, Nationalities and People's Region
SPSS	Statistical Package for Social Sciences
TM	Thematic Mapper
UN	United Nations
UNCHS	United Nations Human Settlements Programme
USGS	United States Geological Survey
UTM	Universal Transverse Mercator

Abstract

This study attempted to analyze the factors affecting the escalation of informal settlements in Wolkite town. The study also explores the land use land cover changes of the study area for the last 30 years, i.e. 1984-2014. Both primary and secondary data were used for the purpose of this study. Landsat image of 1984 and 1999 and SPOT image of 2014 were used to detect the changes in LULC and analyzed through ArcGIS 10.3 and ENVI 4.7. Qualitative and quantitative data were also systematically analyzed using SPSS software. In addition to these participatory mapping as an approach of PRA (Participatory Rural Appraisal) techniques were used to locate the different land use classes before and after 1994 (the year where the first urban land lease law was enacted in Ethiopia). The empirical findings revealed that the nature of settlement is determined by a combination of factors such as monthly income of respondents, previous residence, occupation and mode of accession of respondent's current holding. Forest coverage shows a continuous decrease from 19.39% in 1984 to 11.6% in 1999 and 5.9% in 2014. On the other case, built-up experiences a dramatic increase with three time intervals; it was 14% in 1984, 26.11% in 1999 and 26.7 in 2014. The area covered under crop land had also experienced an increase in volume; i.e. from 31.87% in 1984 to 38.7% 1999 and 32.9% in 2014, unlike the decrease in the area of grass-land from 34.7% in 1984 to 24.15% in 1999 and increased to 34.4% in 2014. Broker's agitation, the unresponsive nature of the municipality, costly nature of the formal lease law and the question of ownership of the town are another causes of informality mentioned by informants in the study area. Empirical observation by the researcher revealed that informal settlements are expanded alarmingly in the study area with the expense of the nearby agricultural fields and the effects are witnessed in the town causing disorganized infrastructures and spontaneous network of villages. Therefore, the municipality should revise its procedures and control the spontaneous expansion of settlements.

Keywords: Informal Settlement, Land use change, Participatory Mapping and Wolkite town

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Urban sprawl refers to the migration of a population from populated towns and cities to low density residential development over more and more rural land. The end result is the spreading of a city and its suburbs over more and more rural land. In other words, urban sprawl is defined as low density residential and commercial development on undeveloped land. Most of the time, people will move from these areas to try to find better areas to live (CEF,n.d).

Together with the process of globalization, though urbanization is considered to be and related to civilization and development; it will result negative consequences like Concentration of Poverty, poor health, loss of rural heritage and open space, environmental pollution and other social problems like crime and destitution when it comes to its sprawl.

Today, 54% of the world's population lives in urban areas, a proportion that is expected to increase to 66 per cent by 2050 (UN, 2014). Projections show that urbanization combined with the overall growth of the world's population could add another 2.5 billion people to urban populations by 2050, with close to 90 percent of the increase concentrated in Asia and Africa(UN, 2014). Yet, the speed and scale of urbanization brings challenges. Demands for housing, basic services, functional transport systems, and jobs continue to surge. And as cities fail to keep pace with the rapid urbanization, informal settlements grow (UN, 2014; Konishi, 2015).

The world's urban population is expected to surpass six billion by 2045. Much of the expected urban growth will take place in countries of the developing regions, particularly Africa. As a result, these countries will face numerous challenges in meeting the needs of their growing urban populations, including for housing, infrastructure, transportation, energy and employment, as well as for basic services such as education and health care (UN, 2014).

In Africa currently 40% of the population lives in urban areas. This figure is expected to reach 54% by 2030, meaning that the urban population of the continent would likely triple over the

next 40 years, from the current 340 million to some 900 million people. A marked phenomenon of rapid urbanization in Africa has been the proliferation and uncontrolled spread of so called spontaneous or informal settlements (UNCHS, 2009, cited in UN, 2014).

Only about 20% of the East African people reside in urban areas and the rest living as agrarian or pastoral rural communities. The rate of urbanization, however, is more than 3.5 percent on average, which is very high. The core reasons for this fast urban population increase can be: rural-urban migration - looking for better lives, and natural growth. That means, urban areas of east Africa have to be able to serve the hugely flocking immigrants and the rapidly increasing total population. In principle, while East African cities struggle to serve their booming inhabitants, the environmental as well as socioeconomic problems should not be induced. In clearer words: settlement and housing should be in a planned manner, land and surface waters should not be contaminated, transport and mobility have to be safe, social security issues should not be compromised, and economic problems should not be exacerbated (Tamrat, 2011).

Ethiopia is among those countries which have been characterized as having high rate of urbanization. Rapid urban growth is occurring in Ethiopia, a country least able to cope with the resultant pressure on jobs, services and the like. The urban population will grow from about 12.7 million in 2007 to 14.4 million in 2010, and 29.8 million in 2030 (Admit , Bacry and Sileshi, 2009). Despite of the fast rate of urbanization, there are also informal settlements increasing from time to time. It will have adverse effects on the environment, socio-economic wellbeing of urban dwellers more than the bad image of the town under development.

This paper is focused on the analysis of spatial and temporal land use land cover change dynamics and the causes and consequences of informal settlements in Wolkite town by using GIS and remote sensing technologies.

1.2 Statement of the Problem

Established in 1912, Wolkite town is expanding alarmingly. However, the town does not have a master plan until today, only it has structural plan. According to the report of Wolkite Town Municipality Department of Land Development there are 3436 informally established built ups until 2012. In addition to this in 2015 (from February up to May), there were about 450-500 built

ups which were marked as informal settlements and decided to be demolished by the town municipality (Interview, Manager of Wolkite Town Municipality, Jan.2016).

The researcher tried to observe a number of informal houses built here and there inside the agricultural fields around the suburbs of Wolkite town. They haven't any infrastructure; disorganized and complex network of electric wires looks the suburb a "refugee camp". The town is expanding in its four directions, illegal land transactions especially the agricultural fields are becoming new villages without formal plan.

Informal settlements are housing units that are constructed without compliance of current planning and building regulations. The underlying reasons why informal settlements exist are poverty, population growth, urbanization, land scarcity and environmental hazards (Getalem and Yewew, 2014). In informal settlements, most of the houses have been built by the families who occupy them (ibid). They also mentioned that lack of good governance and unresponsive nature of municipalities can be the cause for escalation of informal settlements. Therefore, such type of unplanned and uncontrolled urban expansion may have an impact on the socio-economic well-being of the society in particular and the environment at large.

Despite large amount of studies performed on urban sprawl in developed countries, few studies have been conducted on reasons and influential factors affecting urban sprawl in developing world. Besides these, the causes of informal settlements and adverse effects are rarely researched. Recently many research papers are done on c

hange detection especially on land use land cover changes. For instance, (Sayeh, 2014), have examined the characteristics of urban expansion and land use and land cover change and its effects on the land tenure security situation of the suburb population. (Tahir, Imama and Tahir, 2013) studied about consequences of urban sprawl on agricultural land loss, environmental impacts of urban land use land cover changes was also studied by (Bamlaku, 2009). Therefore, to the best of the researcher knowledge, urbanization impacts of escalating informal settlements and the forthcoming causes and the effects are not well researched in Ethiopian urban centers.

The focus of this paper is to assess the spatial and temporal land use and land cover changes and to identify the causes and consequences of increasing informal settlements by taking Wolkite town as a case study.

1.3 Objectives of the Study

1.3.1 General objective

The overriding objective of this paper is to assess the status of the escalating informal settlements and the consequent urban sprawl in Wolkite town.

1.3.2 Specific Objectives

More specifically, the study aspires to:

- Analyze the spatiotemporal land use and land cover changes occurred in Wolkite town and its suburbs based on GIS data and satellite imagery for the previous 30 years.
- Investigate the determinant factors for the escalation of informal settlements and urban sprawl.
- Assess the consequences of informal settlements and urban sprawl in the study area.

1.4 Research Questions

The following questions are answered in this study,

- What are the drivers for escalation of informal settlements in suburbs of Wolkite town?
- What are the consequences of informal settlements in the study area?
- Which LULC type shows a considerable change?
- What are the measures taken by the town municipality to mitigate housing demands and the issue of informality?

1.5 Scope and Limitation

Spatially, this study is delimited to Wolkite town and conceptually it focuses on studying the determinants of urban sprawl and causes and effects of informal settlements in the area. The

most important factors contributing for the escalation of informal settlements in the study area are investigated in this study.

The limitation which faces the researcher during undertaking this study includes unavailability of satellite images of the study area with high resolution. It was impossible to get satellite imageries with different periods. The researcher contacts INSA (Information and Network Security Agency of Ethiopia), CSA (Central Statistical Agency) and EMA for purchasing different time period satellite imageries of the study area. Finally, SPOT (2014) of the study area image has been found from EMA and purchased but the rest two offices refuses to give the data even though there was a formal letter written from Jimma University declaring that the purpose is academic one.

Later on, the researcher tried his best level to reduce this problem. The option was downloading Landsat 1984 and 1999 images from USGS website. However, there were still problems during image classification due to less accuracy problem of Landsat imageries. Another limitation was the bureaucratic nature of municipality officials to give adequate and appropriate data. Low acquaintance of regular individuals with the issues of land use and land cover change and the subjectivity of the issue and its hotness may be another challenge which may affect the output and quality of the study.

1.6 Significance of the Study

Understanding the patterns of urban sprawl can aid natural resource planning, natural resource utilization, and the provision of infrastructure facilities. Besides this, analysis of the spatiotemporal land use and land cover change dynamics is very important aspect of GIS which indicates the trend of land use and land cover change, what are the most important determinants of land use and land cover changes occurred in the past, the present and what it will be in the future. In addition to this, it shows the rate of change during the previous years through matrix analysis. Therefore, besides knowledge transfer, this study will be very helpful for developmental planners, environmentalists, policy advisors and activists to design appropriate interventions in the future land use land cover pattern in the study area and to improve the urban sprawl in controlling informal settlements. The output of the study will benefit the local

community in the study area with interventions which will be done by planners, environmentalists and or concerned government bodies.

1.7 Ethical Consideration

The researcher is informed about and assured that this research work did not have any purposes other than academic one. In order to ensure the confidentiality of data collection and to keep the right of the respondents the following ethical protocols in a research is a must, especially when the research subjects are humans. Therefore, to assure these things, the researcher asked the willingness of the respondents before beginning to give questionnaire or conducting an interview. Based up on their permission the researcher has oriented them or informs the respondents about the objectives and aim of the research and letter of confirmation for conducting the research (from Jimma University) was shown for them. He also promised to the subjects not to disclose their names in any part of the report.

In addition to the above ethical conduct for human subjects ethical considerations applied in this study includes acknowledging the works of others during citation and referencing. Accordingly, the researcher acknowledged the owners of information whenever it is taken from books, journals, websites, articles and other sources including the information gained from Key Informants Interviews.

1.8 Organization of the Study

This thesis is organized in to five chapters. Chapter One is about introduction which contains the general background of urban sprawl and informal settlements, statement of the problem, objective, research questions, significance, scope and limitations of the study and ethical considerations. Chapter Two contains review of related literatures or conceptual frameworks. Socio-economic and demographic nature of the study area and research methods are discussed in Chapter Three. Results and discussions are presented in Chapter Four, and the last chapter, Chapter Five is all about conclusion and recommendations. Relevant appendices like, budget breakdown, time framework and questionnaire are also attached at the end of this document next to the references section.

CHAPTER TWO: REVIEW OF RELATED LITERATURES

2.1 The Concept of Urban Sprawl

There are many definitions given by scholars for urban sprawl. However, there is no consensus on the definitions; some scholars define urban sprawl from the point of view of pro urban development while others define it against urban development. The following are some of the definitions for urban sprawl.

In simpler words, as population increases in an area or a city expands to accommodate the growth; this expansion is considered as sprawl. Usually sprawls take place on the urban fringe, at the edge of an urban area or along the highways (Mishra, *et al*, 2010).

It has also been defined in terms of associated causes: urban sprawl is generally believed to result from poorly planned, large-scale new residential, commercial and industrial developments in areas not previously used for urban purposes Zhang 2001, (cited in Almeida, 2005). The above two definitions of urban sprawl are for instance pro urban development and con urban development respectively. Therefore, the concept of urban sprawl is becoming a little bit confused.

Simon *et al* (2013) cited in Dadras *et al* (2014) argued that urbanization has vital influence both on the abiotic environment and the living organisms of the cities land use change generate new patterns of urban sprawl. They identify eight separate dimensions of urban sprawl including concentration, density, continuity, proximity, centrality, clustering, nuclearity, and mixed uses.

Concentration is a degree of development which is inappropriately located in an area less than 1 square mile from whole city area. The process of urban growth in these circumstances is completely asymmetrical and sprawl. Density is also another dimension of urban sprawl identified by Simon *et al* (2013). In urban growth field, density is determined in three forms: building density floor area ratio (FAR), which is the buildings floor area to the size of piece of land where it is built, net residential density (number of dwellings divided by residential land area in that region), and gross residential density (population of a region divided by area of the whole land of that region). Developable lands, where construction is performed, located in the proximity of urban fabric zone are determined by continuity measure.

Proximity is a measure which defies various land uses which are near each other all over the urban region, whereas centrality is a measure specifying residential and nonresidential developments (both of them) which are close to central business district (CBD) of an urban region. Clustering is a measure of development demonstrating the minimum land area in each mile which is capable of being developed and occupied by residential and nonresidential land uses.

Nuclearity is the value which defies expansion limit of an urban region using single core development pattern (in contrast with multicore pattern). Finally, mixed use is a sign of specifying different land uses to one small area. Considering the aforementioned characteristics, unbalanced urban sprawl is a serious threat for sustainable urban development. Thus, urban expansion models such as smart growth are presented which try to damp and inverse increasing trend of destructive environmental effects using eight aforementioned dimensions.

Urban growth studies in most aspects concentrate on big cities and metropolises. Nevertheless, medium and small urban regions may possess maximum urban growth rate in a specific time interval from their establishment time (Dadras *et al.*, 2014).

2.2 Urban Sprawl and Urban Growth

As urban growth occurs, that growth is often confused with urban sprawl. However, there is a distinction between urban growth and urban sprawl. Cities often experience growth either physically, by population, or by a combination of both. Urban sprawl is much more complicated because it may or may not qualify as urban growth. How a city grows can create the appearance of sprawl. Such urban growth may appear as a low density leapfrog pattern, a linear or strip development pattern along highways, or a tightly condensed pattern of new development around pre-existing built-up landscapes Nechyba *et al* 2004 (cited in Almeida, 2005). Almeida argued that urban growth may have more of a planned appearance while the pattern of sprawl often appears awkward, uncontrolled, and haphazard.

2.3 Urban Sprawl and Population Growth

Recent urban development processes in developing countries differ from trends of development in developed countries. Whereas for example many big European cities experience processes of stagnation or even population decline, most cities in the developing world gain population at very rapid rates. In contrast, the least developed countries' population figures are projected to double until 2040 (Hill and Lindner 2010).

Hill and Lindner (2010) calculated the rate of urbanization based on the 2004 UN data, and assured that Urbanization in developing countries is largely fuelled by rural-to-urban migration and increasingly natural growth of the urban population. In future, Africa is projected to be the only continent where population growth will take place in both urban and rural areas. The UN project an increase in urban growth for all continents between 2003 and 2030. Rural growth is only assumed for Africa (24.6%) and Oceania (20.1%) for the aforementioned timeframe. Africa is projected to have a growth of 127.4% in urban areas, followed by Asia which will experience a growth rate of 79.7% (Hill and Lindner, 2010 calculations; based on UN, 2004).

2.4 Informal Settlements

Informal settlements are human habitats but without formal license, lease, and the tenants pay rent to unofficial property owners (Onyekachi, 2014). Informality is reinforced where the state is not able to accomplish the applicable law. Nevertheless, there is a difference between informality and illegality since informal activities are not necessarily illegal. In fact, some informal activities like building a house, providing services or founding an economic enterprise rather contribute to achieve central concerns of a democratic legal system (De Soto, 1992: 44 cited in Hill and Lindner 2010). The failure of the state can be caused by insufficient financial and personnel public capacities, an inadequate legal framework or administrative system, the behavior of public services, etc. which result in an insufficient capability to respond to public demands like public housing or supply of surveyed and serviced plots.

As many urban residents are poor they cannot afford to participate in the formal housing market. Some of them even cannot afford housing at all. Therefore, most of population growth is “absorbed into informal settlements” (World Bank, 2002: 7 cited in Hill and Lindner 2010).

2.5 Causes of Informal Settlements

Urban centers across Africa and other developing countries are growing rapidly both demographically and spatially. The process of urbanization is accompanied by the erosion of the existing local peri-urban land tenure relations and emergence of new and urbanized form of man to land relationships both within the legal framework formally and outside the legal framework informally (Achamyeleh, 2014).

There are different reasons given by researchers for the escalation of informal settlements in Ethiopia. The UN-Habitat, 2011 cited in Achamyeleh, (2014) identified that insensitiveness of the formal land and housing supply with the urban land lease and condominium housing development program for the poor is the major reason for proliferation of new informal settlements in the peri-urban areas.

In most developing countries, poor economic performance caused by both internal and external factors have led to the growth of informal settlements in the outskirts of urban areas parallel to the formal one. Informal settlements provide cheap accommodation and economic opportunities for a large part of the population meaning that these settlements respond both to housing needs and to the search of economic activities.

Poverty and homelessness are also the causes for the emergence of informal settlements in urban areas as stipulated by (Onyekachi, 2014).

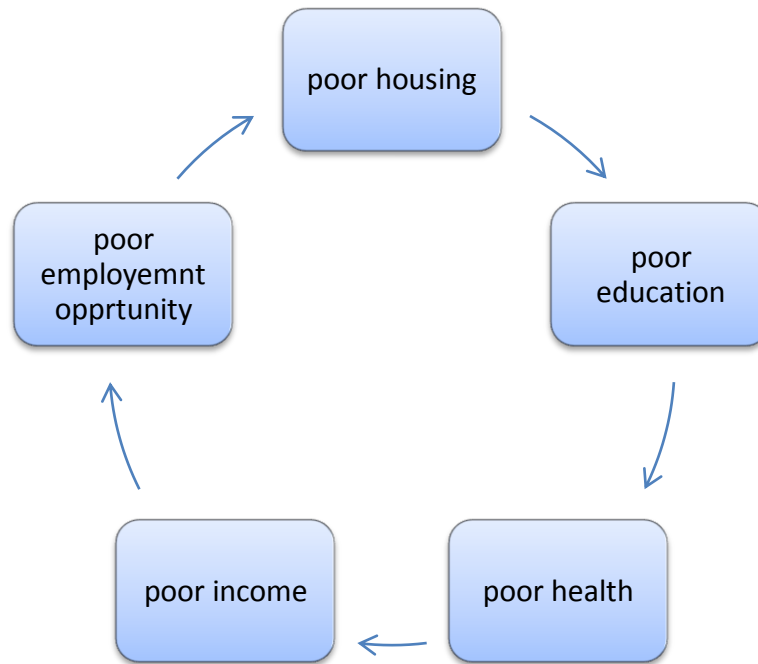


Figure 2.1: Vicious Circle of Informal Settlements (Source: Onyekachi ,2014)

2.6 Characteristics of Informal Settlement

References to illegality in human settlements refers mainly to conformity with planning and construction norms and, more importantly, to tenure situations (Lasserve, 2006). Besides these, informal settlements have some socio-economic and environmental features in common. Onyekachi (2014, p.423) listed out the following characteristic features for informal settlements.

Economic & Financial: People with very low incomes and no obvious economic power occupy the informal settlements. They are not attractive to the regular investor who seeks a handsome return on investment. The issue of urban poverty in Nigeria as exemplified by the situation in Abuja being the administrative center of Nigeria has, been aggravated by high rate of rural urban migration tied with the inability of the urban areas to create jobs for the immigrants.

Socio-Cultural Features: Informal settlements create their own ways of life that are typical for that kind of community. There is harmony and comfort with the circumstances. People have made friends. Upgrading would disrupt a set pattern of life, since it will call for evacuation, displacement, relocation, and new neighborhoods.

Land Tenure: Land tenure refers to the rights of individuals or groups in relation to land. It often involves a complex set of rules. Some users may have access to full use and transfer rights. Other users may be more legally limited in their use of these resources, which illustrates both the diversity of rights to land and the existence of a wide range of options, from full ownership to less singular forms of possession and use (Lasserve, 2006). The land unused or no longer in use for long periods is easy targets for settlement for the homeless. Informal settlements spring upon these lands.

Environmental Condition: In many parts of the world millions of people live in informal urban settlements especially in developing Nations where lack of resources and inadequate infrastructural facilities lead to degradation of the environment. Environmental degradation, inadequate basic services, and infrastructure in these areas are on the increase. Deteriorating environmental conditions populate poverty. Presently these areas in Abuja reflects the embodiment of the contemporary decay of urban life as evident in the standard of living, congested apartments, degraded environment, crime, among others.

The Structures and Social Amenities: in informal settlements most structures are temporary, made of mud walls and roofs or mud walls and grass or other roof covering. Very few are more permanent, in concrete walls and occasionally tiled with no formal approval for building. They also lack social amenities like cinemas, theatre.

Infrastructure: There usually in some cases, no electric power, no piped waters in the house, no roads, no sanitation, no drainage and other services. The residents organize their own vigilante groups. Similarly, the residents themselves organize one of the other social infrastructures. They build their own churches, mosques, and dispensaries.

2.7 Urbanization in Ethiopia

Urbanization is a historical phenomenon in Ethiopia. In previous periods, i.e. prior to 20th century, the factors that contribute to the growth of urbanization in Ethiopia include the establishment of central government, the introduction of modern means of transport and communication, schools, hospitals and modern business, Ethiopia's contact with the outside world and the establishment of large number of industries and organized farms as intensified process of urbanization in Ethiopia (Muluneh, 2003, cited in Bisewur, 2014). Therefore, pull

factors in urban centers like social amenities were important in attracting people towards them unlike the current trend of urban sprawl through expense of agricultural lands.

Urbanization in Ethiopia is accompanied by rapid urban sprawl, resulting in a transformation of agricultural land into urban land (Fransen 2008, cited in Sayeh, 2014). This fact can also be assured from what is being practically observed in different towns and cities of the country. Besides of the horizontal expansion of the major cities, many new cities are also emerging in different parts of the rural areas of the country. So, urban areas in Ethiopia are expanding at fast rates at the current situation and this expansion is deemed to be more even in the future (Sayeh, 2014).

In the 2007 census the term urban center, or urban, is defined as all administrative capitals (region, zone and *woreda*) and localities in which urban *kebeles* were established, irrespective of their population size. It is worth noting that this definition of urban is consistent with that of the 1994 Population and Housing Census (CSA, 2007).

2.8 The Urban Land Lease Policies Review in Ethiopia

Land is of great economic and political relevance in Ethiopia. It is a public resource or means of production as it is decided the 1993 urban land law and 1997 rural proclamation. These laws were amended in 2002 and 2005 respectively but the government ownership of land is unchanged, but use rights of holdings are recognized: private individual; communal, in rural areas; and condominium, in urban areas.

In December 1994, the constitution approved land under the control of the people and government of Ethiopia thus prohibiting land selling (EPA, 1997, cited in Bamlaku, 2009) lease law was enacted in 1994 and revised in 2002. The main goal of the 2002 lease law of Ethiopia was to promote lease system, collect lease payments so as to address infrastructure demands of the city dwellers; to address housing problems of the city by providing lease holding to capable private dwelling houses; to encourage investments so as to alleviate economic and social problems of the city and to ensure fairness (justice) in administrating urban lands.

Accordingly, three types of land lease processes. These are; land lease on auction basis for investment and residence exceeding 175 m², land lease without auction potential for investment and land lease for residence (73 -175 m²).

The urban land lease proclamation in Ethiopia fails to deal with formalization of informal residential holdings. In addition, the Condominium Proclamation No. 370 2003 document provides clear rules regarding the management of the building, but it lacks clarity regarding the rights to the land beneath the common property. Apart from condominium holdings, there is no legal recognition of communal holdings such as green areas, forestland, playing fields, and so forth in urban areas, although such holdings exist and are identified in urban plans (Deininger, Selod, and Burns, 2012).

Though informal settlements account for up to 30 percent of residential holdings in Addis Ababa, no policies or procedures require the systematic regularization of informal holdings. In fact, formalization projects have no basis in federal legislation, and the few sporadic initiatives to formalize existing settlements (in Addis Ababa, Dire Dawa, and Hawassa) were very costly and of a discretionary nature. Established by ad hoc municipal directives, they lacked transparency and were discontinued without reaching their targets (ibid).

2.9 Land Use and Land Cover Changes

Land use and land cover change of a given area refers to the change of socio-economic factors and their utilization across time and space (Mishra *et al*, 2010).

Changes in land use and land cover can have wide-ranging environmental consequences. These include loss of biodiversity, changes in emissions of trace gases affecting climate change, changes in hydrology and soil degradation. Moreover, changes in land use and land cover can influence the vulnerability of people and places to environmental problem by, for example, influencing the spread of infectious diseases, interfering with the migration of species and affecting the risk of natural hazards (Meyer and Turner 1992). The transformation process creates several problems through the expansion of urban land use at the expense of food production. Losses of agricultural land to other uses were undoubtedly substantial in developing countries. In the world with limited food supplies the loss of farm land development is a series of concern (Khan, 1900, cited in Bisewur, 2014).

2.9.1 Change Detection Studies in Urban Areas

GIS makes it possible to incorporate diverse physical, biological, and human elements, and to forecast the size, shape, scale, and dimension of land use parcels (Longley et al, 2004).

2.9.2 Participatory Mapping

The term participatory mapping, as it is used in LULC change detection, is defined broadly as any combination of participation-based methods for eliciting and recording spatial data. Specific examples include sketch mapping, scale mapping, and transect walking, among others (Chambers 1994; World Bank 1996 cited in Vajjhala, 2005). The task is emphasizing the involvement of the community in mapping the real nature of the area. The goal of this work is to develop a medium for participation that retains the elaborated information storage and consolidation capacities of GIS while simplifying and tailoring the graphic display to different audiences using elements and attributes of traditional mapping (Vajjhala, 2005).

Participatory Rural Appraisal (PRA) technique was used in this regard as pointed out by Musungu, especially to highlight the land use land cover classes and to determine the informal and formal built ups. Studies on the sourcing of community data in formal urban areas generally allow for less interaction with the actual households compared to rural and informal settlements. This is because, in the case of formal areas, data is readily available from various sources, such as health facilities, flood reports as well as land use and insurance registers (Musungu, et al, 2012).

2.10 The Literature Gap

There are a number of research works done on land use land cover change detection, change dynamics, the effects of this dynamism on the environment and on the specific LULC types. Urbanization as one of the socio-economic process which is more facilitated and promoted due to globalization and technological transfer is also one of the focus of researchers, especially its effects on the suburbs, socioeconomic amenities and other issues demands investigation and research work.

The effects of informal settlements and urban sprawl on the environment and the suburb agricultural areas had been studied by many researchers nationally and internationally. The cause

of informal settlements and urban sprawl however is unfound and rarely searched. The standards for being informal are not strictly mentioned by any scholar. The practice to mark settlements as formal and informal is also a little bit subjective. Houses having title deeds and master plan are considered to be formal and deemed to have access for infrastructures like water, electricity and road in some towns. But in other case houses with no title deeds and master plan are sometimes considered as formal and have owned infrastructures mentioned above.

2.11 Conceptual Framework

Informal settlements and urban sprawl is increasing from time to time as a result of globalization, urbanization, and migration and population growth. These are however a broader socioeconomic process of changes and experienced gradually. The conceptual framework can be explained by figure 2.2.

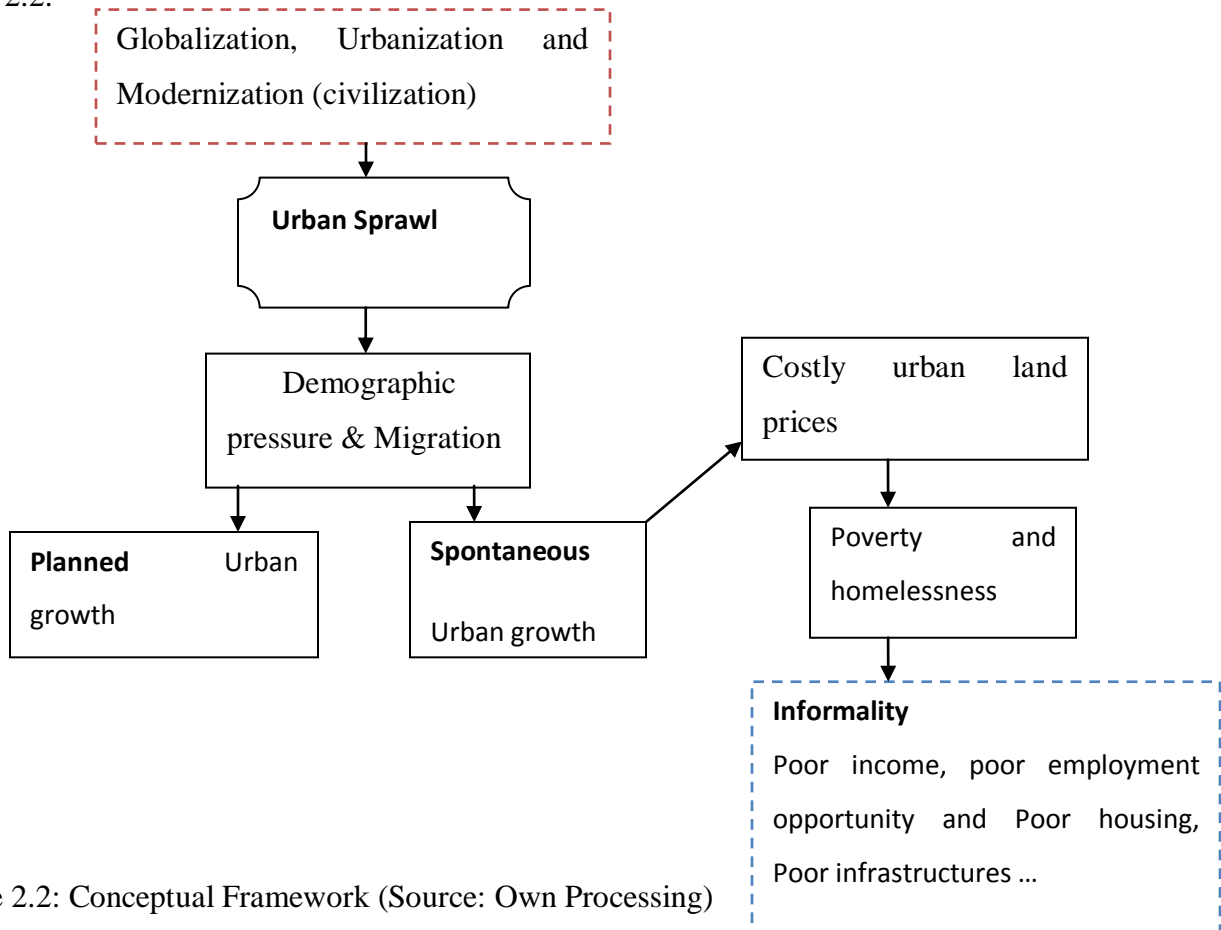


Figure 2.2: Conceptual Framework (Source: Own Processing)

The conceptual framework shows that urban sprawl includes broader things, the formal and the informal expansion of urban area can be referred in it. Therefore, as a result of globalization and industrialization urban centers are expanding more than ever. The socioeconomic factors like pull and push aspects of migration, employment and income issues are also other factors that leads to urban sprawl. The point is the spontaneous urban growth (the informal one) leads to different social and economic problems in urban areas.

Demographic pressures and increasing migration as a result of push and pull factors leads to the expansion of towns. Since rural urban migration is mentioned by scholars contributing to be the cause for urban sprawl in most of the developing countries. Therefore, the sprawl can be of two types, i.e., the planned urban growth and the spontaneous one (the unplanned expansion). The unplanned expansion of towns as a result of demographic pressures and migration is manifested through costly urban land prices, poverty and homelessness, poor infrastructures and destitution generally.

CHAPTER THREE: DESCRIPTION OF THE STUDY AREA AND RESEARCH METHODS

3.1 Description of the Study Area

3.1.1 Physical and Geographical Overview of Guraghe Zone

According to the data gained from GZDCTGA (2012), Guraghe zone is situated in the northern tip of SNNPRS, and covers an area of 5932 thousand sq. km. Among the 14 zones and 4 Special *Woredas*, in the region, Guraghe is the one. It is bounded with Hadiya Zone in the south, Silti in the East, Oromia Region in the North and South East and Yem Special *Wereda* in the west.

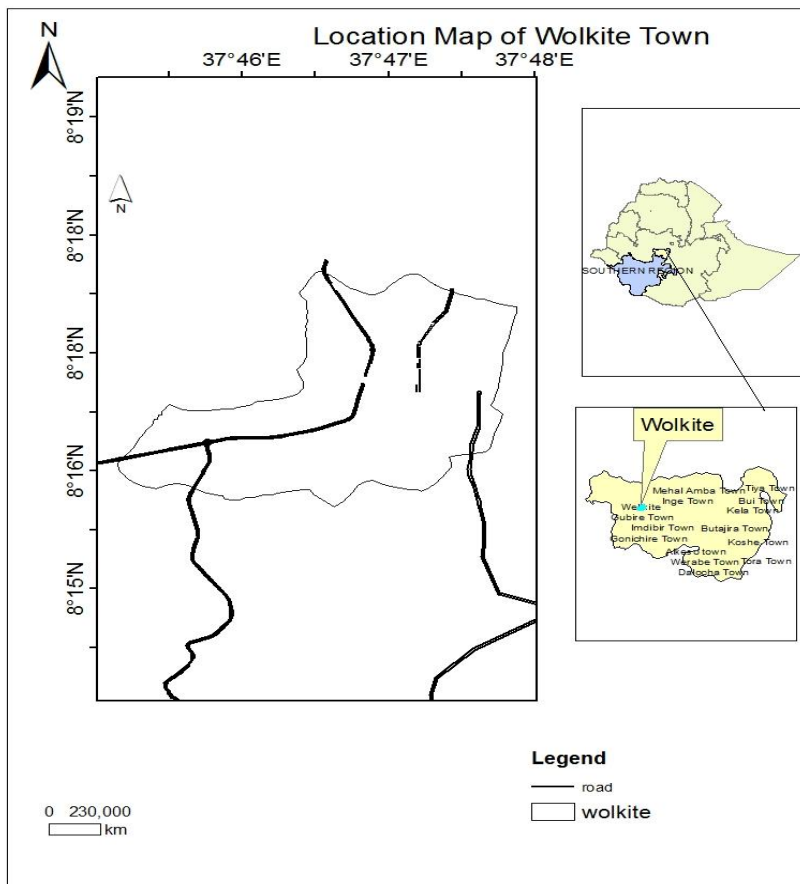


Figure 3.1: Location Map of the Study Area (Own Processing, Ethio GIS, 2004)

In addition, the zone is divided into 13 *woredas* (districts) and 2 reform city administrations. These include Soddo, Meskan, Mareko, Kebena, Abeshge, Gedebanogutazerwellene, Cheha, Ezda, Muhirnaaklile, Gumer, Geta, Enemornaener and Endegagn *woreda* as well as Wolkite and Butajira city administration. Wolkite is the administrative center of the zone which lies 155 km south west of Addis Ababa and 430 km from Hawassa, the capital of the region.

The zone has three agro-ecological zones; *dega* (35%), *weynadega* (62%) and *kola* (3%). The annual average temperature of the zone ranges from 13°C to 30°C and the mean annual rainfall ranges from 600-1600 mm. Considering the land utilization, 52% of the total area is a cultivated land, 13.4% is a grazing land, 9.9% is a natural and man-made forest land, 7.3% unproductive land and the remaining 17.6% is covered by others.

The zone has resource potential exploitable for the development of agriculture, such as floriculture, high land fruits and for establishing agro-based industries, such as chip wood and fiber processing factories from *enset*. In view of the fact that the high land dwellers of the zone are acquainted with the growing of *enset* crops that could be a potential raw material source for fiber processing factory. Wolkite town is the administrative and trading center of the zone. It is one of the nineteen towns opted as a hub of development in the region (SNNPR, 2011).

3.1.2 Wolkite Town

There is no exact written information about the establishment of Wolkite town. But there is a belief that it was around 1912. Still some of them said that the town was established before the mentioned period and it was served as one of the transitional centers for the long distance trade across Ghibe. The nomenclature was given by Abba Jiffar the II, the then king of Jimma kingdom. When he was traveling to Addis he got in to rest in Wolkite which then was believed to be the center given as *wolquitumaa* in Affan Oromo by the king (Wolkite Town Administration, 2014).

The town has a municipality since 1943 and Ato Yirga Abebe was the first mayor. There is a belief that the total area of the town during this period was only 3 hectares. Wolkite town was then served as the capital of Gorro *Woreda* and Cheha Awraja during the emperor Haile Selassie and the *Derge* regime respectively. Currently, the town is the capital of Guraghe zone under SNNPR regional administration (ibid).

3.1.2.1 Geographical Location of Wolkite Town

The town is located at a distance of 158 km south -west of Addis Ababa between 8^o16' N- 80 18'N latitude and 37^o45'E- 37^o 48'E longitudes. Its proximity to Addis Ababa Jimma, and Woliso town is a good opportunity for the future development of the town. The town is structured in to six *kebeles*, namely; Gubre 01 and 02, Edget Ber, Addis Hiwot, Edget Chora, Menharya, Seba Kuteba and Selam Ber. Wolkite has access road that links the town with Addis Ababa, Jimma, Woliso and Hossaena towns (Ethio-GIS, 2004).

It is among the few towns in the region that has good infrastructure facilities such as, hydropower electricity, pipe water supply, modern telephone, banking facilities, educational, health and other services. To promote the investment of the private sector in industrial investments an industrial zone has been demarcated and facilitated (SNNPR, 2011).

3.1.2.2 Demographic Conditions

According to Guraghe Zone BoFED projection the total population of the town during 2013/14 was 42812. Among these 8241 of them were households. The percentage of female population was 21116 (49.3%) and that of male was 21696 (50.7%).

Table 3.1: Population of Wolkite Town in 2013/14

<i>Kebele</i> Name	Number of Households			Number of Family		
	Male	Female	Total	Male	Female	Total
Selam Ber	560	580	1140	1470	1640	3110
Edget Chora	478	678	1156	3384	5389	8773
Meneharya	449	351	800	2719	2735	5454
Gubre	650	719	1369	1983	2032	4015
Edget Ber	780	896	1676	3490	6360	9850
Addis Hewot	900	1200	2100	3650	7960	11610
Total	4238	4952	8241	21696	21116	42812

Source: Own Processing Based on the Data Gained from Guraghe Zone BoFED, 2015

3.1.2.3 Agro Climatic Conditions

The average altitude of study area is found to be 1480m above sea level. Teff, cheak pea, beans, sorghum, oil seeds, maize and chilli are the most important crops which are cultivable in the suburbs of Wolkite. The average annual rainfall and temperature of the study area for the year 2015 is found to be 27.08 mm and 30⁰c respectively (Guraghe Zone BoFED, 2015).

3.2 Research Methods and Materials

3.2.1 Research Approach

Mixed sequential research design was employed which enables the investigator to use both quantitative and qualitative data because they are important to provide the best understanding of a research problem and answer research questions. It also opens the door to multiple methods, different worldviews, and different assumptions, as well as to employ different forms of data collection and analysis methods. It employs strategies of inquiry that involve collecting data either simultaneously or sequentially to best understand research problem. The data collection also involves gathering both numerical data (e.g., on questionnaires) as well as text information

(e.g., on interviews and observation) so that the final database represents both quantitative and qualitative information (Creswell, 2003).

According to Creswell, (2003) this research design enables the researcher first to conduct quantitative research, analyzes the results and then builds on the results to explain them with qualitative research. It is considered explanatory because the initial quantitative data results are explained further with the qualitative data. It is considered sequential because the initial quantitative phase is followed by the qualitative phase. This type of design is popular in fields with a strong quantitative orientation (hence the project begins with quantitative research), but it presents challenges of identifying the quantitative results to further explore and the unequal sample sizes for each phase of the study. The following synergies of methods were used in this study.

3.2.2 Spatial Data Acquisition and Processing

For this study, topographic map and multi-temporal images of Wolkite town was used. Images including TM of 1984, ETM+ of 1999 and SPOT of 2014 for Wolkite town were acquired from image of USGS and EMA. The year 1984 is selected purposively to review the nature of urban sprawl in Wolkite town during the Dergue regime and to compare with the current government (FDRE). 1999 and 2014 years are taken also purposively to analyze the urban sprawl for the last 30 years (1984-1999).

Overlay of these three time period satellite images was done after resampling to compute the change detection matrix. Resampling technique enables the images to have the same resolution so that accurate classification and change detection can be made. The resolution of the first Landsat images is found to be $30\text{m} \times 30\text{m}$ and for the SPOT one it becomes $5\text{m} \times 5\text{m}$.

The 1:50,000 topographic maps of the study area was scanned, georeferenced and projected to UTM coordinate system, map zone 37^0 N of clack 1880 spheroid and Adindan datum. The satellite images were georeferenced to topographic map. Then the study area was clipped from satellite images after doing image classification.

The most important steps followed in the laboratory work includes georeferencing of topographic map, delineation of *kebeles*, clipping the study area, satellite image enhancement, band composite, supervised land use classification and change detection matrix.

3.2.3 Methods for Image Processing

3.2.3.1 Pre-processing

Image preprocessing, also called image restoration, involves the correction of distortion, degradation, and noise introduced during the imaging process. This process produces a corrected image that is as close as possible, both geometrically and radiometrically, to the radiant energy characteristics of the original scene. Radiometric and geometric are the most common types of errors encountered in remotely sensed imagery (Lilles and Kiefer, 1994). Pre-processing is done before the main data analysis and extraction of information.

Distortions occur for many reasons. For instance distortions occur due to changes in platform attitude (roll, pitch and yaw), altitude, earth rotation, earth curvature, panoramic distortion and detector delay. Most of these distortions can be modeled mathematically and are removed before you buy an image. Changes in attitude however can be difficult to account for mathematically and so a procedure called image rectification is performed. Satellite systems are however geometrically quite stable and geometric rectification is a simple procedure based on a mapping transformation relating real ground coordinates, say in easting and northing; to image line and pixel coordinates (Kumar, 2010).

3.2.3.2 Haze Correction

During recording spectral reflectance, atmospheric effects on energy illumination from ground features or geometric distortion can be built up due to high altitude, etc. So the image should be corrected from these distortions. Therefore, the different time period images of Wolkite town were checked on anomalies caused by this energy interaction in the atmosphere.

3.2.3.3 Image Enhancement

Image enhancement is used in order to increase the details of the image by assigning maximum and minimum brightness values to maximum and minimum display values, and it is done on pixel values. This makes visual interpretation easier and assists the human analyst. Histogram equalization is done on the images, where enhancement assigns more display values (or ranges) to the frequently occurring portions of the histogram.

3.2.3.4 False Color Composite (FCC)

Band selections were made in order to obtain the most important information from remotely sensed data through the analyses of reflectance properties of objects or features. Spectral reflectance curve of the different vegetation types of the area and the histogram behavior of the bands were used for the purpose of image processing of SPOT satellite images through ENVI 4.7 software. Band 4, 3 and 2 were layer stacked to generate land use land cover dynamics.

To increase the visual interpretability of the satellite images and the amount of information that can be visually interpreted from the data both True Color Composite (TCC) and False Color Composite (FCC) was produced. Digital image enhancement techniques such as contrast stretching and band ratios were done. The major information of land use/land cover types of the study area at different time periods were extracted from Landsat satellite imageries. In addition bands 6, 7, 5 were composited since it is useful to identify Urban/rural boundaries.

The most important steps to be followed in the laboratory work includes georeferencing of topographic map, subset study area, satellite image enhancement, band composite, supervised land use classification, change detection matrix and participatory mapping.

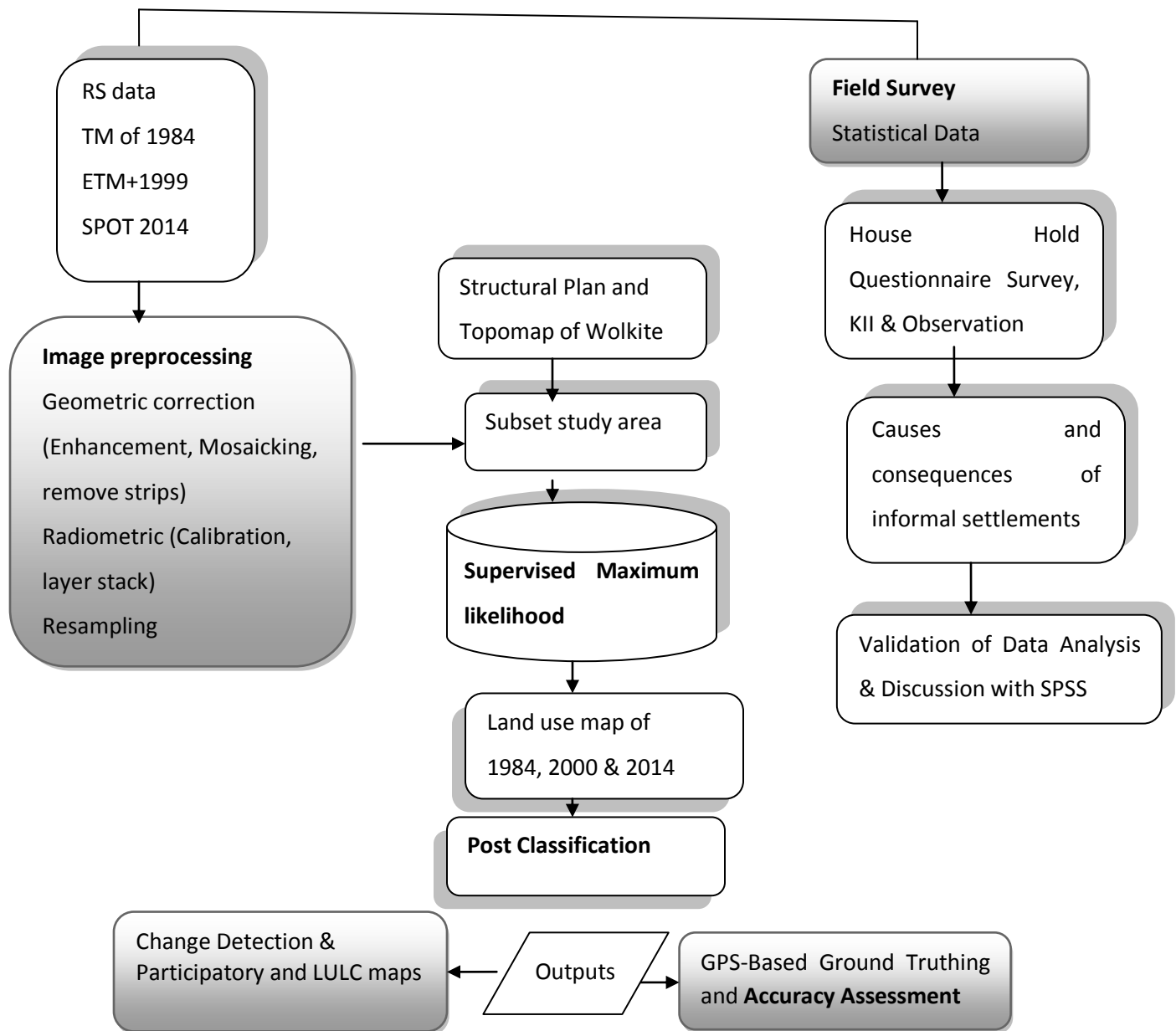


Figure 3.2: Methodological Flow Chart(Followedby the Researcher)

More specifically, in the preprocessing stage the 1984 TM and 1999 ETM+ data were first calibrated. Calibration is one type of radiometric correction methods to enhance the quality of the satellite images through converting the image's Digital Number (DN) which in the range of

0-255 to image Reflectance Value. To do this ENVI 4.7 image classifier software was used. The Meta data shows that the 1984 image has 30m × 30m resolution, acquired from USGS (April12/2016) with datum WGS-1984, UTM, Zone 37 North projection and the sensor type was landsat7 ETM+. The path and row number was 169 and 54 respectively.

In the 1984 image, Bands 1-7 were used for calibration, but to reduce noise and disturbance in the image band 6 is not included in the calibration. Then layer stack was done to ease classification. Unsupervised classification (ISO DATA) was done prior to the supervised classification to know the number of classes able to generate from the map.

Calibration for the 1999 image was done with 8 bands; band 6 and band 8 were excluded in the calibration to avoid noise and disturbance in the image. Then layer stacking was done before running unsupervised maximum likelihood classification.

3.2.4 Image Classification

Unsupervised classification was used for delineating land use classes. It is important to identify the number of land uses so then it aids the supervised classification.

Maximum likelihood supervised classification algorithm was used since it assist in the classification of overlapping signatures; pixels are assigned to the class of highest probability. In addition, according to IDRISI Guide to GIS and Image Processing (2010) it is the most sophisticated, and is unquestionably the most widely used classifier in the classification of remotely sensed imagery.

To increase the visual interpretability of the satellite images and the amount of information that can be visually interpreted from the data both True Color Composite (TCC) and False Color Composite (FCC) were produced. Digital image enhancement techniques such as contrast stretching, band ratios and haze removal were done. The major information of land use/land cover types of the study area at different time periods were extracted from Landsat satellite imageries.

The type of land use classes which are identified in this study includes: forest, built-ups, crop land and open land. Forest refers the land under natural, tree cover with good canopy cover, it includes all forest plantations. Forest is available in south and south western part of the study

area. Built-ups are land use types referring residential, commercial or other types of buildings, settlements and construction of any type. Crop land is another class identified which refers to different agricultural crops. Open land is the type of land use that is open and no activities are underway. It may also include, barren lands, reserved areas for future expansion etc.

For the purpose of accuracy assessment, a total of 200 points (50 per each class) were collected through GPS. Then accuracy assessment was calculated through cross checking the collected points with the classified image.

3.2.5 Socio-Economic Baseline Supplementary Data

As indicated earlier the research design that was employed in this paper is explanatory sequential mixed research design. Therefore, in addition to the laboratory based GIS data, some socio-economic quantitative and qualitative data were generated by using survey questionnaire and key informant interviews.

Household Questionnaire Survey: among the most important data collection tools which were used in the undertaking of this research include household questionnaires survey. Therefore a total of 267 respondents were addressed by questionnaire. The survey used was self-guided questionnaire and conducted by two enumerators. The reason for employing self-administered questionnaire was due to the speculation that most of the residents in the suburbs are not be able to read and write.

Both closed and open ended questions were prepared to address the objectives of the study. The questionnaire was prepared in English and interpreted in to Amharic. In addition to the socio-economic characteristics of the informally settled people emphasis was given to the causes and consequences of informal built ups. Half day training was given for two data enumerators before going to the field.

A total of 15 key informants, 10 local community members and 5 officers from zonal land administration offices and the municipality were also addressed. Field observation by the researcher was also used as another method of data collection. GPS recorder, photo camera, video camera, note books and other tools were employed in this research.

Selection of sample households for the questionnaire-based survey was based on simple random sampling technique from the *kebele* sample frame. But there was no sample frame prepared by the *kebele* authority; therefore, the researcher used serpentine method of listing households. This method is based on the spatial existence of respondents and very important to adequately represent villages (Messay, 2013).

3.2.6 Participatory Mapping

Since it is impossible to easily detect informal settlements with satellite imageries due to resolution problems participatory mapping is needed to show the intensity of informal settlements at different year intervals. It was aided by GPS, the data from the town municipality, interviewing the local people especially elders and also observation by the researcher himself.

3.2.7 Techniques of Sampling and Sample Size

Both purposive and simple random sampling techniques were used to select the *kebeles* and respondents respectively. The first step was selecting *kebeles* purposively based on the severity of increasing informal settlements in the area. Then respondents from each selected *kebele* were selected based on the sample frame prepared by the researcher through geographical listing or serpentine fashion.

Therefore, as preliminary pilot study and informal interview with the residents and municipality authority shows that informal settlement is serious in one of the *kifleketemas* (sub-city) in Wolkite town. Meneharya *Kebele* from Addis *kifeleketema* is selected on the severity of the problem and the existence of many informally established built ups compared to the other areas.

The total number of households resided in this *kebele* is around 5525. Among these, the number of households settled in Meneharya *Kebele* in 2014/15 is found to be 800 according to the report of the town municipality (2016). The reason for not including those settlements (households) built before 2014 is that they are decided to be legal (especially those informal settlements) by the SNNP region urban land proclamation 2014 (No. 4).

Therefore, the sample size was determined as follows by using Yemane (1967) sample size determination formula. With $e = \pm 5\%$ precision value, N refers, number of total population = 800.

$$n = \frac{N}{1+N(e)^2}$$

Where, N= total population

e= margin of error (0.05)

n= sample size

$$\text{Therefore, } n = \frac{800}{1+800(0.05)^2}$$

Sample size (n) = 267

3.4 Techniques of Data Analysis

The collected socio-economic data was analyzed through SPSS and image analysis was done by ENVI 4.7 and ArcGIS software. The following methods of data analysis were carried out in this study.

3.4.1 Regression Analysis

Binary logistic multiple regression model was used to present the results of the data and to show the relationships between and among different dependent and independent variables. This model was selected because the dependent variable is discontinuous dichotomous one and there are both continuous and discontinuous independent variables. Households nature of settlement (0: informal settlement, 1: formal settlement) is a dependent variable. The following are explanatory variables which are identified to have a determinant factor on the dependent variable.

X₁: Age of the respondent

X₂: Respondents' monthly income

X₃: Household size of respondent

X₄: Educational status of respondent (0: Not read and write, 1: Read and write)

X₅: Response of municipality to formal land access requests from respondents (0: No, 1: Yes)

X₆: Residential landholding size of respondents in m²

X₇: Broker's agitation on respondents to buy informal land (0: No, 1: Yes)

X₈: Previous residence of respondent (0: Outside Wolkite, 1: Wolkite)

X₉: Occupation of a Respondent(0: farmers, merchants and unemployed, 1: civil servants)

X₁₀: Respondents accession of their current holding (0: Buying from farmers, 1: Lease holding, 2: Gift, 3: Non-lease municipal holding)

3.4.2 Hypothesis

The selected 10 explanatory variables can be putted in a regression formula like

$$Y = \beta X_1 + \beta X_2 \dots \beta X_{10} \text{ (when all are significant)}$$

Where, Y is the dependent variable

β : is the constant and

X :is the explanatory variables

Therefore, it is possible to draw the following hypothesis,

H₀: $\beta_1 = \beta_2 = \beta_3 = \dots \beta_{10}$: There is no linear relationship between predictors and the dependent variable

H₁: $\beta_1 \neq \beta_2 \neq \beta_3 \neq \dots \beta_{10}$: At least one predictor determines the responsive variables

3.4.3 Land Use Land Cover Change Analysis

The three times period images of the study area (TM of 1984, ETM⁺1999 and SPOT of 2014) were first classified through computer automated unsupervised (ISO data) method in ArcGIS 10.3 software and ENVI 4.7 classifier. It was this unsupervised classified image that was analyzed during the preliminary field visit and aid the subsequent supervised classification. Moreover, during preliminary field visit, representative points in the study area, which believed to represent the existing various land use/land cover category were recorded using GPS. This is also important to make ground truthing and accuracy assessment at the end of classification. Then, the different period images were classified using supervised classification method in Maximum Likelihood parametric rule.

3.5 Data Validity and Reliability

Validity is important in determining whether the statements in the questionnaire instrument and interview manuals are relevant to the study. Content and construct validity were obtained by the

help of the advisors. Reliability aimed at testing for how reliable were the instruments to the study (i.e. ability of instrument to test for the same results over time). To ensure reliability the researcher carried out different tasks during and before data collection. Before data collection, the enumerators given a half day training by the researcher on how to approach respondents, how to convince them to give adequate data and informed not to promise anything for the sake of gaining data. The researcher himself was also tried his best level to get accurate and reliable data during the interview and self-completion questionnaire session.

In order to assure the validity and reliability of the data, especially during satellite image classification, the researcher collected ground truth points accuracy assessment has been done. Moreover, the researcher undertook a pilot survey prior to the actual implementation of the questionnaire to prove legibility, formatting/typesetting and logical sequences of the questions for actual survey. The researcher also avail himself in friendly and good interpersonal relation with research subjects to extract reliable data in case of qualitative data collection procedures such as KIIs and during self-completion questionnaire.

CHAPTER FOUR: RESULTS AND DISCUSSIONS

In this chapter the results of the LULC data are discussed and presented supported with three time periods satellite imageries. The most important Statistical tool used in the socio-economic data is binary logistic multiple regressions. Household's nature of settlement (formal and informal settlement) is a dependent variable having ten independent variables. Infrastructural overview of the study area, participatory mapping of the study area with two time periods i.e. before and after 1994, spatial and temporal land use land cover change of the study area and consequences of informal settlements are the issues that are discussed in here explicitly. The year 1994 is chosen since it was the period where the first urban land lease law was enacted in Ethiopia and the aspiration is to know whether there are any changes in the extent of informal settlements or not in the study area.

4.1 Socioeconomic Characteristics of Respondents

In this sub section socio-economic feature of respondents like age, sex, marital status, educational background, respondents' family size, settlement nature and occupation of respondents are presented in tables and graphs.

4.1.2 Age of Respondents

The average age of respondents was found to be 41. This indicates that most of them are in adolescent stage. Hence, they are thought to be responsive and the possibility to obtain accurate data is maximum.

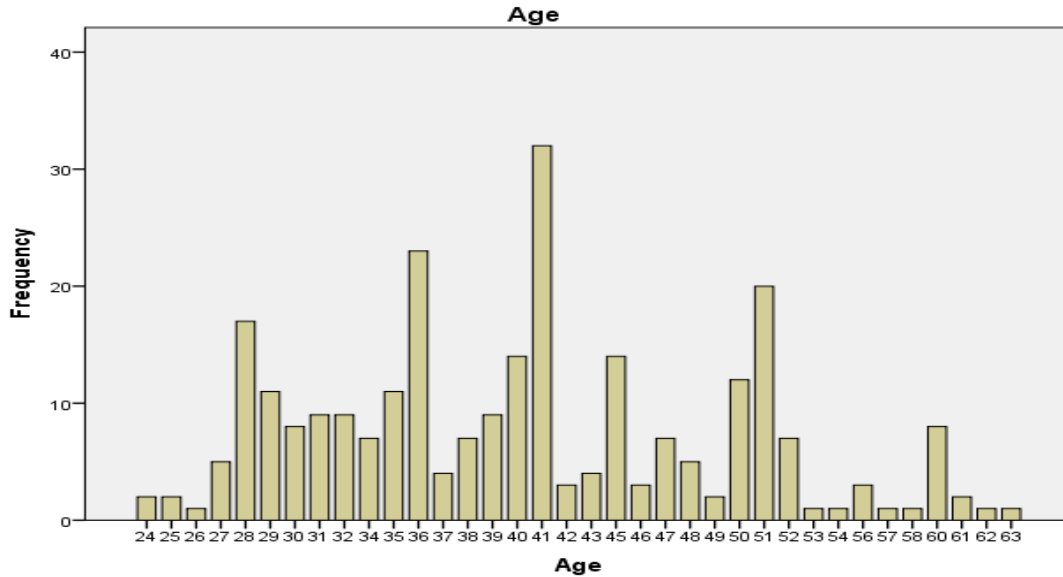


Figure 4.1: Age of Respondents (Source: Household Survey, March, 2016)

According to the above figure, the age range of respondents is between 24 and 63. This shows that they have long life experiences and believed to have knowledge on the informality and related problems in urban areas.

4.1.3 Sex of Respondents

Both male and female respondents were contacted during data collection. Therefore, out of 267 total respondents, 166 of them were males and the remaining 101 of them were females.

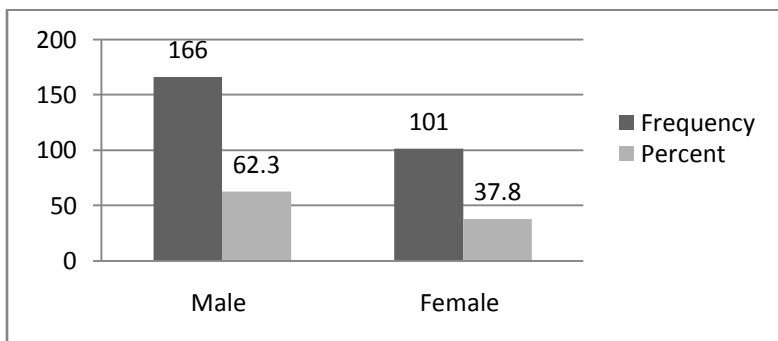


Figure 4.2: Sex Compositions of Respondents (Source: Household Survey, March, 2016)

According to the above figure 4.2, 62.3 % of the respondents were males and the rest 37.8 % of them were females.

4.1.4 Marital Status of Respondents

Out of 267 total respondents, 217 (81.6%) of them were married and the remaining 49 (18.3%) of them were singles.

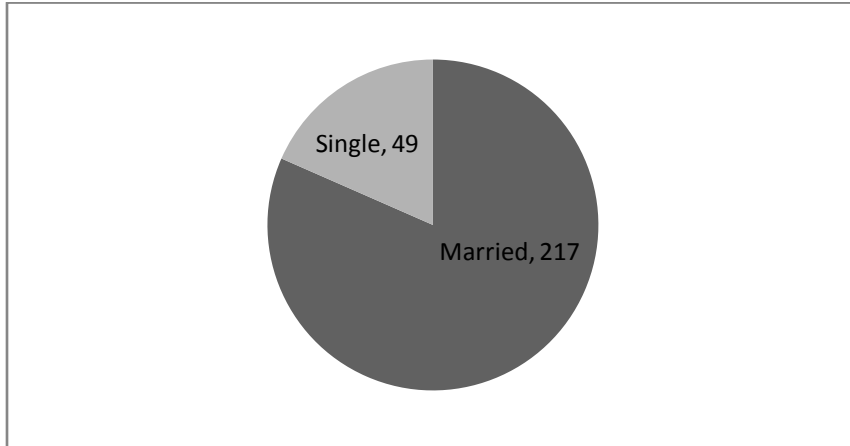


Figure 4.3: Marital Statuses of Respondents (Source: Household Survey, March, 2016)

4.1.5 Educational Background of Respondents

Among the total of 267 respondents 167(62.5%) of them can read and write while the remaining 100 (32.5%) of them cannot read and write.

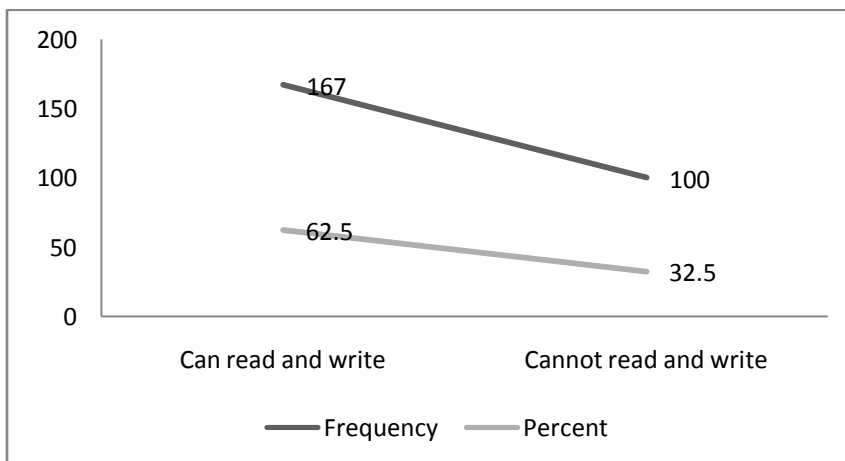


Figure 4.4: Educational Backgrounds of Respondents (Source: Household Survey, March, 2016)

The purpose of aggregating educational background of respondents in to two, those who can read and write and those who cannot is due to the interest of the researcher to analyze the extent of informality between these groups. Besides this, there is an assumption that literate sections of societies are engaged in construction of informal houses compared to the illiterates. The reason as it was explained by key informants from the town municipality is due to the fact that they can understand the lease policy, update information and speculate the loose regulation of municipality in the study area. In addition they know the law gap and intervene easily than those illiterate sections of communities.

4.1.6 Respondents' Family Size

The average size of family of respondents was found to be 2.27 (2 children per family in average). This does not include parents, but the number of children per family. In general the frequency and the respective percentage of number of family of respondents are shown in the following figure 4.5.

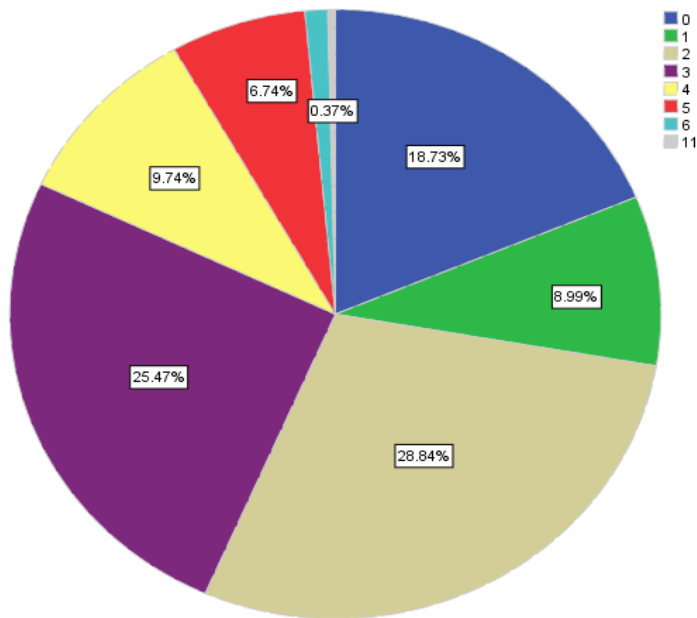


Figure 4.5: Respondents number of children (Source: Household Survey, March, 2016)

As it is revealed in the above figure, 28.8% of the respondents have a family size of 11, 25.5% of them have 6 children, 9.7% of them have 4, 6.7% of them have 5, 0.37% of them have 6 and 8.9% of them have 1 children. In addition, 18.7% of them have no children

As the number of families increases, the tendency to get urban plots of land through formal ways will decrease since it demands additional amount of money and shortage of urban land, this makes the cost of urban lands costly and competitive.

4.1.7 Settlement Nature of Respondents

The nature of settlement was another background information of respondents the nature of settlement. The researcher meets respondents who settled both formally and informally. The annotation however seems subjective, in that the settlers didn't consider themselves as informal but in the eyes of the town municipality, those who had no title deed registration and master plan are informal.

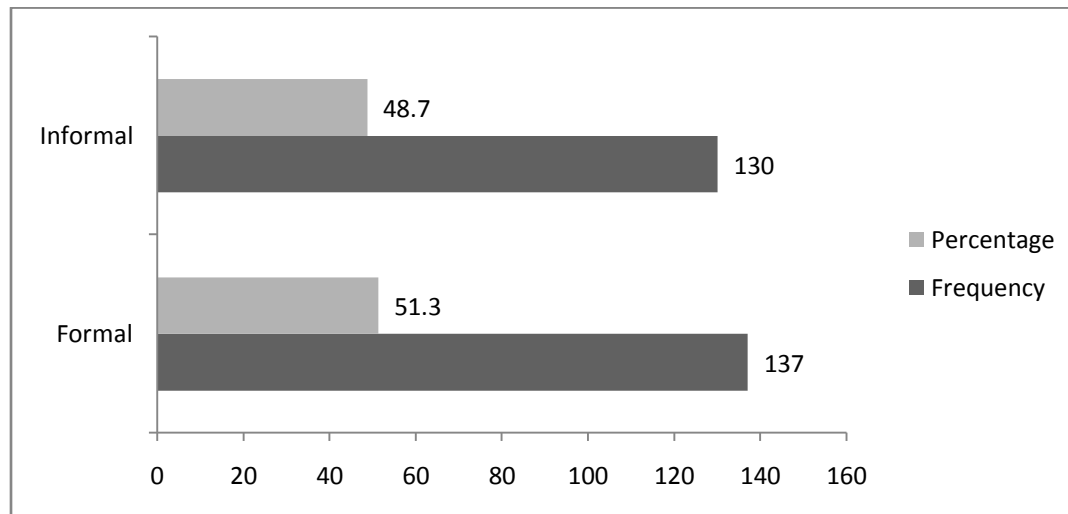


Figure 4.6: Settlement Natures of Respondents (Source: Household Survey, March, 2016)

As revealed in the above figure 4.6, out of the total 267 respondents, 137 (51.3%) of them were formally settled and the rest 130 (48.7%) of them were informally settled respondents.

4.1.8 Occupations of Respondents

This is also another socio-economic characteristic of the respondents which is important to indicate the section of the community involved in construction of informal settlement. Therefore,

the researcher categorize them into two broader groups; civil servants and non-civil servants (includes merchants, farmers and others like unemployed and students who are living in isolation to their parents).

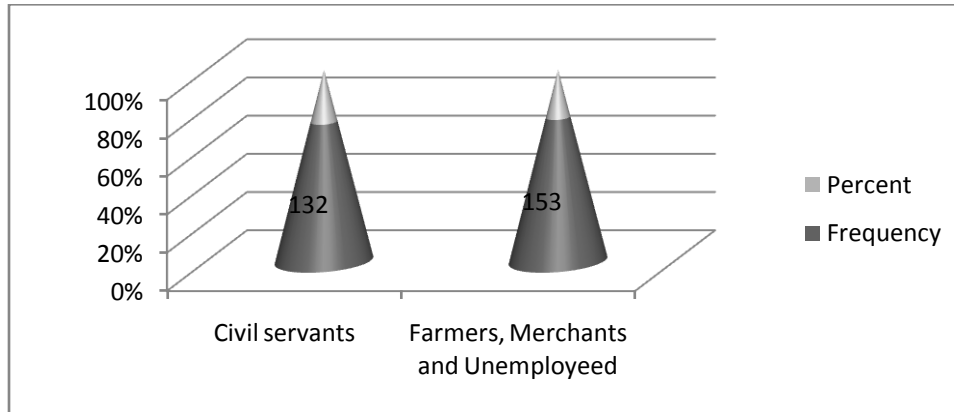


Figure 4.7: Occupational Background of Respondents (Source: Household Survey, March, 2016)

Out of the total respondents 135 (50.6%) of them were non-civil servants while the rest 132 (49.4%) were found to be civil servants.

4.2 Land Use Overview of the Study Area

Wolkite town is the capital of Guraghe zone surrounded with two *woredas* of the zone, namely Kebena and Abeshge. Even though it was established in 1912, there are no as such observed improvements in services and infrastructural developments compared even with the recently established zonal centers. The information obtained from the interview with elders in the town shows that there is ethnic tensions problem over the ownership of the town which resulted in underdevelopment. They explained that the conflict between Kebena and Guraghe society is still occurring here and there in the town. The reason for this according to the informants is Kebenas are claiming that the land where Wolkite town is expanded is on the expense of their agricultural fields. In addition, some Kebenacommunities also explained that they are not equally treated by the town administration.

4.3.1 Land use land cover changes

To quantify the land use land cover change of the study area from 1984 to 2014, Landsat and SPOT images were used. Finally, it was possible to identify four land use land cover classes and their area and their categories are shown in the following maps and tables.

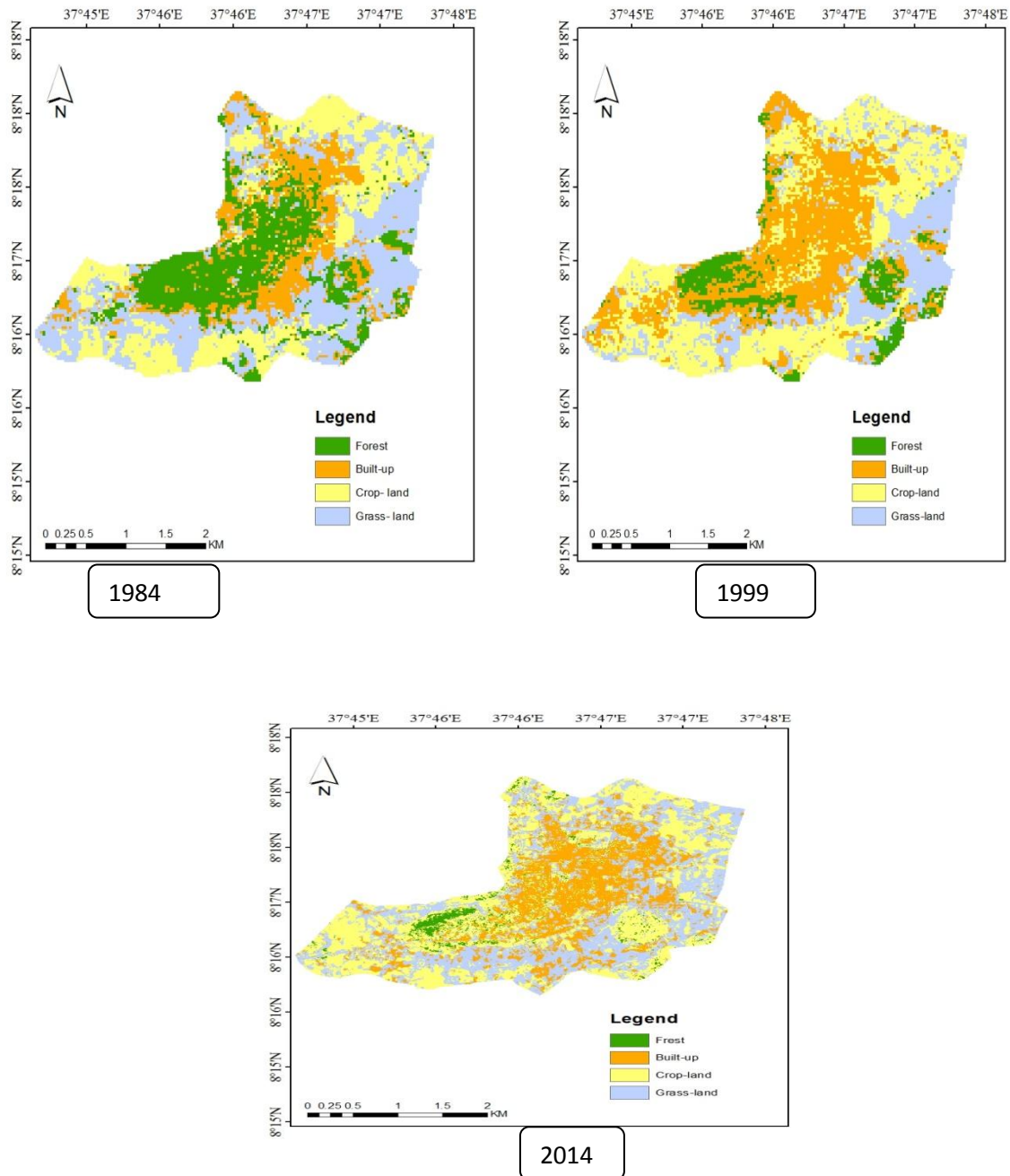


Figure 4.8: Maximum Likelihood Supervised Classification (Own Processing, April 2016)

Figure 4.8 shows the spatiotemporal LULC dynamics of the study area by using different satellite imagery. The maximum likelihood algorithm is employed for classification and five polygons were developed for each identified class. As indicated therefore, the area covered by forest is becoming depleted from time to time whereas; built-up area is increasing in space and time.

4.3.3 LULC Change of Wolkite Town for the Last 30 Years

In this sub-section the LULC change detection is discussed in detail. Area is an important aspect whenever we speak of a change dynamics in a given situation. The area is calculated in hectares (1 hectare equals 100m × 100m). The first step hence was to multiply the number of points with the area of the image (Landsat image, 30m × 30m = 900m²). Then change the result into hectare, this was done by dividing the result with 10,000 m². The area for the 2014 SPOT image of the study area was calculated by considering 5m × 5m resolution.

Table 4.1: Summary of LULC Change of the Study Area for 1984, 1999 and SPOT 2014

LULC	1984			1999			2014		
	Pixels	Area (HA)	%	Pixels	Area (HA)	%	Pixels	Area (HA)	%
Forest	4040	363.3	19.4	2326	209	11.6	1234	111.1	5.9
Built-up	2924	263.2	14	5441	489.7	26.1	5563	500.7	26.7
Crop land	6639	597.5	31.9	8035	723.2	38.6	6863	617.7	32.9
Grass land	7229	650.6	34.7	5030	452.7	24.2	7172	645.5	34.4
Total		1874.88	100		1874.88	100		1874.88	100

Source: Own Processed Based On Satellite Image, Using ENVI 4.7 March, 2016

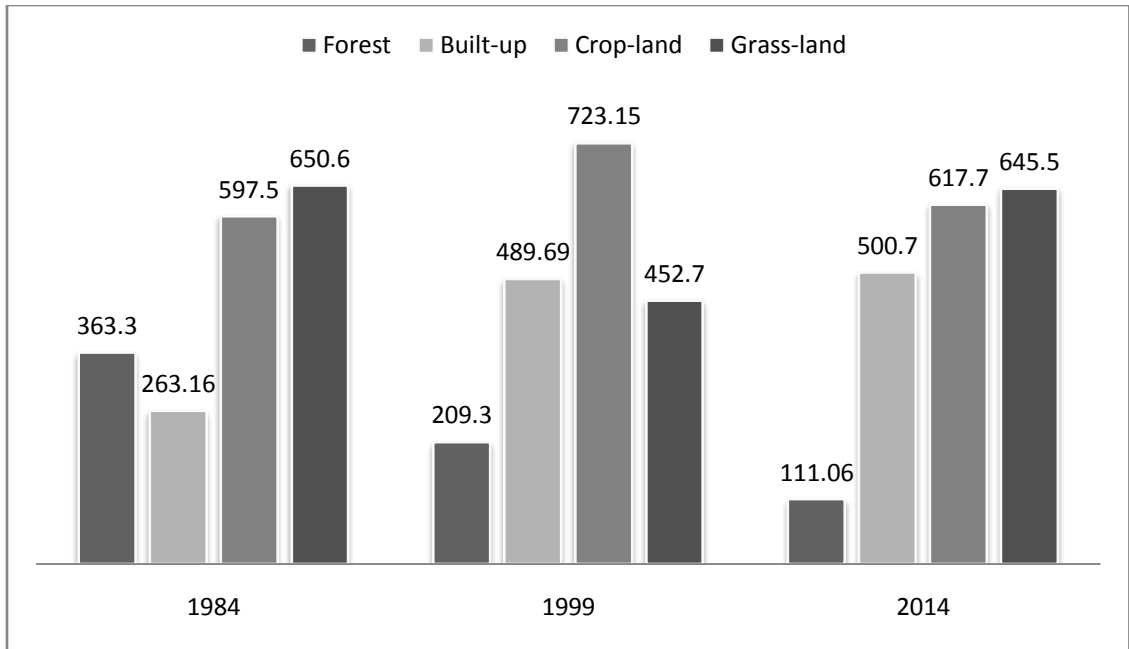


Figure 4.9: Summary of LULC Classes (Source: Own Processing using ENVI 4.7 March, 2016)

Forest coverage shows a continuous decrease from 19.39% in 1984 to 11.6% in 1999 and 5.9% in 2014. On the other case, built-up experiences a dramatic increase with three time intervals; it was 14% in 1984, 26.11% in 1999 and 26.7 in 2014. The area covered under crop land had also experienced an increase in volume; i.e. from 31.87% in 1984 to 38.7% 1999 and 32.9% in 2014, unlike the decrease in the area of grass-land from 34.7% in 1984 to 24.15% in 1999 and increased to 34.4% in 2014.

This shows that the existing forest cover in the nearby town is depleted through time as a result of the expansion of the town and agricultural lands. The increasing trend of grass land from 1999 to 2014 from 24.1% to 34.4% is due to the incorporation of nearby rural *kebeles* to expand the city as a result of the revised urban land lease policy in 2002. Therefore those reserved areas (expansionary areas) are remained grass lands.

4.3.4 Rate of LULC Changes and Trend Analysis

Rate of change of an area can be calculated based on Long *et al.*, (2007) cited in Sayeh (2014) land cover change equation, i.e.,

$$\Delta = (A2 - A1/A1)*100 \dots \dots \dots \text{Equation 1}$$

Where:

Δ = Land cover change (%);

A1 = amount of land cover type in time 1; and,

A2 = amount of land cover type in time 2.

LULC change trend analysis is important to identify the rate of change of LULC per annum. Therefore, it is useful to compare the average rate of change happened in different years of interest. It can be calculated by dividing the rate of change with the number of years where the change happened.

Table 4.2: Summary of LULC Rate of Change and Trend Analysis for different years

	Change 1984-1999			Change 1999-2014			Change 1986-2014		
	Change (ha.)	Rate	(%/year)	Change (ha.)	Rate	(%/year)	Change (ha.)	Rate	(%/year)
LULC									
Forest	-153.9	-42.4	-2.8	-98.3	-46.9	-3.1	-252.2	-69.4	-2.3
Built-up	226.5	86.1	5.7	11	2.2	0.1	237.5	90.3	3
Crop- land	125.6	21	1.4	-105.5	-14.6	-0.9	20.2	3.4	0.1
Grass- land	-197.9	-30.4	-2	192.8	42.6	2.8	-5.1	-0.8	-0.03

Source: Own Processing Using ENVI 4.7, March, 2016

Built-up expanded with 5.7% annual rate on the first analysis period, i.e. the first fifteen years from 1984-1999. This may be attributed with the adoption of the first national urban lease law in 1994. In the same analysis period forest coverage reduced with annual rate of 2.8%. During the second analysis period, 1999-2014 (the second 15 years) built-up area continued to increase with annual rate of 0.1% against the 3.1% annual decrease of forest.

Over the study period, built-up area has been increased by 3 % per annum against 2.3 % and 0.03 % per annum decrease of forest coverage and grass-land respectively. However, the 0.1 % annual increase of crop land is registered through depletion of forest coverage and grass land.

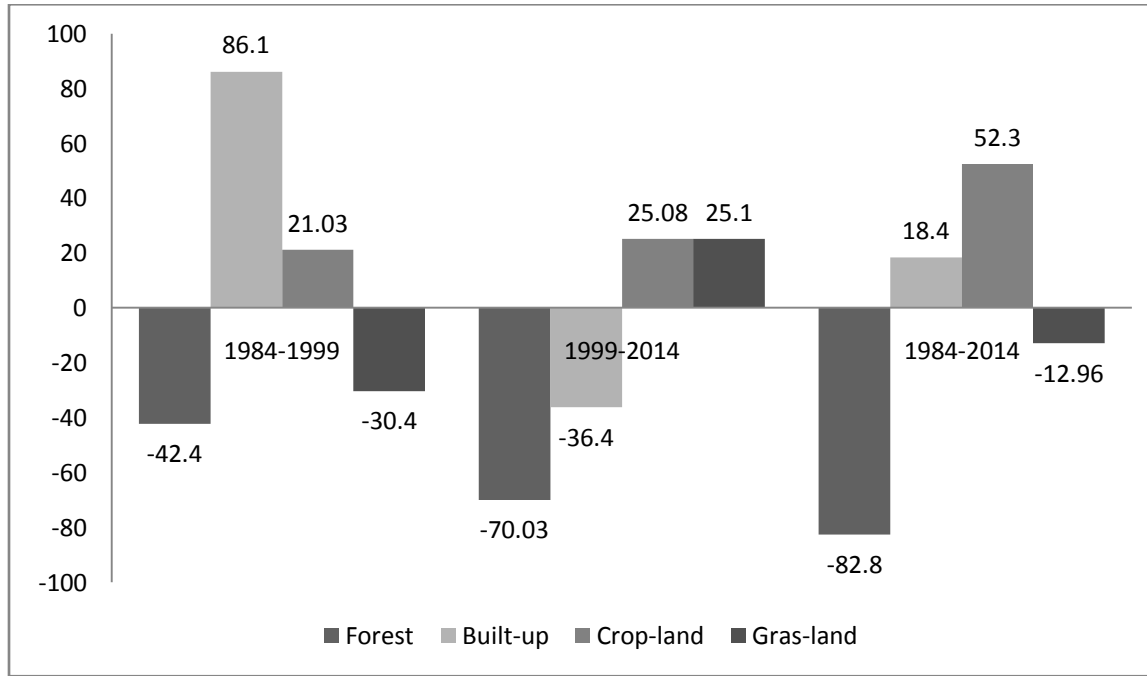


Figure 4.10: LULC Rate of Changes (Source: Own Processing Using ENVI 4.7, March, 2016)

Forest coverage experienced negative rate of change throughout the study period, -42.4%, -70.03% and -82.8% in 1984-1999, 1999-2014 and 1984-2014 respectively. Built-up on the contrary shows a dramatic increase in the first analysis period (1984-1999), with 86.1% but a slight decrease in the second analysis period (1999-2014). This is attributed may be due to the establishment of the first national urban land lease law in 1994. Cropland is in a continuous positive change mainly with the expense of grass-land and forest for the last 30 years. Grassland experienced a negative change in the first analysis period (-30.4%) but increased with 25.1% in the second analysis period.

4.3.5 LULC Change Detection Matrix of Wolkite (1984, 1999 and 2014)

Change detection matrix is important to compare the change in land use land cover changes and to identify which land use or land cover is changed to the specific class under consideration. It

gives a figure where there is foulest land use land cover change since it enables to calculate the rate of change.

Change detection matrix for two consecutive 15 years was calculated from satellite images of 1984, 1999 and 2014. Change matrix for the period between 1984 and 1999 and for 1999 and 2014 is computed from the image analysis as indicated below.

Table 4.3: Change Detection Matrix for Wolkite Town (1984-1999)

	LULC classes	Initial State (1984)									
		Forest		Built-up		Crop land		Grass land		Row total	
		ha	%	ha	%	ha	%	ha	%	ha	%
Final State(1999)	Forest	170.6	46.9	21.9	8.4	0.3	.05	16.5	2.5	208.4	100
	Built-up	164.4	45.2	215.6	81.9	4.5	.8	105.2	16.2	489.7	100
	Crop land	26.7	7.4	20.8	7.9	498.9	83.5	167.7	27.2	723.2	100
	Grass land	18	0.5	4.9	1.8	93.8	15.7	352.3	54.1	452.7	100
	Class total	363.3	100	263.2	100	597.5	100	650.6	100		
	Class change	192.9	53.1	47.6	18.1	85.6	16.5	298.4	45.9		
	Image difference	-	-42.4	226.5	86.1	125.6	21	-197.9	-30.4		
		154.3									

Source: Own Processing Using ENVI 4.7, May 2016

The reduction of forest coverage from 363.3 ha in 1984 to 208.4 ha in 1999 is accompanied by 8.4%, 0.0% and 2.5% by built-up, crop-land and grass land respectively. The boost of built up area from 263.2 ha in 1984 to 489 ha in 1999 is with the expense of 45.2%, 0.8% and 16.25 of forest, crop-land and grass land respectively.

The increasing of crop-land from 498.96 ha in 1984 to 723.2 ha in 1999 is contributed by 7.4%, 7.9% and 27.2% forest, built-up and grass-land respectively. This means built-up and crop land

found to be increasing with the expense of forest and grass-land a little bit. The researchers observation and data gained from key informants interview, especially those residents in the suburbs of the study area witnesses that the nearby agricultural fields and forest areas are changed to settlements.

Table 4.4: Change Detection Matrix for Wolkite Town (1999- 2014)

Final State (2014)	LULC	Initial State (1999)									
		Forest		Built-up		Crop land		Grass land		Row total	
		Ha	%	ha	%	ha	%	Ha	%	Ha	%
	Forest	85.2	40.9	24.1	4.9	0.5	.075	1.1	0.3	111	100
	Built-up	39.9	19.2	259.9	53.5	125.2	17.4	75.6	16.8	500.7	100
	Crop land	39.96	19	130.3	26.8	216.4	30.1	224	49.8	610.4	100
	Grass land	43.6	20.9	71.9	14.8	376.8	52.4	149.3	33.2	641.6	100
	Class total	208.4	100	486.3	100	718.9	100	450.1	100		
	Class change	123.2	59.1	226.4	46.5	502.6	69.9	300.8	66.8		
	Image difference	-9.7	-46.7	14.4	2.9	-108.5	-15.1	191.5	42.6		

Source: Own Processing Using ENVI 4.7, May 2016

The decrease of forest from 208.4 ha in 1999 to 111.06 in 2014 is credited by 4.9%, 0.75% and 0.3% of built-up, crop-land and grass-land. However, built-up experiences an increase from (486.3 ha in 1999 to 500.7 ha in 2014) with the expense of 19.2%, 17.4% and 16.8% of forest, crop- land and grass- land respectively. In addition, the reduction of crop-land from 718.9 ha in 1999 to 610.4 ha is with the expense of 19%, 26.8% and 49.8% forest, built-up and grass-land respectively.

4.3.6 Confusion Matrix

Confusion matrix is important to know how much the maximum likelihood classification was accurate. To do this it is important to collect ground truth point through GPS in each identified class type or it can also be done with ROI (Region of Interest). The first option to calculate confusion matrix is through using ground truth image and the second one is called ground truth with ground truth ROI. The researcher chooses the first option and he collected ground sample

points through GPS. A total of 200 (50 point per class) representative points were collected and the accuracy is found and explained in the table below.

Table 4.5: Summary of Accuracies for Classification of the 1984, 1999 and 2014 Images

LU LC classes	Time								
	1984			1999			2014		
	Producer's	User's	Overall	Producer's	User's	overall	Producer's	User's	overall
Forest	87.07	86.32	87.03	97.86	92.57	91.02	85.62	100	91.55
Built-up	84.95	81.03		76.47	89.04		99.86	86.42	
Crop land	87.59	91.73		90.80	84.04		95.13	95.93	
Grass land	88.03	87.29		63.69	96.30		86.39	84.99	

Source: Own Processing Using ENVI 4.7, April 2016

The overall accuracies for 1984 and 1999 Landsat and 2014 SPOT were calculated to be 87.03, 91.02 and 91.55 respectively.

4.4 Determinants of Informal Settlement in Wolkite Town: Multiple Linear Regression Analysis

Binary logistic multiple regression model was used to present the results of the data and to show the relationships between and among different dependent and independent variables. This model was selected because the dependent variable is discontinuous dichotomous one and there are both continuous and discontinuous independent variables. Households nature of settlement (0: informal settlement, 1: formal settlement) is a dependent variable. The following are list of explanatory variables:

X₁: Age of the respondent

X₂: Educational status of respondent (0: Not read and write, 1: Read and write)

X₃: Household family size

X₄: Occupation a respondent

X₅: Respondents' monthly income

X₆: Residential landholding size of respondents in m²

X₇: Previous residence of respondent (0: Outside Wolkite, 1: Wolkite)

X₈: Respondents mode accession of their current holding (0: Buying from farmers, 1: Lease holding, 2: Gift, 3: Non-lease municipal holding)

X₉: Broker's agitation on respondents to buy informal land (0: No, 1: Yes)

X₁₀: Response of municipality to formal land access requests from respondents (0: No, 1: Yes)

However, it needs to be tested by different hypothesis testing methods like regression and chi square tests in this case. Therefore the following hypothesis can be drawn from the above dependent and independent variable relationships.

4.4.2 Tests of Normality, Linearity and Homoscedasticity

These refer to the assumption about the distribution of scores and the relationships between variables. According to (Stockburger, n.d), in the test of normality we should check the distribution of scores of dependent variables either normally distributed or skewed. Therefore, normal distribution is depicted in a histogram so then the data is ready for further statistical analysis. Linearity test is done in QQ-plot and the residual should have a straight line relationship with the dependent variable scores. In homoscedasticity the variance of residual about predicted DV (dependent variable) scores should be the same for all predicted scores.

4.4.3 Test of Normality

The data should be normally distributed before doing regression analysis and other applications of statistics. The normality test can be checked through histogram or it is called Kolmogorov-Smirnov test (test of goodness of fit).

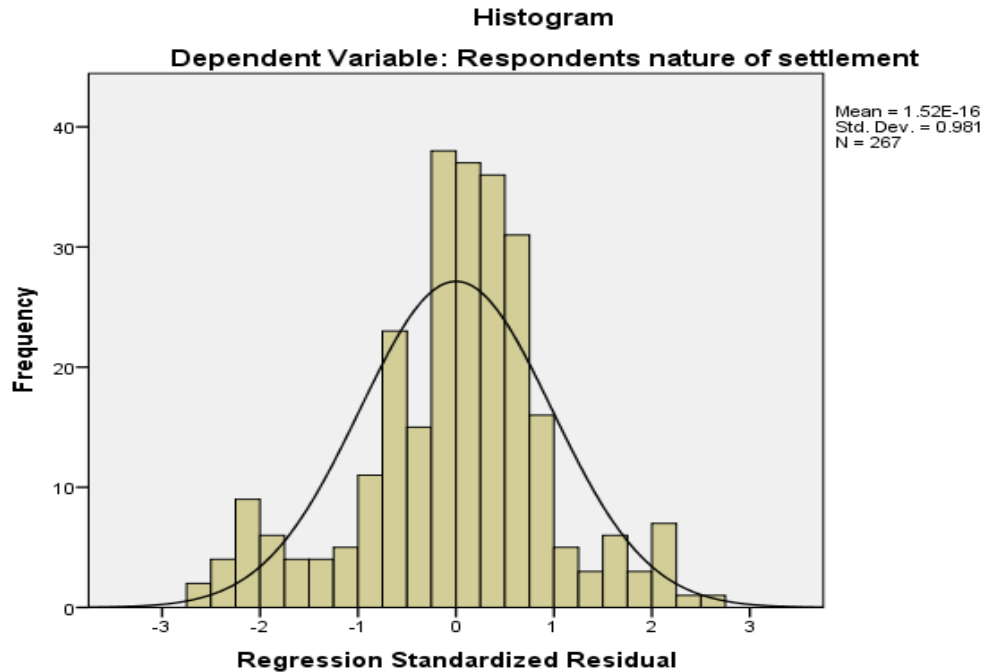


Figure 4.11: Test of Normality (Histogram) (Source: Household Survey, March, 2016)

The bell-shaped trend in figure 4.11 shows that the data is normally distributed, in addition there the gap between standard deviation and the mean is low and this is an indication for normal distribution.

4.4.4 Test of linearity

Test of linearity is also one of the tests that oblige to examine the data before computing statistical models. It measures the presence and absence of outliers in the score. The one that have no outliers is good and fit to further analysis, i.e., without transformation.

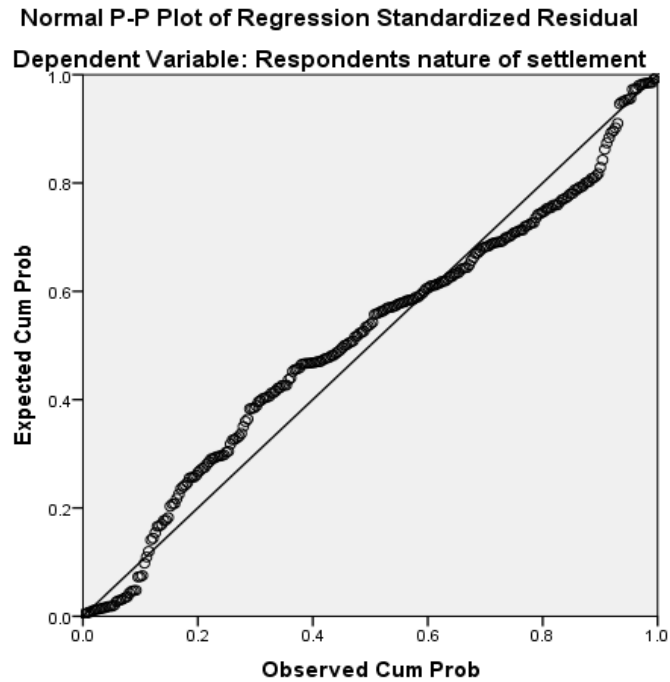


Figure 4.12: Test of Linearity (QQ-Plot) (Source: Household Survey, March, 2016)

As indicated in the above figure, the data is free from outliers and all the values are nearly symmetrical to the diagonal axis. Therefore, the data is ready for further statistical analysis.

4.4.5 Multicollinearity test

Regression assumes that there is little or no multicollinearity in the data. Multicollinearity occurs when the independent variables are not independent from each other. A second important independence assumption is that the error of the mean has to be independent from the independent variables.

Multicollinearity might be tested with 4 central criteria according to Healey (2009):

The first thing is correlation matrix – when computing the matrix of Pearson's Bivariate Correlation among all independent variables the correlation coefficients need to be smaller than 1. The second one is tolerance which measures the influence of one independent variable on all other independent variables; the tolerance is calculated with an initial linear regression analysis.

Tolerance is defined as $T = 1 - R^2$ for these first step regression analysis. With $T < 0.1$ there might be multicollinearity in the data and with $T < 0.01$ there certainly is.

The third criteria is Variance Inflation Factor (VIF which is defined as $VIF = 1/T$. Similarly with $VIF > 10$ there is an indication for multicollinearity to be present; with $VIF > 100$ there is certainly multicollinearity in the sample.

The fourth criteria are Condition Index; it is calculated using a factor analysis on the independent variables. Values of 10-30 indicate a mediocre multicollinearity in the linear regression variables; values > 30 indicate strong multicollinearity.

4.4.6 Test of Homoscedasticity

Test of homoscedasticity describes a situation in which the error term (that is, the “noise” or random disturbance in the relationship between the independent variables and the dependent variable) is the same across all values of the independent variables. In other words it is the condition when error variance should be constant and the variance of the residuals is homogeneous across the levels of the predicted values. Hence, there was no problem of heteroscedasticity in this data and the variances of explanatory variables were found to be constant (Healey, 2009).

4.5 Regression Analysis Results

Binary logistic multiple regression model was computed using one dichotomous dependent variable and 10 possible independent variables. The result of the model is summarized as follows in the table below.

Table 4.6: Omnibus Tests of Model Coefficients

	Chi-square	df	Sig.
Step	175.327	12	.000
Step 1 Block	175.327	12	.000
Model	175.327	12	.000

Source: Own Processing by using SPSS Version 21

Here the chi-square is highly significant ($chi-square=175.3$, $df=12$, $p<.000$) so the model is significant and fit.

Table4.7: Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	194.630 ^a	.481	.642

a. Estimation terminated at iteration number 6 because parameter estimates changed by less than .001.

Nagelkerke's R^2 is found to be 64.2% which means the model explains this much of the variance in the respondent's nature of settlement and correctly classified 84.3% of cases.

Table 4.8: Classification Table

Classification Table ^a					
	Observed		Predicted		
			Nature of settlement		Percentage Correct
			Informal	Formal	
Step 1	Nature of settlement	Informal	109	21	83.8
		Formal	21	116	84.7
	Overall Percentage				84.3

a. The cut value is .500

As indicated in the above table 4.8, formally settled households have correct predictions (84.7%) relative to the informal ones which are 83.8 The overall percentage row in the above table tells that the approach to prediction is correct 84.3% of the time. This is better than tossing a coin.

Table 4.9: Variables in the Equation

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
X ₁ : Age	.013	.024	.289	1	.591	1.013	.966	1.063
X ₂ : Monthly income	.000	.000	4.826	1	.028	1.000	1.000	1.001
X ₃ : No. of children	-.258	.144	3.208	1	.073	.773	.583	1.025
X ₄ : Educational status	.701	.391	3.210	1	.073	2.016	.936	4.342
X ₅ : Response of municipality	-.650	.424	2.346	1	.126	.522	.227	1.199
X ₆ : Landholding size (M ²)	-.001	.001	1.019	1	.313	.999	.996	1.001
X ₇ : Brokers agitation	-.473	.436	1.177	1	.278	.623	.265	1.464
X ₈ : Previous residence	3.543	.440	64.799	1	.000	34.574	14.591	81.923
X ₉ : Occupation	.985	.367	7.201	1	.007	2.679	1.304	5.501
X ₁₀ : Mode of accession			14.852	3	.002			
X ₁₀ : Mode of accession (1)	1.406	.466	9.089	1	.003	4.079	1.635	10.173
X ₁₀ : Mode of accession (2)	.453	.606	.559	1	.455	1.574	.479	5.165
X ₁₀ : Mode of accession (3)	2.375	.724	10.777	1	.001	10.754	2.604	44.405
Constant	-3.697	1.199	9.499	1	.002	.025		

As indicated in the above table, results of the binary logistics multiple regression analysis revealed that among the 10 explanatory variables four of them are found to be statistically significant and determinant factors for the nature of settlement of households at 95% confidence level. These are; monthly income of respondents, previous residence, occupation and mode of accession of respondent's current holding.

Accordingly, among the significant explanatory variables previous residence of respondents is 34.6 times more likely to determine the respondent's nature of settlement followed by 10.8 times determined by mode of accession of respondent's current holding (non-lease municipal holding), whereas buying from farmers is 4.1 times determines the respondents nature of

settlement. Occupation of the respondent determines the nature of settlement of respondents by 0.8 times.

Therefore, the reduced multiple regression formula is written as:

$$Y = \alpha + \beta X_2 + \beta X_8 + \beta X_9 + \beta X_{10}$$

$$Y = - (3.697) + 0 X_2 + 3.543X_8 + .985X_9 + 1.406X_{10}$$

This indicates that the respondents nature of settlement is determined by the association of the above four explanatory variables, especially a unit of change in the respondents monthly income decreases the respondents nature of settlement by 3.697. a unit of change in the previous residence of respondents increases the nature of settlement of respondents by 3.543. A unit of change in respondent's occupation results in the increases of nature of settlement of respondents by 0.985 and a unit of change in the respondent's mode of accession results in an increase in the nature of settlement of respondents by 1.4.

4.7 Participatory Mapping to Assess Informal Settlements at Different Years

The issue of informal settlements is subjective here in the study area and in many of urban centers in Ethiopia. This is because of the fact that there are no strict and updated regulations that can administer informality. During the interview with the manager of Wolkite town municipality, there is a tendency for that the whole of one urban *kebele* is covered with informally settled households. However, there are also households in this place who have a master plan and claiming that they are formal. Therefore participatory mapping was an important tool to triangulate the reality of informality and to assess the land use land cover aspect of the area at different time intervals.

The city residents of Wolkite town (especially elders) were asked about the nature of the area before some years back during the field survey. The reason behind choosing elders as the source of data for participatory mapping was due to the belief that they could know the place how it looked like in the past periods. For the sake of this study therefore, participatory mapping was done for two time intervals, i.e. before and after 1994. It was the time when the first urban land

lease law was enacted in Ethiopia. Therefore, it is to know whether there are any changes in the extent of informal settlements, if any when the policy or regime changes.

The 1984 Landsat image of the study area was used to digitize the polygons, points and line features for participatory mapping.

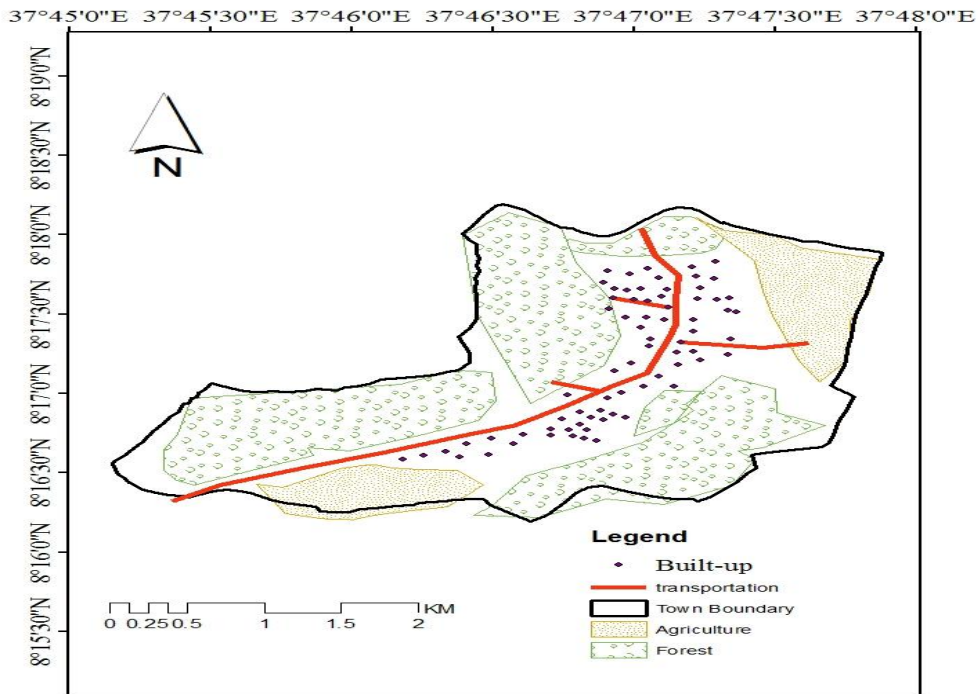


Figure 4.13: Participatory Mapping of Wolkite Town Before 1994

Participatory mapping that was drawn through interviewing local community members can be presented in tabular form as follows. It shows the amount of hectare and the percentage of each land use type identified in the participatory mapping approach.

Table 4.10: LULC Change of Wolkite Town before 1994 (Participatory Mapping)

Land use/land cover	Magnitude	Scale	%
Agricultural plots	195	Ha	18.9
Forest	478	Ha	46.4
Informal built-ups	Not found	Housing units	

Formal built-ups	183	Housing units	---
Road/transportation	6	KM	

Source: Household Survey, March, 2016

As indicated in the table 4.10 above, almost half of the study area 46.4 (478 ha) was covered by a forest during the period before 1994. There was no standard however to classify settlements as formal and informal in the study area during the specified period and it was difficult to identify informal settlements.

Table 4.11: LULC Change of Wolkite Town after 1994

Land use/land cover	Magnitude	Scale	%
Condominium house	10	Ha	0.97
Open land	248	Ha	24.07
Stadium	11	Ha	1.07
Agricultural plots	174	Ha	14.27
Forest	39	Ha	3.78
Informal built-ups	*3509	Housing units	
Formal built-ups	*9190	Housing units	
Road/transportation	20	KM	

*These data are compiled from Guraghe Zone Urban Development Office report, 2012.

Source: Participatory Mapping, Processed by the Researcher using ArcGIS10.3

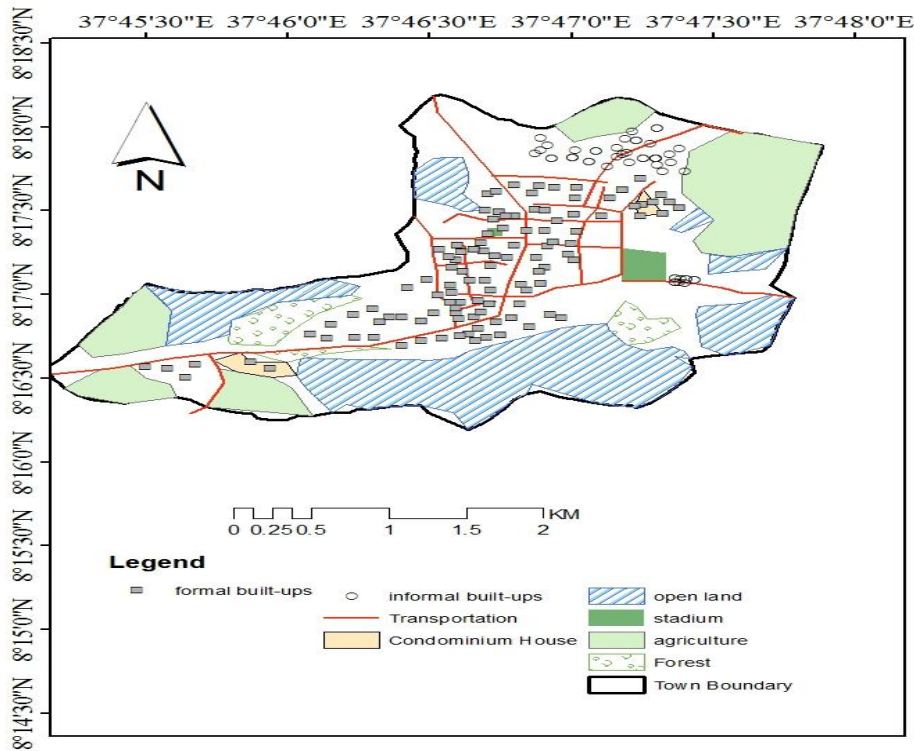


Figure 4.14: Participatory Mapping of Wolkite Town after 1994 (Source: Landsat ETM⁺ Image Captured & Processed by the Researcher Himself, April 2016)

Table 4.12: LU/LC of Wolkite Town for the Periods before and after 1994

Land use/land cover	Scale	% Before 1994	% After 1994
Condominium house	Ha	--	0.97
Open land	Ha	---	24.07
Stadium	Ha	----	1.07
Agricultural plots	Ha	18.9	14.27
Forest	Ha	46.4	3.78
Informal built-ups	Housing units	---	*3509
Formal built-ups	Housing units	183	*9190
Road/transportation	KM	6	20

Source: Processed by the Researcher Himself Using ArcGIS 10.3, April, 2016

According to the above participatory mapping land use and cover change table, forest coverage was highly reduced accompanied with the slight decrease in the agricultural plots. Informants explained that Wolkite town is expanding alarmingly to the nearby open fields and agricultural areas. They added that the urban expansion is attributed highly with the expropriation of the nearby rural land by the government after the urban land lease law was enacted in 1994. The researcher can able to digitize and identify 200 informal built ups from the 2014 SPOT image of the study area.

4.8 Causes for Escalation of Informal Settlements in the Study Area

Informal settlements are a serious problem in Wolkite town currently and in the previous years. The study conducted by Guraghe Zone Urban development Office shows that the rate of informal settlements in the study area before 1991 was only 3.2%. But it reached 32.2% and 40.4% during 1992-1994 and 2005-2008 year intervals respectively.

Table 4.13: Percentage of Informal Settlements per Year of Construction

No.	Year of construction	Frequency	%
1	Before 1991	114	3.2
2	1992-1994	1126	32.2
3	2005-2008	1426	40.4
4	2009-2012	132	3.9
5	Unknown	711	20.4
	Total	3509	100

Source: Compiled by the Researcher with the Data Gained From Guraghe Zone Urban Development Office

The enactment of the first urban land lease law policy of Ethiopia in 1994 believed to solve the problem of informal settlements. However, in the study area the reverse was true and there was high rate of informal settlements.

The causes for escalation of informal settlements in the study area as it was explained by interviews includes, brokers agitation, involvement of richer people in the process, low response of the municipality, ownership clash between Kebena and Guraghe ethnic groups over the

territory are the most important ones. Most of the causes mentioned are compatible with the multiple linear regression result. Those IVs which are significant are also raised as a cause during the interview with the city residents and elders of community in the study area,

Brokers are misleading the frames and inspiring them to sell their plots unless the government will expropriate their property without compensation. The low awareness of farmers about the urban land lease laws can easily be deceived and engaged in selling their plots so that they get relief with the many gained.

The question of ownership of the town is one of the causes for the expansion of informal settlements in the study area which is mentioned by the informants during the interview. The Kebena ethnic group claim that the town and expansionary areas are belonging to them. Therefore they are not allowed when the town is expanded. In the other way there are settlements constructed by the Kebenas themselves and these are considered informal and void by the municipality since they are without following the master plan of the town. Therefore there is tension and disagreement in the study area which opens the door for expansion of informal settlements.

According to the data from key informants from municipality officers and the city residents, the issue of demarcating the town boundary is disputable and beyond the regional government. They explained this makes the master plan of the town not to be approved and functional, and it opens the door for informality.

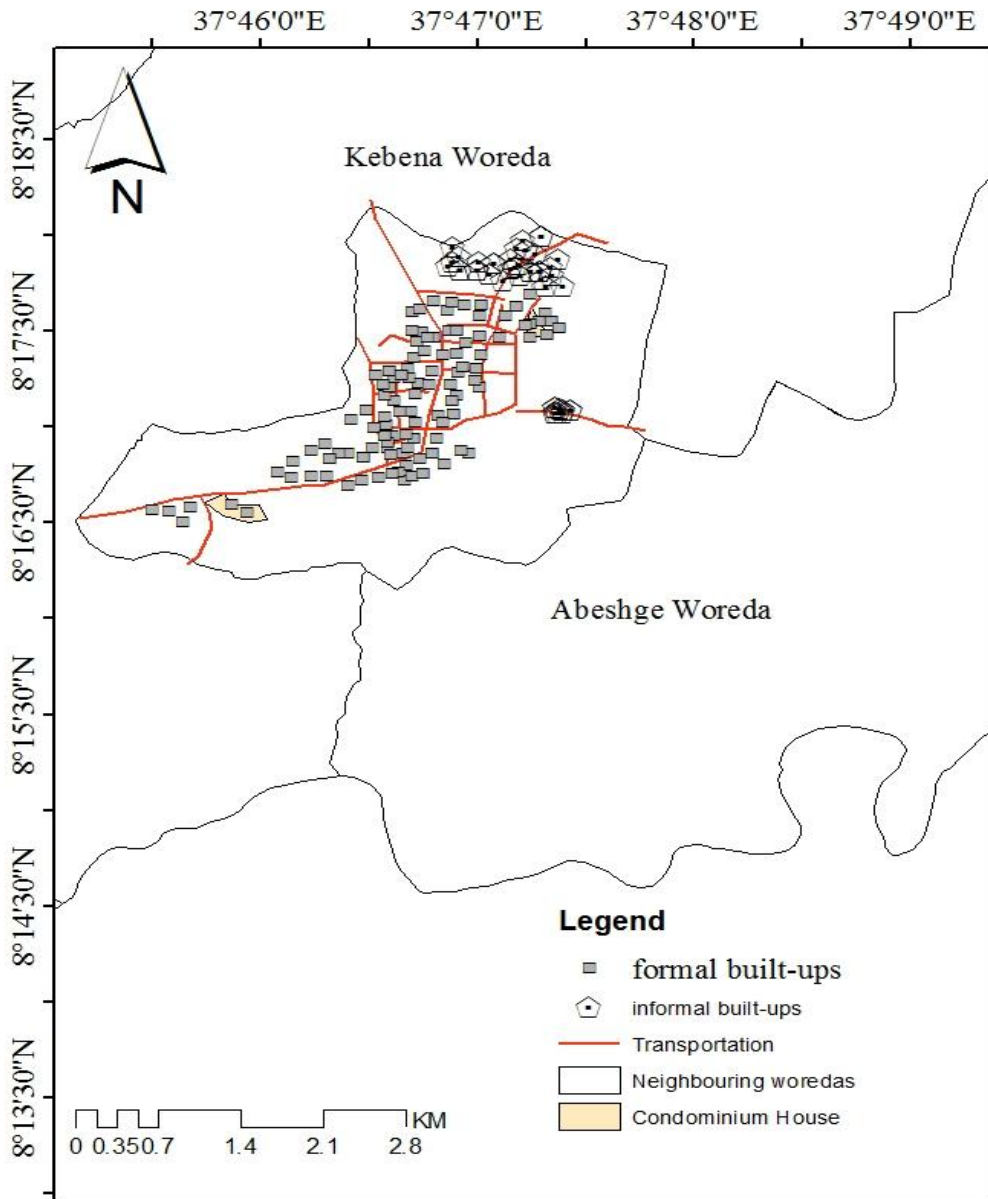


Figure 4.15: Location of Wokite Town Associated With Neighboring *Woredas* (Source: Landsat ETM⁺ Image Captured & Processed by the Researcher Himself, April 2016)

As it is shown in the above figure, informal built-ups are expanded in the northern and eastern part of the town.

Involvement of rich people on the process of buying and selling urban lands is exacerbating the expansion of informal settlements in the study area. The poor have no access for constructing built-ups informally. Informants added that most of the rich people especially merchants and public officials have a number of built-ups with their name.

4.9 Effects of Informal Settlements

The expansion of informal settlements in the study area is on the suburb forest areas and agricultural fields occupied by farmers. This will have an impact on the life of farmers in loss of livelihood and unemployment problems.

Besides these, informal built-ups deteriorated the image of the town. A network of electric wires here and there, unfinished roofs and walls, built -ups with no fence makes the village looks like a refugee camp. The network of electric wires can be a source of danger and risky.



Figure 4.15: Spontaneous Network of Electric Wires in the study area (photo by the researcher, April, 2016)

During field observation by the researcher, most of the informally constructed houses have no access for infrastructures like, road, electricity, water supply. However, street light problem is

common for all parts of the town; informal houses even lack electricity for lamp light at home. Many of them are trying to access it from remote through thin wooden poles.

Besides these, majority of informal houses had no access to improved sanitation which is consistent with the study done in Zanzibar town in 2003 (cited in Getalem and Yenew, 2006) which indicates sanitation is the major problem in informal settlement areas due to lack of established collection points, piles of garbage are scattered in and around residential areas which leads to environmental and health problems.

4.10 Measures Taken by the Municipality to Manage Informal Settlements

The data gained an interview with the local community revealed that the problem of informal settlement expansion in the study area is caused by among other factors the loose regulation of concerned bodies like the municipality. The office failed to regulate the expansion of informal settlements in the town. But, currently there are organized committees who are demolishing constructions which are marked as informal by the municipality. They added that the socioeconomic cost of demolishing the already constructed houses is very high and it leads to conflicts between the security forces and the community.



Figure 4.16: Constructions under Demolishing (Photo by the Researcher, April, 2016)

Besides the reluctant of the municipality, high turnover in the office is also another problem mentioned by key informants as a problem for escalation of informal settlements in the study

area. Accordingly, there is frequent change of municipality managers in the town. This makes development programs and activities inconsistency which will open the door for bad governance.

Currently, there are activities done by the town municipality to regulate the expansion of informal settlements explained by key informants from the municipality of Wolkite town and community members. These include; legalizing houses which were constructed before 2014, demolishing those which are constructed after the mentioned period, organizing committee from each village who regulate and report informal constructions whenever arise.

But, to solve the problem sustainably the municipality in cooperation with the zonal urban development office is facilitating to give urban lands for those members of community who can't afford the lease system, usually government employees and cooperatives. This believed to reduce homelessness problem and the tendency of informality.

Table 4.14: Types and Numbers of Informal Construction in Guraghe Zone

Town	Types of Informal Constructions						Total
	Residence	Service residence	Villa & service	Commercial	Spiritual	Other	
Wolkite	297	1918	277	48	6	981	3509
Butajira	47	828	42				917
Kela		38		12			50
Ensino	17						17
Walga	4	1			1	8	14
Gunchire	13						13
Quosie		11		1			12
Emdiber	1			1		2	4
Suten		2					2
Agena					2		2
Hawaryat				1			1
Total	36	2798	319	63	9	991	4541

Source: Guraghe Zone Urban Development Office Report, 2014

As indicated on the table 4.10 above, from the total 4541 informal constructions 2834 (62.4 %) of them are for the purpose of residence. The same is true in the study area; around 63% of informally established constructions are for the purpose of residence. It indicates that people are engaged in informal constructions due to lack of residential urban land.

Therefore, understanding this shortage of residential problems the municipality is currently on the way to give residential land for cooperatives. Construction of condominium was also another option taken by the municipality, though it failed to meet its targets due to a number of problems which needs its own investigation.

As indicated in the figure 4.18 below, there are more open lands reserved for some kind of activity. Therefore, these open lands may appropriate for the future if they are assigned to be residential sites by the municipality.

The structural plan however is not approved yet; the problem for this according to some residents of the town is the unresolved ethnic tension and demarcation problems.

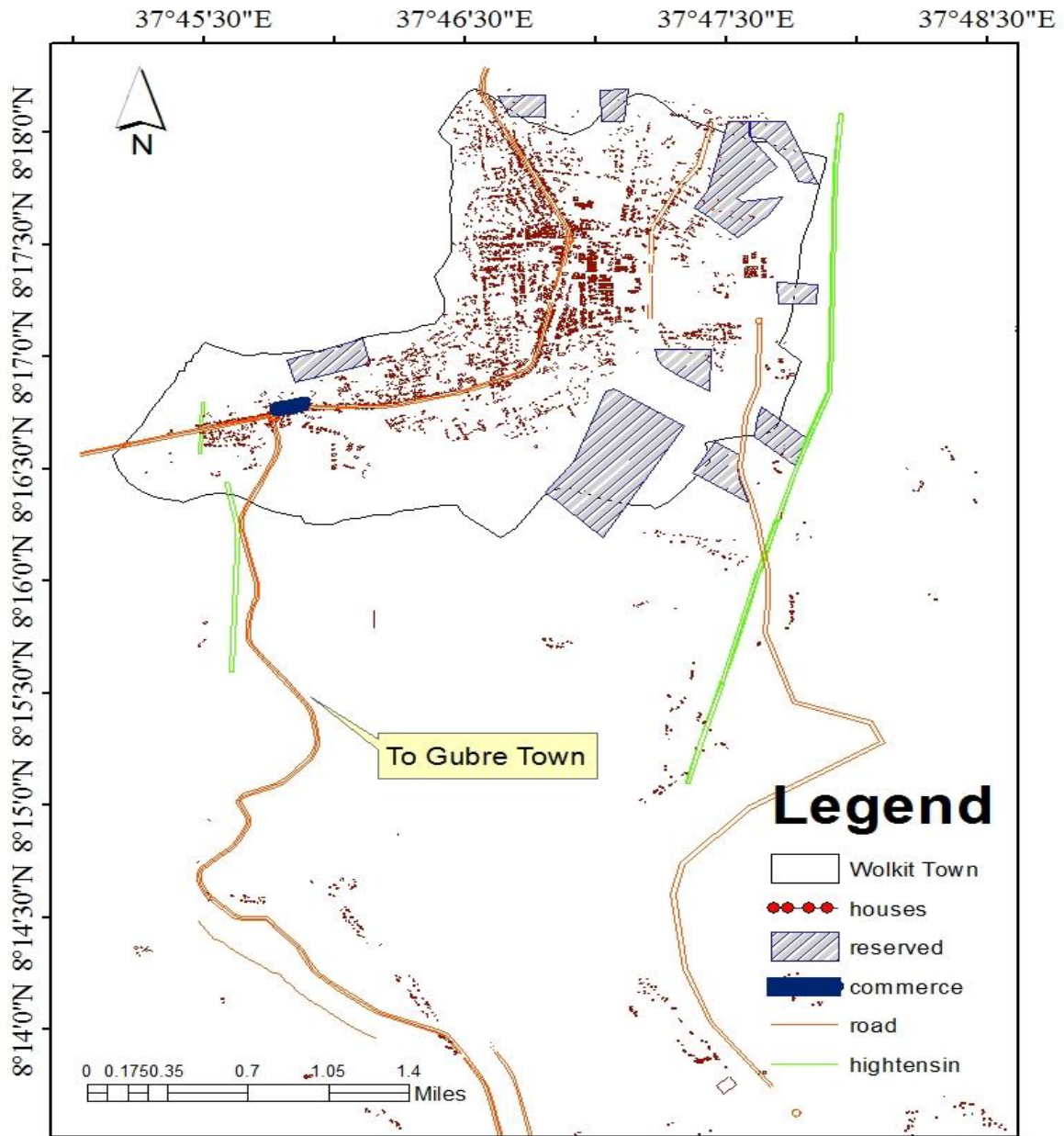


Figure 4.17: The Current Structural Plan of the Study Area Integrated With the Nearby Gubre Town (Source, Wolkite Town Municipality, 2016)

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

Three time period satellite imageries with GIS and RS analysis tools supported with observation and household questionnaire survey were used to study the factors for the escalation of informal settlements in Wolkite town since 1984 for the last 30 years. The study clearly indicated that there was land use land cover change conversion and modification witnessed by the results of satellite image classification and analysis.

Forest coverage shows a continuous decrease from 19.39% in 1984 to 11.6% in 1999 and 5.9% in 2014. On the other case, built-up experiences a dramatic increase with three time intervals; it was 14% in 1984, 26.11% in 1999 and 26.7 in 2014. The area covered under crop land had also experienced an increase in volume; i.e. from 31.87% in 1984 to 38.7% 1999 and 32.9% in 2014, unlike the decrease in the area of grass-land from 34.7% in 1984 to 24.15% in 1999 and increased to 34.4% in 2014.

This shows that the existing forest cover in the nearby town is depleted through time as a result of the expansion of the town and agricultural lands. The increasing trend of grass land from 1999 to 2014 from 24.1% to 34.4% is due to the incorporation of nearby rural *kebeles* to expand the city as a result of the revised urban land lease policy in 2002. Therefore those reserved areas (expansionary areas) are remained grass lands.

The LULC rate of change shows that built-up expanded with 5.7% annual rate on the first analysis period, i.e. the first fifteen years from 1984-1999. This may be attributed with the adoption of the first national urban lease law in 1994. In the same analysis period forest coverage reduced with annual rate of 2.8%. During the second analysis period, 1999-2014 (the second 15 years) built-up area continued to increase with annual rate of 0.1% against the 3.1% annual decrease of forest.

Over the study period, built-up area has been increased by 3 % per annum against 2.3 % and 0.03 % per annum decrease of forest coverage and grass-land respectively. However, the 0.1 % annual increase of crop land is registered through depletion of forest coverage and grass land.

The reduction of forest coverage from 363.3 ha in 1984 to 208.4 ha in 1999 is accompanied by 8.4%, 0.0% and 2.5% by built-up, crop-land and grass land respectively. The boost of built up area from 263.2 ha in 1984 to 489 ha in 1999 is with the expense of 45.2%, 0.8% and 16.25 of forest, crop-land and grass land respectively.

The LULC matrix shows that the increasing of crop-land from 498.96 ha in 1984 to 723.2 ha in 1999 is contributed by 7.4%, 7.9% and 27.2% forest, built-up and grass-land respectively. This means built-up and crop land found to be increasing with the expense of forest and grass-land a little bit. The researchers observation and data gained from key informants interview, especially those residents in the suburbs of the study area witnesses that the nearby agricultural fields and forest areas are changed to settlements. In addition, the decrease of forest from 208.4 ha in 1999 to 111.06 in 2014 is credited by 4.9%, 0.75% and 0.3% of built-up, crop-land and grass-land. However, built-up experiences an increase from (486.3 ha in 1999 to 500.7 ha in 2014) with the expense of 19.2%, 17.4% and 16.8% of forest, crop- land and grass- land respectively. In addition, the reduction of crop-land from 718.9 ha in 1999 to 610.4 ha is with the expense of 19%, 26.8% and 49.8% forest, built-up and grass-land respectively.

According to the participatory mapping, forest coverage was highly reduced accompanied with the slight decrease in the agricultural plots. Informants explained that wolkite town is expanding alarmingly to the nearby open fields and agricultural areas. They added that the urban expansion is attributed highly with the fear of expropriation of the nearby rural land by the government after the urban land lease law was enacted in 1994.

There were combinations of factors attributed for the escalation of informal settlements in the study area such as monthly income of respondents, previous residence, occupation and mode of accession of respondent's current holding. Accordingly, among the significant explanatory variables previous residence of respondents is 34.6 times more likely to determine the respondent's nature of settlement followed by 10.8 times determined by mode of accession of respondent's current holding (non-lease municipal holding), whereas buying from farmers is 4.1 times determines the respondents nature of settlement. Occupation of the respondent determines the nature of settlement of respondents by 0.8 times.

brokers agitation, the unresponsive nature of the municipality, costly nature of the formal lease law and the question of ownership of the town are another causes of informality mentioned by informants in the study area. Accordingly, the Kebena ethnic group claim that the town and expansionary areas are belonging to them. Therefore they are not allowed when the town is expanded. In the other way there are settlements constructed by the Kebenas themselves and these are considered informal and void by the municipality since they are without following the master plan of the town. Therefore there is tension and disagreement in the study area which opens the door for expansion of informal settlements.

During field observation by the researcher, most of the informally constructed houses have no access for infrastructures like, road, electricity, water supply. However, street light problem is common for all parts of the town; informal houses even lack electricity for lamp light at home. Many of them are trying to access it from remote through thin wooden poles.

6.2 Recommendations

The escalation of informal settlement is currently a serious problem in Wolkite town. It is even possible to say that almost half of the total housing units are informal. The problem is worse in the northern and eastern part of the town. The absence of clearly demarcated boundary for the town, and the absence of master plan is a challenge to control the spontaneous flow of settlements. The municipality was demolishing informally established settlements in the last June 2015. But it resulted in clash between the community and security forces and the demolishing process quit with the loss of two individuals, one civil and one police force. Based on the results of the study in general, the researcher would like to propose the following possible suggestions to control the expansion of informal settlements and for the sustainable development of the study area.

- The municipality of the town should establish clear set of guidelines and set ups to monitor and regulate the sustainable development of the town.
- It should adopt proactive measures before taking reactions or measures because it has socio-economic costs on the society and the nation at large.
- Integration is required by institutions which are delivering social amenities for sustainable and better urban development. Therefore, the municipality of Wolkite town should work in connection with other client institutions.
- The municipality should withstand its responsibility of designing and preparing the master plan, since it is a base for the integrated development of the town.
- There should be a transparent way of addressing the issue of those informally constructed settlements.
- The government should create conducive conditions especially for the low and middle income sections of society for access to shelter.
- Finally, the concerned bodies especially the city administration and the municipality should integrate with NGOs, private organizations and the community at large to solve the problems of housing inadequacies and control informal settlements.

References

- Achamyelch Gashu (2014). Institutions Governing Informal Settlements in the Peri-urban Areas of Ethiopia, the Case of Bahir Dar. FIG Congress, Malaysia.
- Admit Zerihun, Bacry Yusuf and Sileshi Tefera. (2009). Land Lease Policy in Addis Ababa. Produced and Distributed by the Addis Ababa Chamber of Commerce and Sectoral Association with financial support from the Swedish Agency for International Development Cooperation Sida. Private Sector Development Hub/Addis Ababa Chamber of Commerce and Sectoral Associations. Addis Ababa, Ethiopia.
- Almeida, B. (2005). A GIS Assessment of Urban Sprawl in Richmond, Virginia. Virginia Polytechnic Institute and State University. MA thesis.
- Bamlaku Amente (2009). Environmental Impacts of Urban Land-Use Changes in Kolfe Keranyio Sub-City, Kebele 04 Selti Area, Addis Ababa Using Remote Sensing and GIS Techniques, MA Thesis. Addis Ababa University, Addis Ababa.
- Bisewur Eyaya (2014). Impact of Urban Expansion on the Agricultural Land Use a Remote Sensing and GIS Approach: A Case of Gondar City, Ethiopia. International Journal of Innovative Research & Development. *Volume, 3.Issue, 6*.
- CEF, Conserve Energy Future What is Urban Sprawl? <http://www.conserve-energy-future.com/causes-and-effects-of-urban-sprawl>. Php (Accessed Date 23/09/2015).
- Congalton, R. (1999). Assessing the Accuracy of Remotely Sensed Data: Principles and Practices. Boca Rota: Lewis Publisher.
- Creswell, J.W. (2003). Research design: Qualitative, quantitative, and mixed approaches. Thousand Oaks, CA: Sage Publications.
- CSA (2007). The 2007 Population and Housing Census of Ethiopia, National Statistical Summary Report. UNFPA: Addis Ababa.
- Dadras, M., Zuhaidi, H., Shafri, M., Ahmad, N., Pradhan, B., and Safarpour, S., (2014). Land Use/Cover Change Detection and Urban Sprawl Analysis in Bandar Abbas City, Iran. The Scientific World Journal Hindawi Publishing Corporation.

- Deininger, K., Selod, H., and Burns, A. (2012). *The Land Governance Assessment Framework. Identifying and Monitoring Good Practice in The Land Sector*. Wb, Washington DC.
- Environmental protection Authority (EPA, 1 997).Federal Democratic Republic of Ethiopia.The Conservation Strategy of Ethiopia,Volume II Federal Policy on the Environment. Environmental Protection Authority in collaboration with Ministry of Economic Development and Cooperation Addis Ababa, April 1997.
- Foody, G. (2002).Status of Land- Cover Classification Accuracy Assessment, Remote Sensing.
- Getalem Aychew, Yewew Amsal (2014). Assessment of Informal Settlement and Associated Factors as a Public Health Issue in Bahir Dar City, North West Ethiopia; a Community Based Case Control Study. *Science Journal of Public Health*.Vol. 2, No. 4, 2014, pp. 323-329.doi: 10.11648/j.sjph.20140204.23.
- Guraghe Zone Department of Culture, Tourism and Governmental Affairs.(2012). *Tourist Guide Book*.Wolkite .
- Healen, J. F. (2009). *Statistics; A Tool for Social Research*.*Eighth Edition*.Christopher Newport University,USA.
- Hill, A. and Lindner, C. (2010).Modeling Informal Urban Growth under Rapid Urbanization. A CA-Based Land-Use Simulation Model for the City of Dar es Salaam, Tanzania. Doctoral Thesis.
- Imam, E. Tahir Hussain and Tahir, M.(2013).Evaluation of Land Use/Land Cover Changes in Mekelle City, Ethiopia using Remote Sensing and GIS. *Computational Ecology and Software*, 2013, 3(1): 9-16. IAEES.
- Konishi, M. (2015). *Making In-City Resettlement Work for the Poor* Motoo, The world bank. Asia-Pacific Housing Forum, Manila.
- Lasserve, A.D.,(2006). Informal Settlements and the Millennium Development Goals: Global Policy Debates on Property Ownership and Security of Tenure. In *Global Urban Development Magazine (GUD)*.Volume 2, Issue1.Retrieved from

<http://www.globalurban.org/GUDMag06Vol2Iss1/Durand-Lasserve.htm> (Accessed Date, 17 January, 2016).

Longley P. A., Michael F. David J., Maguire, G. , and David W. Rhind (2004). Geographical Information Systems and Science .John Wiley & Sons, Ltd. 2nd edition.

Mishra, M., Mishra, K. K. and Subudhi ,A. P. (2010). Urban Sprawl Mapping and Land Use Change Analysis Using Remote Sensing and GIS (Case Study of Bhubaneswar City, Orissa). Ravenshaw University, Cuttack, Orissa.

Motala ,S., Musungu, K., and Smith, J. (2012). A Participatory Approach to Data Collection for GIS for Flood Risk Management in Informal Settlements of Cape Town. *South African Journal of Geomatics, Vol. 1, No. 1, January 2012.*

Onyekachi, A. F., (2014). Prospects and Challenges of Informal Settlements and Urban Upgrading in Abuja. International Journal of Innovation and Scientific Research Obafemi Awolowo University, Ile- Ife, Nigeria.

Skilla, M. M. (2013). Urban Sprawl and Escalation of Informal Settlements in Dododma, Tanzania. MA Thesis (unpublished).

SNNPR (2011). Investment Expansion Main Process. Potentials of Guraghe Zone. Retrieved from <http://www.southinvest.gov.et/home.htm> (Accessed Date 08 October 2015).

Stockburger, David, W. (n.d). Multivariate Statistics: Concepts, Models, and Applications

Tamrat Nebiyu (2011). East African Informal Settlements, A Treat to Resilient Urban Future Ede, Netherlands.

UN, department of economics and social affairs.(2014). Revision of the World Urbanization Prospects. New York.

Vajjhala, S.P. (2005). Integrating GIS and Participatory Mapping in Community Development Planning. Paper for the ESRI International User Conference, Sustainable Development and Humanitarian Affairs Track, San Diego, CA, July 2005.

Yamane Taro. (1967). Statistics: An Introductory Analysis, 2nd Ed. New York: Harper and Row.

7. የከተማቦታ የሚፈልጉ የቤተሰብብዛት?

8. ስራ

_____.

9. የወርገቢዎምን ያህልነው;

10. ከሚከተሉት አቅርቦቶች ውስጥ የተቻሉትን ያውቁ የተሟሉ ሎት? ካለ 1 ቁጥር ከሌለ ደግሞ 2 ቁጥር ን ያክብሩ
አቅርቦቶች አለዩለም

- የቧንቧ ወሃ 1 2
- ሽንት ቤት 1 2
- የኤሌክትሪክ መብራት 1 2
- ቆርቆርቤት 1 2

11. ቤቱ መቼ ነበር የተሰራው; _____ (ዓ.ም)

ክፍል 2 ትክክለኛውን መልስ ያክብሩ

ማሳሰቢያ:

መለሰች ሁከት ከአንድ በላይ ከሆኑ እባክዎ ሁሉንም ያክብሩ፡፡ ከተሰጡት ምርጫዎች መልስ የሚሆን ከሌለ ደግሞ መልስ ይሆናል ሆኖ ሌት ንክታ ችይዳሉ፡፡

ሀ. የመሬት አጠቃቀምና ሽፋን በተመለከተ

1. አሁን ያለዎት ቦታ ስፋት በካሬ ምን ያህል ነው;
2. ይህ ቦታ ይበቃል ብለው ያስባሉ;
 1. አዎ 2. አይበቃም
3. ለጥያቄ ቁጥር 2 መልስ ያይደብቃል ከሆነ፡ ምክንያቱም ነው።
 1. ቤት ለመስራት 3. ለልጆች
 2. ወደ ፊት ቦታ ሲወደድ ለመሸጥ 4. ሌላ ካለቢ ገለፅ _____

ለ. ለህገ-ወጥ ቤቶች መጨመር ምክንያቶች

4. ቀደም ሲል የትክክል የሚኖሩት;

1. ሌላከተማ 3. ወልቂጤ
2. ጉራጌዘንገጠርቦታዎች 4. ሌላካለቢገለፅ_____
5. ለጥያቄቁጥር 4 መልስዎ “3” ከሆነየመኖሪያቤትአንዴትነበርያገኙት/ ይኖሩየነበረው?
 1. በኪራይ 2. የግልይዞታ 3. በወርስበተገኘ 4. ሌላካለቢገለፅ_____
6. አሁንየሚኖሩበትንቦታአንዴትነውያገኙት;
 1. ከአርሶአደሮችበመግዛት 2. በሊዝጫራታ 2.በወርስ 2.የቆየይዞታ
7. ከአርሶአደሮችገዝተውትከሆነምክንያቱምንድነው?
 1. ዋጋወርካሽስለሆነ 3. የቤትኪራይወድስለሆነ
 2. ወደፊትበወድዋጋሸጠለማትረፍ 4. የሊዝጫራታወድመሆን
8. አሁንያለውየሊዝጫራታዋጋከእርሶአቅምጋርተመጣጣኝነውበለውያስባሉ
 1. አዎ 2. አይደለም

ሐ. የህገ-ወጥነትመመዘኛዎች

ቁጥር.	ጥያቄ	መልስ	
		1= አለዉ.	2=የለዉም
9	አሁንያሉበትቦታካርታናፕላንአለዉ.		
10	የኤሌክትሪክቆጣሪ		
11	የቧንቧዉሃ		
12	ጣሪያዉቆርቆርግድግዳዉጭቃ		

መ. ለህገ-ወጥነቶችመጨምርዋናዋናምክንያቶች

የዚህንዑስክፍልዋናአላማለህገወጥነቶችመጨመርእንደምክንያትከተዘረዘሩትነገሮችዉስጥየተኞቹጉልህሚናአንዳላቸዉለማወቅነዉ::በመሆኑምአንዱንምክንያትከሌላኛዉለማወዳደርይረዳዘንድየተቀመጡማወዳደሪዎችየተመረጡሲሆንበቅ/ተከተል፤ 1 (በጣምዝቅተኛ)፤ 2 (ዝቅተኛ)፤ 3 (መካከለኛ)፤ 4 (ከፍተኛ) እና 5 (በጣምከፍተኛ) ይገልጻሉ::

ተ.ቁ.	ዋናዋናምክንያቶች	መለኪያ				
		1	2	3	4	5
13	የከተማድህነት					
14	የከተማመሬትአጥረት					

15	ማዘጋጃቤቱለከትማወነዋሪየቤትፍላጎትቀልጣፋምላሽአለመስጠት					
16	ሀብታምሰዎችከአርሶአደሩበህገ-ወጥመንገድስለሚነግዱ					
17	የሊዝህጉከነዋሪወኢኮኖሚሁኔታጋርያለመጣጣም					
18	ከፍተኛየሆነከገጠርወደከተማየሚደረግፍልሰት					
19	ከተማወላይያለወህዝብቁጥርመጨመር					
20	የቤትኪራይዋጋመጨመር					
21	ከከተማወአጎራባችያሉአረሶአደሮችየይዘታባለቤትነታቸወአርግጠኛአለመሆን					
22	የብሔርየበላይነት					
23	ወደፊትህጋዊይሆናልበሚልተስፋበህገ-ወጥመንገድቤትየሚሰራሰወመጨመሩ					
24	የቤትደላሎችተጽዕኖ					
25	በሊዝጫራታጊዜየድሀናሀብታምበአንድቦታመወዳደር					
26	በህጋዊመንገድቤትለማግኘትአሰራሩየሚዘገይናወድመሆኑ					

27. በህገ-ወጥመንገድየሚሰሩቤቶችየሚያስከትሉትተፅዕኖ፤

I. በከተማገፅታ

II. ባአጎራባችባሉየእርሻመሬቶች

III. በከተማነዋሪዎች

APPENDICES II

JIMMA UNIVERSITY

COLLEGE OF SOCIAL SCIENCE AND HUMANITIES

HOUSEHOLD LEVEL SURVEY QUESTIONNAIRE

Dear respondents;

This questionnaire is designed to gather data on “**Urban Sprawl and Escalation of Informal Settlements in Suburbs of Wolkite Town; Central Ethiopia.**” To achieve this purpose and to deeply investigate the case, your response to the questions given below has a crucial value. Therefore, you are kindly requested to read the questions carefully and give accurate and real data which exists on the ground. The response that you reply will not be used for any other purpose other than this research work, so be free and give your honest and genuine response.

Researcher’s contact address

AdaneMengist, Phone No. +251910885611 e-mail address: adanemengist@gmail.com

Thank you in advance for your Cooperation!

Part I: Background Information of key informants

Code _____

1. Sex

1. Female 2. Male

2. Age

3. Marital Status

1. Single 2. Married 3. Divorced 4. Widowed 5. separated

4. Educational level

1. Illiterate 4. Secondary Education (grade 9-12)

2. Read and write 5. above Secondary Education

3. Primary education 6. Other (specify) _____

5. Family size

6. Number of household members above 18 years of age except parents_____

7. How many of them need and able urban plot for house?

8. What is your occupation?

_____.

9. What is your monthly income in birr?

12. Does your household have the following facilities?

No.	Questions Related to Access of Facilities	Response	
		1= yes	0=No
9	Does your current house have a master plan?		
10	Do you have your own electricity balboa?		
11	Do you have access to pipe water?		
12	Does the house have corrugated roof and walls?		

Part II: Encircle the right Answer

Note: in case your answers may be more than two, just encircle them and if it is out of the listed options write it below the question.

A. land use land cover dynamics

2. What amount of urban land do you have now in m²?

2. Do you think the holding is enough to construct houses?

1. Yes 0. No

3. Why do you need more urban lands?

1. To construct houses

3. For children

2. To sell it later with high price 4. other specify _____

B. Determinant Factors for Informality

9. Where is your previous residence?

3. Other towns outside of Wolkite

3. in Wolkite town

4. Rural areas from Gurahge zone

4. other specify _____

10. If your answer to question no. 4 is “3” then, how you sponsored for housing?

2. Renting 2. Own urban land 3. Lands inherited from family 4. no house

11. where do you obtain your current urban land

1. Buying from farmers 2. Lease bid 2. Inherited 2. Previous holding

12. If you buy informal plots from the suburb agricultural fields, then what is your reason?

3. Since it is cheap

3. due to high price of renting houses in the mid town

4. To get profit for the future 4. costly lease policy

13. Do you think the current urban land lease law is affordable to your level?

2. Yes 0. No

C. Standards for being informal

No.	Questions	Response
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		1= yes	0=No
9	Does your current house have a master plan?		
10	Do you have your own electricity balboa?		
11	Do you have access to pipe water?		
12	Does the house have corrugated roof and walls?		

D. Opinion about the determinant factors of escalation of informal settlements

The objective of this sub section is to know the trigger factor for the escalation of informal settlements. Please select the determinant causes and choose the coefficient according to the wait given in the matrix (likert scale). “1” stands for strongly disagree, “2” for disagree, “3” for moderate, “4” for agree and “5” strongly agreed.

No	Determinant Causes	Scale				
		1	2	3	4	5
13	Urban poverty					
14	Shortage of urban lands					
15	Unresponsive nature of the municipality to the growing demand of residents for urban land					
16	Richer people are more engaged in scramble of plots informally from farmers for future profit					
17	The costly lease price is unaffordable by residents					
18	High rural to urban migration					
19	Population growth in the town					

20	Increasing house rent price					
21	Insecurity of holding by Farmers in the suburb					
22	Caused by other factors like ethnic dominancy					
23	I bought informal plots because they will be formal in the near future					
24	The reason for buying informal plots is due to the influence of brokers					
25	There is a different session for the poor and rich during urban land bid					
26	The formal way to receive urban plots and construct houses is costly and lengthy					

27. What do you think about the negative impacts of informally established settlements on;

I. The image of the town

II. The suburb agricultural fields

III. Residents in the town

Interview Guiding Questions for Officers from Municipality

1. How many informal settlements are in the town in different time periods?
2. How do you describe the nature of informal settlements in the area?
3. What is the standard for formal settlements in Wolkite town? Cadaster, master plan, quality of houses, area square meter, distance from road.
4. Why do you think informal settlements are increasing in this town?
5. What are the causes and consequences?
6. Who do you think is responsible for this problem?
7. what kinds of reactive and preventive measures taken to curb informal settlements
8. Are there any grounds for the urban residents with no house to give urban land for housing other than the lease law?
9. What sections of society do you think is involved in building informal settlements?
10. The How many houses built in 1984, 1999 and 2013?
11. How many people are migrated from rural areas in year intervals?