JIMMA UNIVERSITY

COLLEGE OF SOCIAL SCIENCES AND HUMANITIES

GIS BASED SPATIOTEMPORAL ANALYSIS OF URBAN SPRAWL AND ITS IMPACTS: THE CASE OF LEGETAFO LEGEDADI TOWN, OROMIA SPECIAL ZONE, CENTRAL ETHIOPIA

BY

SELAMAWIT KEBEBEW DIBABE

A THESIS SUBMITTED TO SCHOOL OF GRADUATE STUDIES OF JIMMA UNIVERSITY, IN PARTIAL FULFILLMENT OF THE REQUIRED FOR DEGREE OF MASTERS OF SCIENCE IN GEOGRAPHIC INFORMATION SYSTEM AND REMOTE SENSING

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Table of Content **page**

List of tables V

Lists of Figures VI

Acronyms VII

Abstract 1

CHAPTER ONE 2

1. INTRODUCTION 2

1.1. Background of the study 2

1.3. Objective of the study 5

1.3.1 Specific objectives 5

1.4. Research Question 5

1.5. Significance of the Study 5

1.6. Scope of the study 6

1.7. Limitation of the study 6

CHAPTER TWO 7

2. REVIEW OF RELATED LITERATURE 7

2.1. Conceptualization and definitions 7

2.1.1. Concept of Urban Sprawl, Urbanization, Land use and Land cover 7

2.1.2. Geographic Information System 9

2.1.3. Remote Sensing 10

2.2. Theoretical framework 10

2.2.1 Shannon's entropy 11

2.2.2 Need of Entropy 11

2.3. Empirical Review of Related Literature 11

2.3.1. Causes of Urban Sprawl and urban growth 11

2.3.2. Consequences of urban sprawl 14
2.3.3 Measure of urban sprawl 15
2.3.4 Solutions for urban sprawl.....16
2.3.5. Global Trends of Urban growth and its implication for urban sprawl 17
2.3.6. Trends of Urban growth in Africa and its implication for urban sprawl.....18
2.3.7. Trends of Urban growth in Ethiopia and its implication for urban sprawl..19
2.3.8. Application of GIS and RS for analysis of Urban Sprawl.....19
2.3.9. Related works 20
CHAPTER THREE 22
3 METHDOLOGY OF THE STUDY 22
3.1 Description of the Study Area.....22
3.1.1 Historical Background of Lege tafo Lege dadi Town 22
3.1.2. Area and Location……22
3.1.3. Location Topography and climatic condition.....23
3.1.4. Demographic and socioeconomic characteristics.....24
3.1.4.1 Population Profile of the Study Area.....24
3.1.4.2 Socioeconomic characteristics……...25
3.2. Research Methods 25
3.2.1. Research Design 25
3.2.2. Data Sources and Instrument.....25
3.2.2.1 Software and Instru ments 26
3.2.3. Sample Size and Sampling Techniques.....27
3.2.4. Techniques and Methods of Data Analysis 28
3.2.5. Validity and Reliability assessment.....31
3.2.6. Ethical consideration 31
CHAPTER FOUR.....32

4. RESULT AND DISCUSSION 32
4.1. Spatiotemporal Analysis of Urban Sprawl 32
4.1.1 Image Analysis of Legetafo Legedadi Town 1996-2016 32
4.1.2. LULC Change Detection Analysis 36
4.1.3 Land use Land cover matrix of LTLD Town 39
4.2. Urban sprawl map 42
4.2.1. Expansion of urban built up area 42
4.3 Socioeconomic and impact analysis urban sprawl 43
4.3.1 Demographic Characteristics 43
4.3.2 Family size 45
4.3.3 Household occupational status 46
4.3.4 Households average monthly Income 47
4.3.5 Length of residence in the town 47
4.4 Socio economic profile of respondent household heads 48
4.4.1 Land ownership status 48
4.4.2 Landholding Size in Hectare 48
4.4.3 Land use categories 49
4.5 Expansion of LTLD Town 50
4.5.1 Reaction towards Urban Expansion 50
4.5.2 Type of change observed in LTLD 50
4.5.3 Factors of expansion 51
4.6. Impact of Urban Sprawl in LTLD Town 52
4.6.1 Eviction from Land 52
4.6.2 Vacated type of land 52
4.6.3. Temporal dimension of land taken 53
4.6.4 The Effects of Urban sprawl 54
4.6.5 Types of Effects of Urban sprawl in LTLD Town 54

CHAPTER FIVE 56
5. CONCLUSION AND RECOMMENDATION.....56
5.1. Conclusion 56
5.2. Recommendation 57
Reference 58
APPENDIX I 61

Lists of Tables

Table 1: Number of population by kebeles of Laga Tafo-Laga Dadi (2007)…..…..……24

Table 2: Available imageries and their source……26

Table 3: Software and their purposes……27

Table 4: percentage distribution and LULC map of LTLD Town in 1996……...…33

Table 5: percentages distribution and LULC map of LTLD Town in 2006…….…….35

Table 6: Percentages distribution and LULC map of LTLD Town in 2016…….…….36

Table 7: Areal extent of LULC categories of LTLD town in 1996, 2006 and 2016…….37

Table 8: Patterns of LULC of LTLD town in different periods……...….38

Table 9: LULC class's matrix between1996 and 2006 …….……40

Table 10: LULC classes matrix between 2006and 2016……...41

Table 11: percentage distribution of Socio- Demographic variables of the respondent…45

Table 12: Average monthly income……...……..…..47

Table 13: Land ownership status……..….48

Table 14: land use categories…….....49

Table 15: understanding Urban Expansion…….…….....50

Table16: Land taken from the respondents …….……..52

Table17: Vacated type of land……...53

Table18: when land was taken from the Respondents……...53

Table19: Reaction of the Respondents towards the effects of Urban Expansion……..…54

Table20: Types of Effects of Urban Expansion…….54

Lists of Figures

Figure 1: Location map of the study area…….…….23

Figure 2: DEM of Legetafo Legedadi..... 23

Figure 3: Flowchart of Research Methods…….…30

Figure 4: Land use land cover map of study area 1996…….33

Figure 5: land use land cover map of study area 2006…….....34

Figure 6: Land use land cover map of study area 2016…….....35

Figure 7: Urban expansion map…….42

Figure 8: Family sizes of respondents……...46

Figure 9: family sizes of respondent ……..…….....46

Figure 10: Length of respondent live in the town……...……...48

Figure 11: Hectares of Land the Respondents Have …….…….....49

Figure 12: observed type of change ……..…….....51

Figure 13: Factors of expansion…….52

Acronyms

CSA	Central Statistical Authority
DFID	Department for International Development
EMA	Ethiopia Mapping Agency
ENVI	Environmental for Visualizing Images
ERDAS	Earth Resource Data Analysis System
ETM+	Enhanced Thematic Mapper plus
FGD	Focus Group Discussion
GIS	Geographic Information System
GPS	Global Positioning System
GLCF	Global Land Cover Facility
LULC	Land Use Land Cover
MoFED	Ministry of Finance and Economic Development
RS	Remote Sensing
SLF	Suitable Livelihood Framework
SRTM	Shuttle Radar Topography Mission
SSA	Sub Saharan Africa
SZOSF	Special Zone of Oromia Surrounding Finfine
TM	Thematic Mapper
UN	United Nation

Abstract

This study analyzed the spatial and temporal pattern of urban sprawl and its impact on Legetafo Legedadi town of special zone of oromia using geographic information system and remote sensing data spanning from 1996 to 2016. To this end, the research has identified urban sprawl and its pattern based on time series data and its indicators analyze major impact and produce urban sprawl map. In order to *achieve these objectives, qualitative and quantitative research approaches were used. Furthermore, to generate qualitative and quantitative data primary and secondary sources were employed. Interview, questionnaires, and focus group discussions were used as primary sources whereas journal, reports and other relevant documents were used as secondary sources. Both probability and non-probability sampling techniques were employed to select 264 sample households. Maximum likelihood supervised classification of satellite imageries using ERDAS IMAGINE and Arc GIS applied for Image classification. The finding of the study shows that urban/built up land has expanded horizontally by 48.3 and agricultural land loss 42.95% over the study period. Loss of agricultural land, loss of livelihoods and displacement of farming households were major impacts of urban sprawl on study area. Increase in the number of population and land use land cover change as an indicator of the problem in the town. Therefore it is recommended that Lege tafo Legedadi town administration consider vertical development of the town, creating good governance to apply rule and law effectively and properly.*

Key words: urban sprawl, remote sensing, geographic information system, spatiotemporal

CHAPTER ONE

1. INTRODUCTION

1.1. Background of the study

Urban sprawl is often considered as unplanned and uncontrolled spread out of built up areas (Verzosa and Gonzalez, 2010). It is the condition mainly associated with the growth and spread of built up areas that come with urbanization over time by encroaching isolated traces of land (Yeh and Li, 2001; Mujtaba, 1994). Different researchers define sprawl differently based on their perspective which made the term complex and ambiguous. While some argue that urban sprawl is bad, harmful and a threat to ecology, others argue that it is something inevitable and maybe even should be encouraged (Haregewoin, 2005). For Burchell, (2003) urban sprawl is characterized by the dispersion of urban occupation, which rapidly reaches rural areas and is caused mainly by the low population density of these areas, which extend beyond the consolidated city center. It usually occurs outside of the center of services and available jobs, thus separating the places where people shop and work, and even where they study, from the place where they live. One of the principal indicators of the phenomenon of urban sprawl is the creation of large urban gaps, decentralization of public land. Lack or inability of local government to control the value of real estate for fiscal purposes, loss of agricultural farmlands, displacement of farm households, loss of livelihoods in peri-urban territories.

Urban sprawl has become a global or universal problem, and is being faced by both developed and developing countries. It all began during the post war prosperity of the 1950's and60’s, when housing developments popped up across the landscape like mushrooms after a rain. A half century later, it is understood that many environmental problems accompany the outward spread of cities: fragmenting and destroying wildlife habitat, for example, and discharging polluted runoff water into streams and lakes. In developing countries sprawl is largely the result of mobility of people to the city in search of better employment and opportunity (Menon,2004). This leads to an increase in size well beyond the limits of the city and has become life threatening due to health and

hygienic problem. In contrast, sprawl in developed countries is the results of higher incomes, which in turn result in people preferring (and affording) to live in the outskirts of the city, with open spaces at reasonable distances from cities. However with the expansion of urban land day by day, engulfing the neighboring land, there is a major threat to sustainability and quality of life. The consequences can be devastating in the long run (Menon, 2004).

Africa is urbanizing fast. Its rate of urbanization soared from 15 % in 1940 to 40 % in 2010, and is projected to reach 60 percent in 2050 (UN, 2007).Africa urban growth is in line with trends observed in most emerging and developed countries. Nonetheless, a level of urbanization is still below 20% in poorest countries of the region including Burundi, Ethiopia, Malawi, Burkina Faso, and Uganda. But, in the rapidly industrializing economy of South Africa, approximately 60% of the population now lives in urban areas (UN, 2007).

Ethiopia is one of the most populous countries in Sub Saharan Africa (SSA) and urban population growth is estimated at 6%, a much higher figure compared to other Sub Saharan African countries. The country is one of the least urbanized of the third world and its economy almost entirely depends on agriculture (The World Fact Book, 2004). Like most developing countries, Ethiopia experiences high rural to urban migration in search of better employment and different opportunity. The need for housing is not integrated with the need to prevent horizontal expansion and hence saving land. Formal and informal settlements are stretching out horizontally from the central capital in all directions. Land is ineffectively used, and new developments are planned on virgin land usually leapfrogging from cores. Nechyba et al. (2004) states the lists of problems linked to sprawl such as the loss of open space, urban decay, unsightly strip mall developments, the loss of a sense of community, patchwork housing developments in the midst of agricultural land, increasing reliance on the automobile, the separation of residential and work locations, and the spreading of urbanized developments across the landscape. Generally, sprawl in Ethiopia is a result of population pressure both from natural births and migration (Haregewoin, 2005). Therefore, this study will attempt to identify urban

sprawl change and its impacts on the study area from1996to2016 by using Geographic Information System and Remote Sensing technologies.

1.2 Statement of the problem

Urban sprawl is now becoming a common problem in most part of the world. As of many other developing countries, Ethiopia has encountered a problem of urban sprawling due to unplanned urban expansion and residential houses in many of its towns and cities (Zewdu, 2011). The effect of Urban sprawlhas brought sever problem related to land use, environment, socioeconomic activities etc. Land use change has environmental impact like reducing regional open space, increased air pollution, and energy consumption, decreased aesthetic appeal of landscape, loss of farmland, reduced diversity of species, increased runoff of storm water and ecosystem fragmentation (Burchell et al,1998). It also has socioeconomic impact such as soil erosion, desertification; soil degradations which are associated with agricultural production and deforestation reduce land quality and agricultural productivity. Urban development patterns also affect the lives of individuals and the society in which the livelihoods of community becoming hard to survive in their livelihood. Life is become deteriorate from time to time compared to their previous income level which modifies the socio economic activities and revolutionizes the land use practice according to time frame (Bhagawat, 2011). Therefore, there is a need for, mapping, analyzing and continuously monitoring the phenomena of urban growth patterns. The remote sensing data together with GIS helps us to analyze the data spatially and very important to make reasonable urban planning and land use management.

Legetafo Legedadhi is one of the town of Ethiopia in which condition of sprawling has been occurring for the past few year. No study has been made on urban sprawl and land use changes in Legetafo Legedadhi town and the town has no updated maps to indicate those urban growth changes with an acceptable resolution that can at least give a picture (impression) about the physical changes and growth rate of the urban area of the town. Various studies have been done on urban sprawl and its impact. But, all these studies focus on the spatial aspects or focus on analyzing image. But this study comes up with the spatial and socioeconomic aspects of urban sprawl. Therefore, this research is

initiated to study GIS based spatiotemporal analysis of urban sprawl and its impact on surrounding residents with focus on Legetafo Legedadi town.

1.3 Objective of the study

The principal objective of this study was to examine urban sprawl based on spatiotemporal data and its impact on surrounding residents in Legetafo Legedadhi town using Geospatial technologies.

1.3.1 Specific objectives

More specifically, the study was aspired to:

- ✓ Identify urban sprawl and its patterns based on time series data to detect trend of land use land cover(LULC) change,
- ✓ Identify major indicators of urban sprawl in the study area,
- ✓ Analyze major impacts of urban sprawl on socioeconomic condition of community in the outskirt
- ✓ Generate urban sprawl map of the Legetafo Legedadhi town.

1.4. Research Question

- ✓ How urban sprawl is takes place in the study area?
- ✓ What are the major indicators of urban sprawl?
- ✓ What are the effects brought by urban sprawl on the socioeconomic condition of community in outskirts?
- ✓ What the direction and expansion of built up land?

1.5. Significance of the Study

This study may serve the interest of various stakeholders. Primarily, it can help policy makers, urban and/or regional planners, and administrators by providing information which supports decision making process. The study also helps to identify pattern of urban sprawl which is useful for natural resource planning and utilization, provision of infrastructure facility on the study area. In addition, the produced map of urban sprawl is used to identify area where environmental and natural resources are critically threatened,

to suggest future direction and pattern of sprawling growth. Finally, it will serve as an input or base for further studies.

1.6. Scope of the study

To properly address the stated objective, the study was spatially confined to urban sprawl in Legetafo Legedadhi town and its impacts on socioeconomic condition of community. Conceptually, it's delimited to study urban sprawl, cause, indicators and impacts of urban sprawl in Legetafo Legedadi town. Temporally, it is delimited to investigate the level of urban sprawl in Legetafo Legedadhi town between the year 1996 and 2006 using Google earth with landsat and spot image respectively as well as between 2006 and 2016 using spot image and Google earth with landsat to show the change due to population growth, migration and industries. Similarly, this study investigates the land use land-cover change that occurred in study area over those 20years.

1.7. Limitation of the study

The big challenge in doing this thesis came from availability of the required and suitable imagery data. Access to up to date and quality data were the major problem the researcher faced during this study. Some of the respondents were reluctant to give relevant information due to sensitiveness of the issue

CHAPTER TWO

2. REVIEW OF RELATED LITERATURE

2.1. Conceptualization and definitions

This section tries to conceptualize or define key concepts about Urban sprawl, Urbanization, land use, land cover, GIS and RS.

2.1.1. Concept of Urban Sprawl, Urbanization, Land use and Land cover

Urban sprawl is defined in different way by different writers. Most of the researcher argues that urban sprawl is an expansion of urban area to agricultural land due to increasing of population growth and rural urban migration. This spread of development across the landscape is commonly identified as urban sprawl.

Urban sprawl is not to be considered as increase of urban lands in a given area rather it is an extent of urbanization mainly caused by population growth and large scale migration which is mainly unplanned and unchecked (Sudhira, *et al* 2004). It can also describe as scattered development outer of compact urban and village centers along highways and in rural countryside (Nanda, 2005). Glaster (2001) also defined it as a cause of an externality, such as high dependence on the automobile, isolation of the poor in the inner city, the spatial mismatch between jobs and housing, or loss of environmental qualities. He also point out it as the consequence or effect of some independent variable such as fragmented local government, poor planning, or exclusionary zoning.

The concept of sprawl was developed by Earle Draper in 1937 in the United States of America. This concept has been used by city planners to refer to a wasteful type of urban growth. Urban sprawl is a pattern of uncontrolled development around the periphery of a city, and is an increasingly common feature of the built environment especially in the industrialized nations. The phenomenon reduces the orderly physical development that produces economically efficient land use and management at the fringes of rapidly urbanizing cities. As cities expand, the main zone of direct impact is the peri-urban area. The manifestation and impact of urban sprawl are therefore felt most in peri-urban

communities. At these peri-urban communities, development is patchy, scattered and spread out, with a tendency for discontinuity (Cobbinah, and Amoako, 2014).

According to Cobbinah, and Amoako (2014) from a conceptual perspective, a major relationship between peri-urban development and urban sprawl is the loss of the traditional livelihood in agriculture of peri-urban dwellers resulting from competition for peri-urban land due to the rapid expansion of the city. The resultant effect of the urban sprawl phenomenon is the engagement of peri-urban dwellers in urbanized less profitable economic activities such as petty trading, commercial and other related livelihood.

There are three basic spatial forms of sprawl: low density sprawl which has an unfair feature of use of land for housing purpose along the margins of existing urban areas associated with services like water, power and roads. Ribbon sprawl which is follow main road corridors away from the center leaving lands some distant from the roads. Leapfrog development sprawl which is characterized by an irregular pattern piece of developed land that is widely separated (Barnes et al., 2001 and Harvey and Clark, 1965)

Conversely, urbanization is defined as the demographic process whereby an increasing share of the national population lives within urban settlements. Settlements are also defined as urban only if most of their residents derive the majority of their livelihoods from non-farm occupations. Throughout history, urbanization has been a key force in human and economic development. This increasing of population in urban area causes urban sprawl if they are unplanned and unchecked (Arouri *et al*, 2014).

Urbanization also deals with the increase in the proportion of people living in towns and cities. Urbanization occurs because people move from rural areas to urban areas .This usually occurs when a country is still developing. Rural to urban migration is happening on a massive scale due to population pressure and lack of resources in rural areas. People living in rural areas are pulled to the city. Often they believe that the standard of living in urban areas will be much better in urban areas (Arouri *et al*, 2014). Therefore, the concept of urban sprawl is interrelated with urban growth because the increased population in urban area can cause urban sprawl unless it is managed and controlled.

Land use means, use of land for different purposes like built-up recreation, commercial, forest etc. Moreover, it is relates to the human activities or economic function rated with a specific piece of land In other words the land use denotes the multifaceted use of land, which includes both use and misuse of the land. Land cover relates to the type of feature present on the surface of the earth (Arouri *et al*, 2014). Besides, it can be described as ground blanket of natural and culture landscape. It consists of vegetation, soils, snow, rocks, settlements etc. Generally land cover means the area covered by various physical features like vegetation, hills, water bodies etc.

2.1.2. Geographic Information System

Geographic Information System (GIS) is a computerized system that facilitates the phases of data entry, data analysis and data presentation especially in cases when we are dealing with geo referenced data. It is a system which provides a computerized mechanism for integrating various geo information data sets and analyzing them in order to generate information relevant to planning needs in a context. GIS is also a computer based tool for mapping and analyzing things that exist and events that happen on earth (Patra, 2008).

A GIS without data is like a car without fuel. Without fuel, a car cannot move, likewise without data a GIS will not produce anything. Data for GIS can be obtained from different sources like aerial photographs, satellite imageries, digital data, conventional maps, Census, Meteorological department, field data (surveys/GPS) etc. These data obtained from various sources can be classified into two types; spatial data which describes location and attribute data which specifies the characteristics at that location. Spatial data tells us, “Where the object is?” Attribute data tells us “What the object is?” or “How much the object is?” In other words, it tells the characteristics at that location.
Application of GIS is very wide which ranges from public to private sectors. Its application is only limited by the imagination of the users (Patra, 2008). Some areas of GIS application .In the environment such as to protect the environment through producing maps, inventory species and to measure environmental impact, or trace pollutants. For forestry; by using GIS foresters can manage the forest as ecosystem through studying change detection of the forest.In geology; geologies use GIS in studying

geological features, analysis soils and strata, assess seismic information etc..It also useful to land use planning; it is the tool to visualize and plan land use needs of cities, regions, and even national governments. Useful for risk management; it can help with risk management and analysis by indicating which areas will be prone to natural or man-made disasters. Once identified, preventive measures can be developed so as to deal with the different scenarios.

2.1.3. Remote Sensing

Remote Sensing means obtaining information about an object, area or phenomenon without coming in direct contact with it. If we go by this meaning of Remote Sensing, then a number of things would be coming under Remote Sensor, e.g. Seismographs, fathometer etc. Without coming in direct contact with the focus of earthquake, seismograph can measure the intensity of earthquake. Likewise without coming in contact with the ocean floor, fathometer can measure its depth. However, modern Remote Sensing means acquiring information about earth's land and water surfaces by using reflected or emitted electromagnetic energy (Yeh and Xia, 2001).

There are two ways for interpretation of remotely sensed data. Namely, (a) visual interpretation in which data is interpreted without computer (visually) and (b) digital Interpretation: it facilitates quantitative analysis of digital data with the help of computers to extract information about the earth surface. Digital interpretation is popularly known as 'Image Processing'. Image processing deals with image correction, image enhancement and information extraction.

Like GIS the application areas of Remote sensing is unlimited and used in different area such as; crop Monitoring and Damage Assessment, forestry, land cover & land use (LC/LU) for mapping it has also agricultural applications in crop type classification

2.2. Theoretical framework

Developing model on urban land uses, their distribution, and changes requires the application of theories on urban structures and development. In this study the researcher described Shannon's entropy theory to measure urban sprawl.

2.2.1 Shannon's entropy

The term Entropy is most frequently used while describing the quantity efficiency of elements. Entropy is related to the expansion of the spatial variable in a given area or limit, which was given by Shannon's Entropy. This method is useful to measure and distinguish types of sprawl. The Entropy method is beneficial with GIS because of simplicity and uncomplicated integration. It is used to measure the degree of spatial concentration and dispersion of urban sprawl, defined by geographical variables (Yeh and Li 2001; Sudhira *et al.*, 2004). The entropy value varies from 0 to 1. If the distribution of built-up is most concentrated in one area, the lowest Entropy value is 0. Distribution of built-up across space will give the maximum Entropy value 1.

2.2.2 Need of Entropy

The measurement and monitoring of land use changes are crucial to understand land use cover dynamics over different spatial and temporal time scales for effective land management. Today, with rapid urbanization and industrialization, there is increasing pressure on land, water and environment in cities.

Urban sprawl has been criticized for inefficient use of land resources and energy and large-scale encroachment into the agricultural lands. There are many problems associated with fragmented conversion of agricultural land into urban use. The cities are expanding in all directions resulting in large-scale Urban Sprawl and changes in urban land use. The spatial pattern of such changes is clearly noticed on the urban fringes or city peripheral rural areas, than in the city centre.

2.3. Empirical Review of Related Literature

2.3.1. Causes of Urban Sprawl and urban growth

The causes of urban growth are quite similar with those of sprawl. In most of the instances they cannot be discriminated since urban growth and sprawl are highly interlinked. However, it is important to realize that urban growth may be observed without the occurrence of sprawl, but sprawl must induce growth in urban area. Some of the causes, for example population growth, may result in coordinated compact growth or uncoordinated sprawled growth (Bhatta, 2010). Whether the growth is good or bad

depends on its pattern, process, and consequences. According to him some of the catalyst that is responsible for the occurrence of urban sprawl is as follows:

2.3.1.1. Population growth

Rapid rising of urban population is the main reason for the urban growth. This is occurred due to: (a) natural increase in population, and (b) migration to urban areas. Natural population growth results from excess of births over deaths. Migration is defined as the long-term relocation of an individual, household or group to a new location outside the community of origin. Although very insignificant comparing the movement of people within the country; international migration is also increasing. International migration includes labor migration, refugees and undocumented migrants. Both internal and international migrations contribute to urban growth (Bhatta, 2010).

In the recent time, the movement of people from rural to urban areas within the country (internal migration) is most significant. Because, in the urban area, there are better basic services as well as other specialist services that are not found in rural areas. There are more job opportunities and a greater variety of jobs in the cities. Health is another major factor. People, especially the elderly are often forced to move to cities where there are doctors and hospitals that can cater for their health needs. Natural population growth is a major element in urban growth for all countries, but rural urban migration contributes even more in many developing countries (Gugler, 1996). Other factors include a greater variety of entertainment (restaurants, movie theatres, theme parks, etc.) and a better quality of education. Due to high populations, urban areas can also have much more diverse social communities allowing others to find people like them (Bhatta, 2010).

Therefore, this huge growth in urban population may force to cause uncontrolled urban growth resulting in sprawl. The rapid growth of urban strains their capacity to provide services such as energy, education, health care, transportation, sanitation, and physical security. Since governments have less revenue to spend on the basic upkeep of urban and the provision of services, urban areas become areas of massive sprawl and serious environmental problems.

2.3.1.2. Economic growth

According to Boyce (1963), Giuliano (1989), Bhatta (2009b) as cited in Bhatta (2010) expansion of economic base (such as higher per capita income, increase in number of working persons) creates demand for new housing or more housing space for individuals. This also encourages many developers for rapid construction of new houses. Rapid development of housing and other urban infrastructure often produces a variety of discontinuous uncorrelated developments. Rapid development is also blamed owing to its lack of time for proper planning and coordination among developers, governments and proponents.

2.3.1.3. Independence of decision

The competitors (government and/or private) hold a variety of expectations about the future and a variety of development demands. Often these competitors can take decisions at their own to meet their future expectations and development demands. This is especially true if the city lacks a master plan as a whole. This independence ultimately results in uncoordinated, uncontrolled and unplanned development (Harvey and Clark, 1965 cited in Bhatta, 2010).

2.3.1.4. Demand of More Living Space

In many developing countries, residents of the core city lack sufficient living space. This encourages countryside development for more living space. People can buy more living space in the countryside than in the inner city, since the cost of property is less in the countryside. However, consumption of more living space not always causes sprawl. Population density is a major concern in this issue. Cities in developing countries are three times denser than the cities in developed countries (Acioly and Davidson 1996 cited in Bhatta, 2010). Therefore, higher per capita consumption of built-up area (or living space) is desired in many instances. In such cases, higher per capita consumption of living space may indicate better and extended living facilities within the confines of compact urban growth. However, if the demand of more living space forces rapid low-density development in the countryside then it must be an indication of sprawl.

2.3.1.5. Land-use and Land Consumption

There is a major controversy whether land-use and consumption decisions are the primary engines of urban sprawl or whether it is continuing population boom that provides most of the expansion. Some argue that sprawl is first and foremost a land-use phenomenon since even an area of static population can experience sprawl as its built environment is modified in a sparse, low-density, auto-friendly way pushing city limits further and further out (Haregewoin, 2005).

According to her fulfilling the resource requirements of a growing population ultimately requires some form of land-use change in order to provide for food, living space, recreation, infrastructure development and service provision. Urban land use generally expands at the expense of agriculture as demand for housing grows. This brings about differences between land consumption in the centre and fringe of the urbanized area and creates changes in land consumption rates through time.

2.3.1.6. Industrialization

Establishment of new industries in countryside increases impervious surfaces rapidly. Industry requires providing housing facilities to its workers in a large area that generally becomes larger than the industry itself. The transition process from agricultural to industrial employment demands more urban housing. Single-storey, low-density industrial parks surrounded by large parking lots are one of the main reasons of sprawl. There is no reason why light industrial and commercial land-uses cannot grow up instead of out, by adding more storey instead of more hectares. Perhaps, industrial sprawl has happened because land at the urban edge is cheaper (Bhatta, 2010).

2.3.2. Consequences of urban sprawl

There is no doubt that urban sprawl exists in most of the cities now a days. For many, a suburban home or apartment is a very comfortable place to live in. To those who have recently escaped from the inner city, the suburbs are wonderful places. For most people the rise in affluence has meant a better, not a worst, existence, and they look upon their much despised 'suburban middle-class lives' as fulfillment rather than deprivation. The

consequences and significance of such sprawling, average or good are evaluated, based on its socio-economic and environmental impact (Ewing, 1994).

Sprawl can damage ecological systems and their natural functions, such as wildlife habitats and wetlands. Housing subdivisions, commercial developments, and the roads that connect them all divide a landscape, which results in habitat fragmentation. This fragmentation forces wildlife to either find another place to live or compete with each for a smaller amount of land. Urban sprawl is also threatening wetlands, an important key to healthy ecosystems. In addition to being home to a number of critical wildlife and plant species, wetlands improve water quality by filtering outSediments and other pollutants, protect the shorelines of rivers and lakes from erosion, and help control and reduce flooding. However, since 1800, over two--thirds of Great Lakes wet lands have been lost or severely damaged, and land development continues to destroy wetlands today (Ewing, 1994).

Pollution is also a cost of urban sprawl. Most sprawling towns are built for cars and force us to drive more frequently and for longer periods of time. And increase increased use of cars leads to more air and noise pollution as well traffic jams. As for water pollution, lands covered with highways, buildings, and parking lots increases runoff, polluting our streams, lakes, and watersheds. As a result, our access to clean and safe drinking water becomes threatened, and our aquatic plant and animal life suffer (Brunner, 2012).

Generally, unplanned and unchecked urban growth has an impact on agricultural land and destruct a sensitive environmental areas , due to emission of gas from vehicles the quality of air is affected, as people and dollars flow to new suburbs; the neighborhoods of central city and older suburbs become decreases, deterioration in quality of life diminishes the capacity to attract and retain business in the state and increases the costs of building and maintaining new suburban infrastructure (Myers and Kitsuse, 1999).

2.3.3 Measure of urban sprawl

The improvement in modern Remote Sensing and Geographic Information Systems permit us to collect a set of physical data with relatively low cost and high speed on cyclic basis. The remote sensing data together with GIS helps us to analyze the data

spatially and very significant to build rational urban planning and land use management. So, it's ideal to use a tool such as GIS as element of research on urban sprawl because of the capability to handle various types of spatial data. Several spatial and non-spatial technique of estimating the urban sprawl level exists. Still, all technique used are subjective and in debate.

(Glaster, 2001) examined six different measures of urban sprawl development:

1. Density: - the average number of residential units per square mile
2. Concentration:-the degree to which development is located within a relatively few square miles of the urbanized area
3. Compactness: - the degree to which development has been clustered;
4. Centrality: - the degree to which development is located close to the central business district;
5. Nuclearity:- the extent to which an urbanized area is characterized by a single center of development;
6. Proximity of land uses: - the degree to which different land uses is close to one another.

2.3.4 Solutions for urban sprawl

Understanding Sprawl is a guide for decision-makers and citizens who want to create a healthy, affordable and sustainable urban future. It is not an architectural blueprint but an exploration of the forces that shape cities and what people can do about them. It probes the history of city and suburban development, which is critical for understanding current urban patterns. It reviews the nature of the city and outlines the social and economic costs incurred by recent development (Mills, 2003).

As Haregewoin (2005) pointed out to overcome the problems of urban sprawl the following solution are very important:

- ✓ The creation of employment opportunities away from the major metropolitan areas; a number of small towns and cities that are closer to the hinterland could be developed as potential sources of employment for rural people. This would

reduce the burden on larger cities and create an alternative source of work, thereby addressing the problems of both unemployment and sprawl

- ✓ Development and use of better and most efficient land use policies; communities can grow in an efficient manner by using existing infrastructure, or by building away from natural wildlife resources. For these development policies can be targeted more towards an already urbanized area.
- ✓ Implement means to decrease or stop migration; in addition to the push factors, the pull factors that attract migrants to cities other than job opportunities need to be addressed. Improving efficiency of land use or other proposed solutions would not be effective in the long run if migration continues.
- ✓ The reuse of existing land within the city and concentrating growth; abandoned building sites such as old schools, industrial land and parking space may be reused providing alternatives to using virgin land outside of city limits. This attacks the problem of city sprawl encroaching on new land outside the city.

2.3.5. Global Trends of Urban growth and its implication for urban sprawl

Urbanization is now a rising trend seen all over the world, especially in an alarming rate in developing countries. This makes cities grow both in number and in physical size. The world's urban population will grow from 2.86 billion in 2000 to 4.98 billion by 2030, of which high-income countries will account for only 28 million out of the expected increase of 2.12 billion. The world's annual urban growth rate is projected at 1.8 per cent in contrast to the rural growth rate of 0.1 per cent (State of the World Cities, UN Habitat, 2004/5 cited in Haregewoin 2005).

The urban growth rate of less developed regions reached 3.0 per cent per year in 1995-2000 compared to a much lesser figure of 0.5 per cent in more developed regions. This growth rate will continue to be particularly rapid in the urban areas of less developed regions. In contrast, the world rural population is expected to remain nearly stable. Even within the less developed regions category there are marked differences in the level and pace of urbanization. Regionally, Latin America and the Caribbean as a whole are highly urbanized. Africa and Asia are considerably less urbanized and, consequently, are expected to experience rapid rates of urbanization from the year 2000 onwards. With 80

percent of the population being urban, Europe is the most urbanized continent (Haregewoin, 2005).Therefore, this implies an alarming rate of urban growth and increasing of world population in urban area can causes urban sprawl if it is unplanned and unchecked.

2.3.6. Trends of Urban growth in Africa and its implication for urban sprawl

The level of urbanization in Africa is low (37.1%) when compared with developed countries like Europe (72.7%) and North America (79.1%). However, urbanization in the developing world in general is progressing much faster than in developed countries, which may reach 3% or even 4 % a year. This fast rate of urbanization in developing world is attributed to rural–urban migration, economic growth and development, technological change, and rapid population growth (Soubbotina, 2004). Africa's population reached more than 1 billion in 2009, of whom around 40% lived in urban areas. It is expected to grow to 2.3 billion by 2050, of whom 60% will be urban. This urbanization is an important challenge for the next few decades (UN, 2011).

Unlike similar trends in Asia and South America, urbanization in Africa is characterized by high poverty. Sub-Saharan African countries have the highest levels of urban poverty in the world. Despite African cities generating about 55–60% of the continent's GDP, 43% of its urban populations live below the poverty line. Urban poverty in Africa frequently manifests itself in unequal access to decent housing. For example, the majority of the urban and peri-urban poor tend to live in ecologically fragile zones where they overexploit the surrounding lands. Urbanization in Africa is characterized by a high proportion of urban poor living in slums: Sub- Saharan Africa's slum population was recently more than 60% among urban residents. They tend to lack basic urban services such as access to sanitation, clean water, energy and solid waste disposal. This population is likely to be adversely affected by climate change and its effects, since their precarious living conditions make them particularly vulnerable to disease and natural disasters (Arouri *et al*, 2014).

2.3.7. Trends of Urban growth in Ethiopia and its implication for urban sprawl

Urbanization in Ethiopia is in its infant stage. Given the direct relation of urbanization and economic development, the country still deserves promoting urbanization. MoFED (2006) stated that Ethiopia is one of the least urbanized countries in the world. It has only 16% of its population living in urban centers. However, given the 2.73% total annual population growth rate, high rate of in-migration to towns, and increase in the number of urban centers, the rate of urbanization is increasing at a rate of 4.4%. Furthermore, the country's urban population is expected to grow on average by 3.98% and by 2050; about 42.1% of the total population is expected to be inhabited in urban centers (UN-HABITAT, 2007).

If rapid urban population growth not managed proactively, it may pose urban sprawl and a demographic challenge as cities struggle to provide jobs, infrastructure and services, and housing. Infrastructure and service delivery are already undermined in many cities by growing urban extents and by stretched municipal budgets, while formal labor markets are failing to keep up with demand for jobs. Ethiopian cities run the risk of becoming less attractive places for people and economic activity. Moreover, constraints on rural urban migration including the loss of land rights for those who leave rural areas reduce incentives to move to cities, which in the long run could slow agglomeration, reducing productivity and economic growth (World Bank, 2007).

Ethiopia has a problem with urban sprawling due to unplanned urban expansion and residential houses in many of its towns and cities which causes burdens on urban administrators, planners and other concerned bodies to provide the required infrastructure and service facilities (Zewdu, 2011). Therefore, in order to maximize the benefits of urbanization and minimize its negative externalities in peri-urban environment and livelihoods, the concerned bodies should planned and control rapid urban growth.

2.3.8. Application of GIS and RS for analysis of Urban Sprawl

Now a day the field of Remote Sensing and GIS has become exciting and glamorous with rapidly expanding opportunities. They are very useful in the formulation and implementation of the spatial and temporal changes, which are essential components of

regional planning to ensure the sustainable development. The different stages in the formulation and implementation of a regional development strategy can be generalized as determination of objectives, resource inventory, analysis of the existing situation, modeling and projection, development of planning options, selection of planning options, plan implementation, and plan evaluation, monitoring and feedback (Yeh and Xia, 2001). GIS and remote sensing techniques are quite developed and operational to implement such a proposed strategy. The spatial patterns of urban sprawl on temporal scale are studied and analyzed using the satellite imageries. The image processing techniques are also quite effective in identifying the urban growth pattern from the spatial and temporal data captured by the remote sensing techniques. These help in delineating the growth patterns of urban sprawl such as, the linear growth and radial growthpatterns(Yeh and Xia, 2001).

Remotely sensed satellite image are important in land use/ land cover map preparation for detecting urban land use/ land cover change. Land use means, use of land for different purposes like built-up recreation, commercial, forest etc. Land cover means the area covered by various physical features like vegetation, hills, water bodies etc. Therefore, remote sensing technology plays key role in land use /land cover mapping of urban area ((Yeh and Xia, 2001)).

2.3.9. Related works

Now a day the use of Remote Sensing and Geographic Information Systems techniques has become important for mapping, monitoring, measure degree of urban sprawl and managing urban land-use/land cover changes. Mapping urban sprawl provides a picture of where this type of growth is occurring, and helps to identify the environmental and natural resources threatened by such sprawls, and suggests the likely future directions and patterns of sprawling growth. Analyzing the sprawl over a period of time will help in understanding the nature and growth of this phenomenon. GIS and remote sensing are very useful in the formulation and implementation of the spatial and temporal changes. A number of urban sprawl- related studies were done using GIS and Remote Sensing. For example, Manishika Jain, Works on GIS and remote sensing application to study urban sprawl of Undapur, India. In the methodology part he only use Landsat imageries to show

urban sprawl which has poor image quality means low resolution and its mostly used to show land use land cover type of study area in addition to this he only focus on one factor to identify urban sprawl which is LULC change without considering other factor. There are also many other works done by scholar, Adane Zeleke 2013 on mapping of urban sprawl and its problem in teppi town using aerial photograph, Landsat and spot-5 satellite data were used to produce the LULC maps he use only image for urban sprawl analysis, Sudhira et al (2003) Urban sprawl: metrics, dynamics and modeling using toposheet, Landsat image, and different attribute data. These studies try to show urban sprawl in different area by employing different methodologies without considering its socioeconomic impact. However, this study is try to analyze urban sprawl using spatial aspect like spot image to detect urban land use land cover change and its socioeconomic impacts that helps policy makers what strategies should developed in order to minimize its negative effect on the study area.

CHAPTER THREE

3 METHDOLOGY OF THE STUDY

3.1 Description of the Study Area

3.1.1 Historical Background of Lege tafo Lege dadi Town

The original settlements of the current Legetafo Legedadi town were founded in 1935 during the Italian occupation as a garrison town. When the Italians invaded Ethiopia in 1935 they settled on hilly land owned by a man called Basha Ergete, near Lege Dadi River. After the liberation in 1962 Mulugeta Habtegiorgis who was landlord ordered the distribution of land to those who settled from Addis Ababa through lease and Legedadi town expanded as rural urban settlement.

Before the emergence of the town these settlement had been two separate areas under kebele farmers association. Legedadi was rural in berek district. In 1974 during the Derg regime land was distributed to the peasants and extra houses weretransferred to government by proclamation.

These settlement were combined together to form a single town of Legetafo Legedadi in July 2006. The town also got legal recognition as municipal town under Berek district, Oromia special zone. Historical sources show that the town got its present name from the two major rivers called Legetafo and Lege dadi bordering and passing through the town and its surrounding areas.

3.1.2 Area and location

Legetafo-Legedadhi is located in Oromia National Regional State, Oromia special Zone, Berek District, along the road to Dessie at a distance of 21 km North East side of Addis Ababa. Its astronomical location is between 9º01'29" N - 9º06' North Latitude and between 38 º 53'42" E - 38 º 55'30" East Longitude. Relatively the town is bordered by Addis Ababa city and Sululta Wereda from the west,by Berek Wereda from the North, East and South. The town has two Kebeles namely Tafo 01 and Laga Dadi 02 with a total area of 7444.53 hectare (Municipality of Laga Tafo_Laga Dadi Town, 2016).

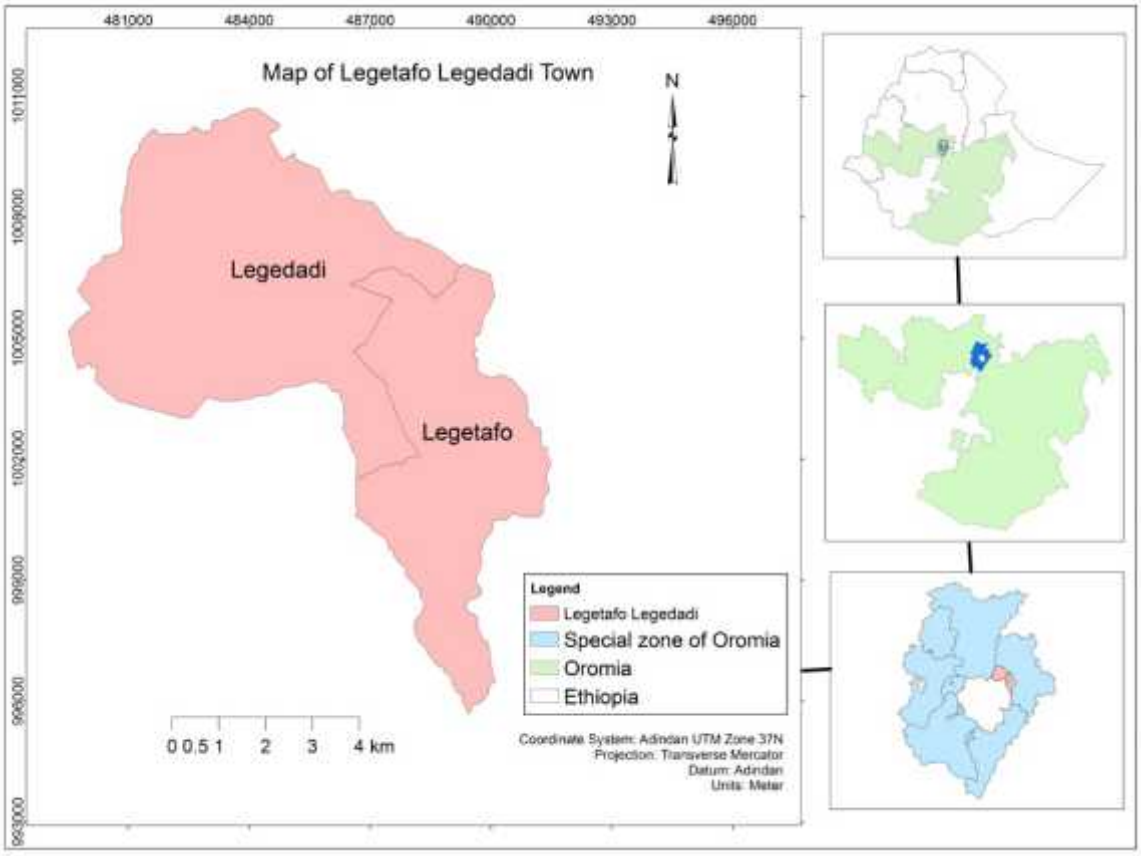
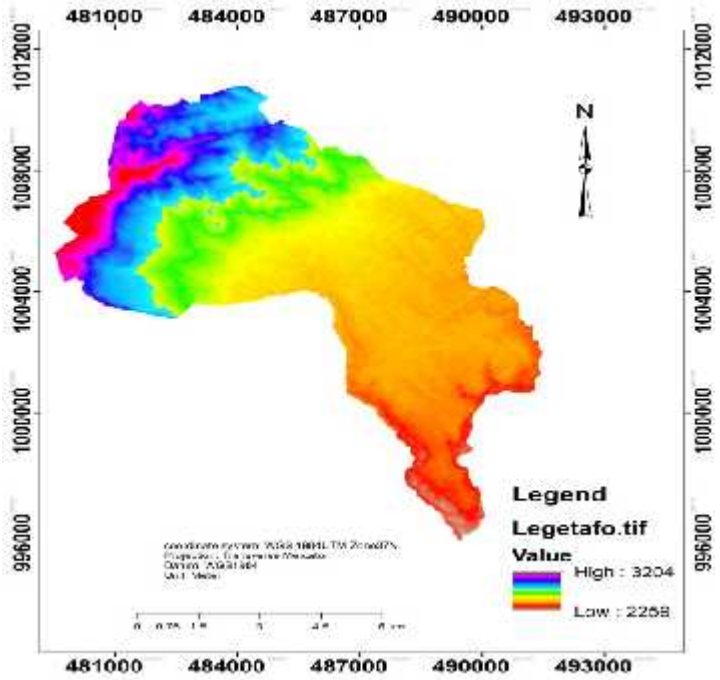


Figure 1: Location map of the study area

3.1.3. Topography and climatic condition

Laga Tafo-Laga Dadi town is found on 2316m -2500m above sea level; the mean annual maximum and minimum temperatures of the town are 23.76ºC and 10.67ºC, respectively and the Mean Annual Rainfall is 1,223.54 mm. The prevailing wind directions of the town are easterly and southeasterly. This is categorized within temperate (locally named *Weyna Dega*) agro-climatic zone of Ethiopia. The town falls in the summer and spring rainfall regions of Ethiopia, which experiences moderate temperature and high rainfall between June to early September and no or little rainfall and low temperature between December to March. In other word the town falls within summer maximum rainfall region of Ethiopia. (Municipality of Laga Tafo_Laga Dadi Town, 2016).

Figure 2 DEM of Legetafo Legedadi



3.1.4. Demographic and socioeconomic characteristics

3.1.4.1 Population Profile of the Study Area

According to CSA (2007), total population of the town was about 18,177 out of which 9157 were Males, and 9020 were Females. The household size of the town is averagely of four member families with rapid population growth rate estimated at 3.8 per year. The total numbers of households in the town were 5563.The population figures of the town and household number by sub-*kebeles* have been presented in table 1 below.

Table 1: Number of population by *kebeles* of Laga Tafo-Laga Dadi (2007)

NO.	Kebeles	Population size	Household number
1	Laga Tafo 01	10735	3421
2	Laga Dadi 02	7442	2142
Total		18177	5563

Source: CSA, (2007)

3.1.4.2 Socio economic characteristics

Laga Tafo – Laga Dadi town is a home for almost all Nations and Nationalities in the country, and the Oromo ethnic groups constitute the majority. Most of the residents of the town engaged in different trade activities, construction work, manufacturing and others were employed in different governmental organizations and factories. Agriculture is also another economic activity in the peri urban area of the town. On the other hand, there is standardized apartment house that provides there in habitants with comfortable of life, for instance Ropak international and CCD villages are very beautiful and attractive part of the town. In contrary to this, there are unplanned, congested and dirty housing conditions, which present physical and psychological discomforts to their in habitants (Municipality of Laga Tafo_Laga Dadi Town, 2016).

3.2. Research Methods

3.2.1. Research Design

This study has used mixed research approach which is quantitative and qualitative approach. Quantitative approach is employed for description of phenomena based on the exploration of correlation between urban sprawl and its factors. To conduct quantitative data the researcher also used developmental design that explores how urban sprawl changes over time with in the study area. Under this method the cross-section study is employed to compare two different spot imageries within the same parameter. The qualitative approach is used to analyze the data from focus group discussion (FGD), observation and interview which helps to substantiate quantitative one.

3.2.2. Data Sources and Instrument

The study has used data collected from different sources. Firstly, primary data is collected using structured questionnaires to analyze the impacts of urban sprawl on the study area, digital camera to get photo of affected area, GPS to get ground truth point for accuracy assessment, field observation and interviews for affected people and experts to substantiate data get from other sources. A discussion with elders and experts working in the municipality about the past and present status of LULC of the town is also conducted.

Secondary data is collected from different offices like Ethiopian Mapping Agency (EMA) to get image of Spot 2006, and shape file of the study area. Municipality and Central Statistics Agency (CSA) for population data of the town. The data collected from online sources and different offices include Google earth and landsat of 1996, spot image of 2006 having 5m resolution and Google earth with landsat of 2016 years. Additional ancillary data for this study were also obtained from different published and unpublished sources such as; books, journals, internet sources, research reports and articles documents.

Table 2 Available imagery data and their source

Sensor	Acquisition date	Source	Resolution
Landsat (TM)	1996	GLCF	30m
SPOT-5	2006	EMA	5m
Landsat (ETM)	2016	GLCF	30m

3.2.2.1 Software and Instruments

Commonly used and known image processing GIS software program were used in this study. To collect the ground truths for field verification purpose a GPS instrument is utilized. ERDAS 2010 software were also be used for image processing purposes. The structured questionnaire were initially prepared in English then translated in to Amharic and Afan Oromo. Finally, the questionnaire is distributed for the samples household heads in the town. Table 2 illustrates the software which used in this study

Table 3 Software and their purposes

No.	Software Version	Purpose
1	ArcGIS10.1	For clipping, georeferencing to cross tabulate (to compute the LULC class matrix between images of different time), preparation of map layout, for extraction of polygon from raster, extraction of slop and elevation maps from SRTM data
2	ERDAS2010	For layer stacking, subseting, clipping, performing the classification of the different LULC categories, post classification, Computing area, assessing the accuracy of classification
3	Garmin 72 GPS	To collect the ground truth control point
4	Digital Camera	To capture photography of the study area

3.2.3. Sample Size and Sampling Techniques

To address the objective of the study and to find answers for questions related to impact of urban sprawl it is needed to collect the information from the local people. To collect data both probability and non probability sampling techniques were employed. The study has involved 10 purposively selected experts from Municipality of the town. The experts were selected based on their experience on working on the issue. Besides, sample household heads were selected by using simple random sampling method. According to data obtained from (CSA, 2007)5563 total households registered from two kebeles. To determine the required sample size this simplified formula assumes a 95% confidence level and the maximum variance (p = 0.05). The formula is:

n= N/1+N(e)2..... (Kasunic, 2005)

Where

n -is the sample size

N -is the population size (total household)

e -specifies the desired level of precision (6% (0.06)

1 = a theoretical or statistical constant

By applying the above simplified formula the appropriate sample size for this study were 264 respondents.

3.2.4. Techniques and Methods of Data Analysis

Before using digital images for different purposes image pre processing techniques are crucial steps. Landsat image acquired from website (GLCF) is not complete enough for direct usage. For this reason image pre processing is required to make the raw data ready for different purposes. Accordingly, the acquired images were pre-processed before a classification of the images into different urban LULC classes for analysis of urban sprawl and its impacts on the study area. This image processing includes image pre-processing technique like layer stacking means combining layer together to make ready for classification. Image enhancement to increase tonal vibration with in an image for better visualization, image classification (supervised classification).Moreover, post classification is carried out by using ERDAS 2010 software and spatial reference of the Universal Transverse Mercator (UTM) zone 37N projection with datum World Geodetic System (WGS) 1984 UTM were carried out using ArcGIS10.1 software to produce LULC map of 1996 of the study area.

Spot image of 2006, landsat of 1996 and 2016 were classified by using supervised method of maximum likelihood algorithm techniques to classify urban LULC of 1996, 2006 and 2016 in order to see the possible LULC changes over time and for identification of pixels that have specific spectral characteristics and to determine the different land use/cover classes represented by these groups. Five training areas for the supervised classification were taken for the following five LULC class categories. The first one is agricultural land is a land use for the cultivation of small scale farms for subsistence crops such as teff and wheat. An area of land with different buildings for different purpose such as commercial, office, residential, industrial, recreational. uses built up land. A forest land is an area of land covered by natural trees and trees being planted by man. Bare land an area of the land left open with rocky surface. Lastly Open land area

mostly covered with grass mixed with some sparsely grown trees in between the cultivated lands and around streams used for grazing purpose.

After completion of image classification urban LULC classification result was evaluated by employing accuracy assessment technique using the ground truth points collected by GPS instrument. In order to overcome errors of commission and omission occurred during data processing error matrix or confusion matrix methods were employed by using ERDAS IMAGINE 2010. After producing urban LULC map for 1996, 2006 and 2016 years, the reclassification process is employed by spatial analyst tool in ArcGIS 10.1 for the purpose of change detection. Finally, urban sprawl map of Legetafo Legedadi town is produced.

Socio economic data of both quantitative and qualitative data obtained from field survey by using questionnaires, Digital camera, field observation and interview was analyzed through tables, graphs, percentages, pie charts and figures.

Flowchart of Research Method

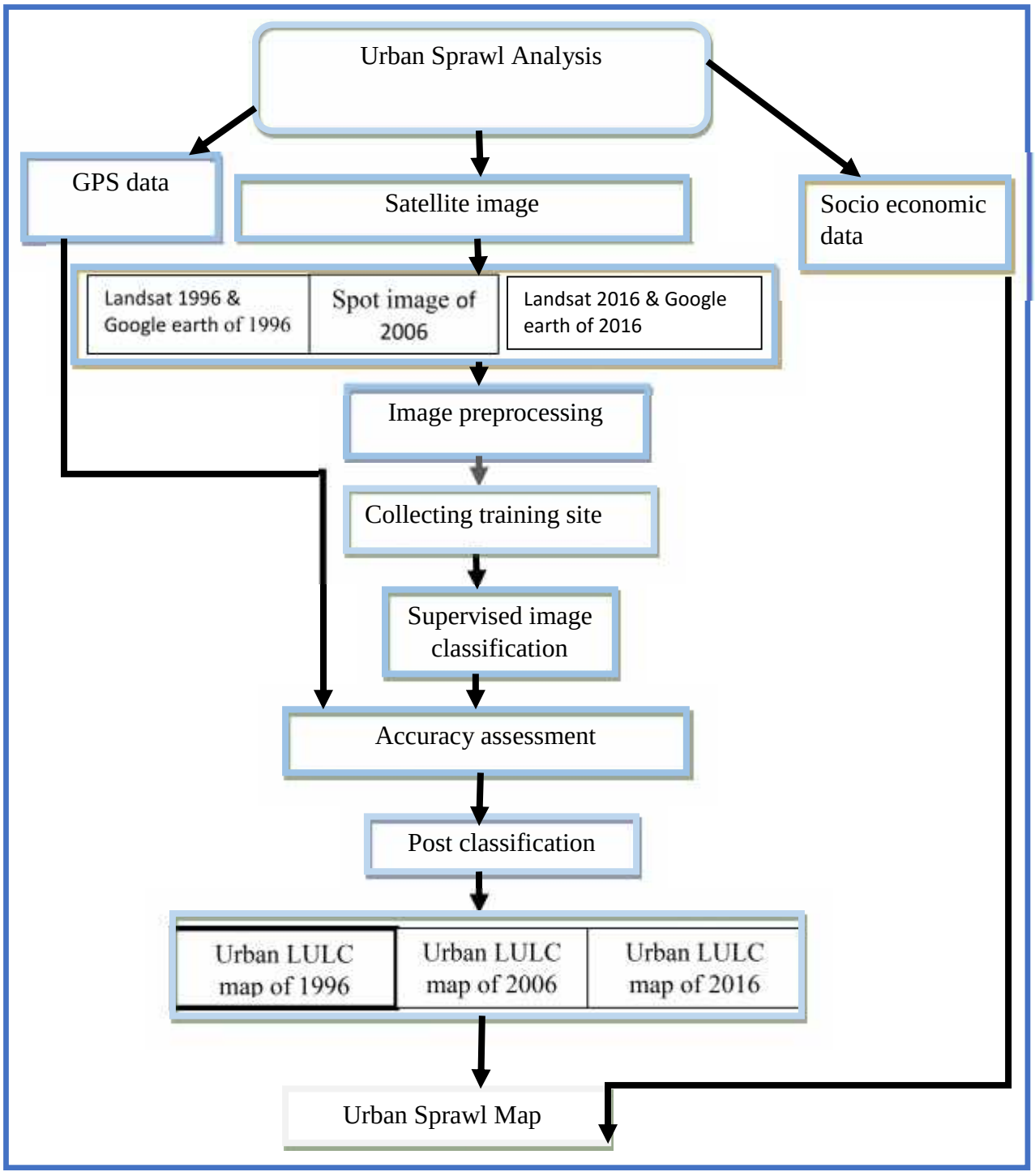


Figure 3: Flowchart of Research Methods

3.2.5. Validity and Reliability assessment

It is imperative that the data and the instruments used to collect data to be validated. In order to assess the validity of data, the researcher has reviewed quite adequate conceptual and empirical researches which are related to urban sprawl. Besides, review of methodological aspect of past research outputs and scholarly work was carried out to establish accurate data collection tools and techniques. Reliability deals with the consistency, dependability and replicability of the results obtained from a piece of research. Accordingly, the researcher has carried out a pilot survey prior to the actual implementation of the questionnaire to prove the legibility, formatting, typesetting and logical sequences of the questions for actual survey. The researcher has also approached the research participants in a friendly manner in order to create good interpersonal relation which in turn allowed extracting reliable data in case of qualitative and quantitative data.

3.2.6. Ethical consideration

Ethical consideration is arises during the design and data collection phases of a study. Acknowledgement of data generated by others and appropriate citations of scholarly research outputs, books, websites, and any other related documents is one of conducting ethical research. By recognizing this, the researcher has cited and acknowledged all the information taken from scholarly literatures. The researcher has also considered herself as one member of a society and respected the norms, value and also confidentiality and privacy of respondents.

CHAPTER FOUR

4. RESULT AND DISCUSSION

This chapter deals with what was found both through quantitative and qualitative data obtained from different period imageries, questionnaire, interview, and field observation related to the urban sprawl and its impact on land use land cover and livelihood of the community living in Legetafo Legedadi town.

4.1. Spatiotemporal Analysis of Urban Sprawl

4.1.1 Image Analysis of Legetafo Legedadi Town 1996-2016

4.1.1.1 Percentage distribution and LULC map of Legetafo Legedadi town in 1996

As it displayed in fig 4 open, built up, agricultural, forest and bare lands are major land use land cover (LULC) classes for the study period. Out of this agricultural land use classes was the largest where as bare land use class was the least of all. Open, forest and built up land also there by order. This implies that economic activity of the town was highly depending on agriculture which was base for their livelihood. Besides, there is low density of built up area which tell there is small number of population.

Fig 4 Land use land cover map of study area 1996

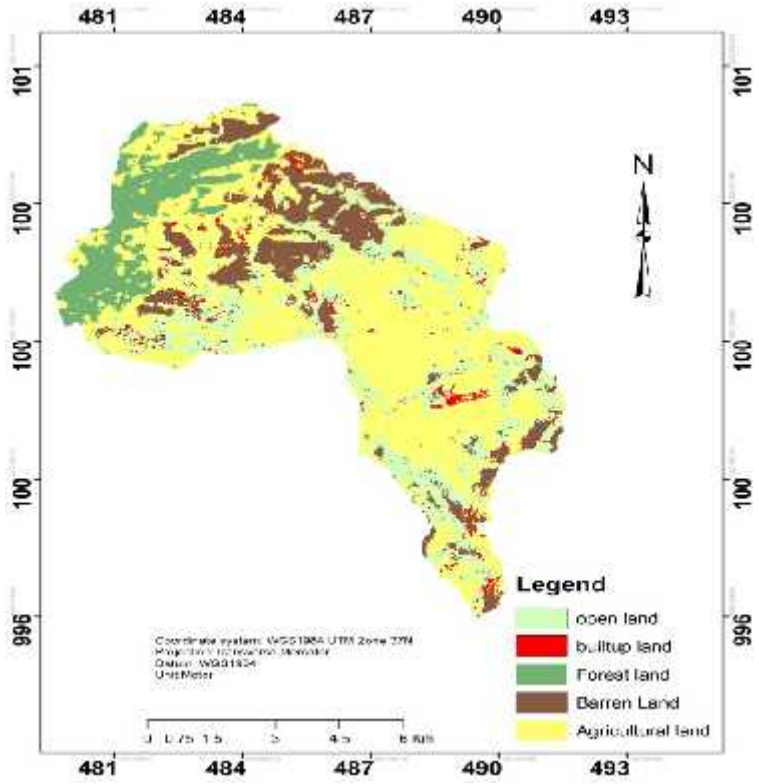


Table 4 proves that which LULC classes is the highest and least by hectare and percent. Based on this agricultural land constitutes 55.74% the highest and 8.51% of bare land the least. Open, forest and built up land accounts 12.71%, 12.09% and 10.93% respectively.

Table 4 percentage of land use land cover map of LTLD Town 1996

Lu/Lc type	**Hectare**	**%**
Open land	946.8	12.71
Built up land	813.87	10.93
Agricultural land	4149.9	55.74
Forest land	900.36	12.09
Bare land	633.60	8.51
Total	**7444.53**	**100**

4.1.1.2 Percentage distribution and LULC map of Legetafo Legedadi town in 2006

As it indicated in fig 5 below agricultural land still take the first place compared to other land use classes but it shows decreasing trend. Open and forest land also decrease in their areal coverage. Conversely, built up and bare land is gradually increase because of change in land use classes due to this livelihood of community become affect and displacing of people also happen. Besides number of population is increase from time to time either by natural growth or migration in Legetafo Legedadi town.

Fig 5 Land use land cover map of study area 2006

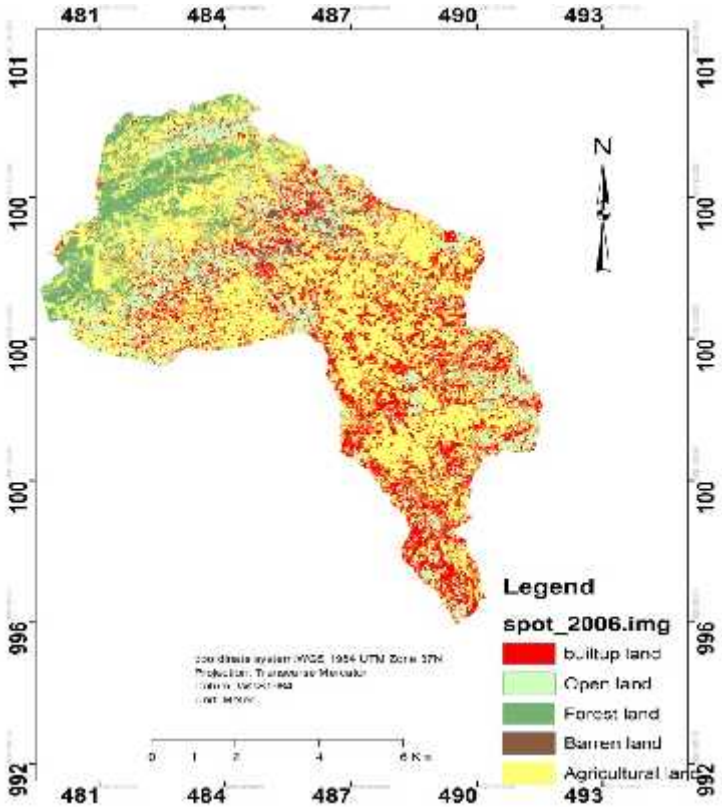


Table 5 concludes that agriculture land become decrease 43.84% but built up land increase 23.93% in 2006. Open and bare land shows decreasing and increasing trend 10.73 and 10.01% respectively. Forest land is approximately same with 1996.

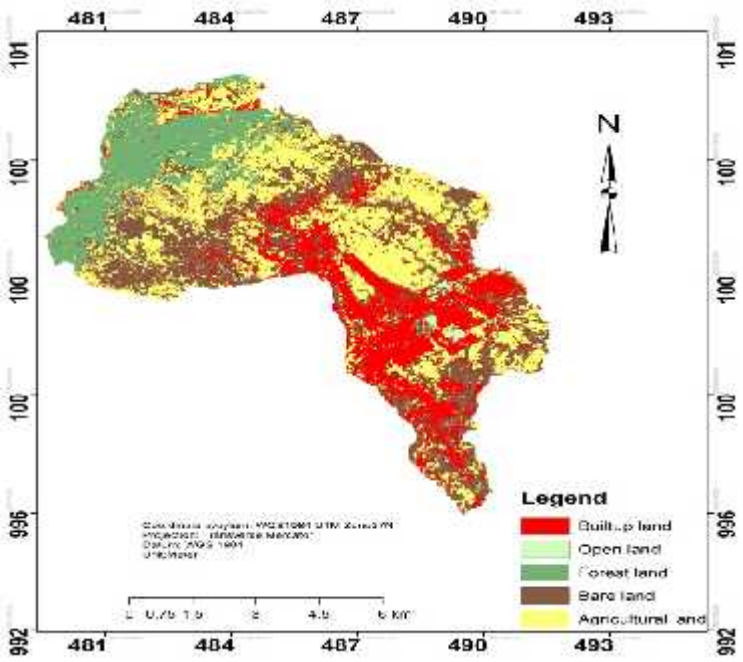
Table 5 percentages of Land use/Land cover in LTLD in 2006

Lu/Lc type	**Hectare**	**%**
Open land	799.02	10.73
Built up land	1781.64	23.93
Agricultural land	3264.21	43.84
Forest land	853.83	11.46
Bare land	745.83	10.01
Total	**7444.53**	**100**

4.1.1.3 Percentage distribution and LULC map of LegetafoLegedadi Town in 2016

Land uses Land cover map of Legetafo Legedadi town in 2016 reveal that the occurrence of significant change in LULC. Most of agricultural and open land is being replaced by urban built up area and it is mainly because of increase in number of population through natural growth and migration especially from Addis Ababa city, other towns and rural village. Besides, built up area of the town follow major road by this reason Legetafo 01 kebele have high concentration of built up area which is near to capital city border.

Fig 6 Land use land cover map of study area 2016



The table 6 states that built up area are regularly increased through the study period and it constitutes 59.23% and agricultural land shows decreasing trend about 12.79%. No significant change is occur in forest land and stands 11.11%but it decrease from 1996 year area coverage. Open and bare lands share same 8.42% by the year 2016.

Table 6 Percentages of Land use/Land cover of study area in 2016

Lu/Lc type	**Hectare**	**%**
Open land	627.03	8.42
Built up land	4409.82	59.23
Agricultural land	952.65	12.79
Forest land	827.73	11.11
Bare land	627.30	8.42
Total	**7444.53**	**100**

4.1.2. LULC Change Detection Analysis

Change detection, one of the post-classification activities for monitoring the LULC change because it give helpful information between the first and last LULC types in a complete matrix of change direction (Campbell, 2002; Fan et al., 2007 and Singh, 1989). The classification of images of the study area over the study periods was essential in the detection of changes of different LULC categories. Thus the LULC distributions of the study area for each study year (1996, 2006 and 2016) are shown in table below.

Table7 Areal extent of LULC categories of LTLD town in 1996, 2006 and 2016

LULC category	1996		2006		2016	
	ha	%	ha	%	ha	%
Open land	946.8	12.71	799.02	10.73	627.03	8.42
Built up	813.87	10.93	1781.64	23.93	4409.82	59.23
Agricultural land	4149.9	55.74	3264.21	43.84	952.65	12.79
Forest land	900.36	12.09	853.83	11.46	827.73	11.11
Bare land	633.60	8.51	745.83	10.01	627.30	8.42
Total area	7444.53	100.0	7444.53	100.0	7444.53	100.0

As shown in table agricultural lands constituted the largest LULC category through 1996 and 2006 of the study period. On the other hand, the bare LULC class contained the least cover in all years. But agriculture LULC class showed a regular pattern of decrease over the study periods. It decreased from 55.74% in 1996 to 43.84% in 2006, decreased from 43.84% in 2006 to 12.79% in 2016. After agricultural land LULC class, the forest land formed the second largest LULC category and showed a regular pattern of decrease between the study periods. It decreases from 12.09% in 1996 to 11.46% in 2006, decreased from 11.46 to 11.11 in 2006 and 2016 respectively. In all the study periods the built up LULC showed regular pattern of increase from 10.93% in 1996 to 23.93% in 2006 and from 23.93 in 2006 to 59.23% in 2016.

Thus, agriculture and open LULC categories experienced considerable loss in both of the two study period between 1996- 2006 and 2006-2016table 4. 4 Built up LULC category with the highest rate of expansion from 813.87 ha.(10.93%) in 1996 to 1781.64 ha.(23.93%) in 2006 and Forest land shows a little change of decrease but as compared to other LULC it is relatively same within the study year from 900.36 ha.(12.09%) to 853.83 ha.(11.46%) and bare land from 633.60 ha.(8.51%) in 1996 to 745.83 ha.(10.01%) in 2006 gained additional coverage 627.30 ha.(8.42%).agriculture and open LULCs lost their previous extent of land.

In the second period of the study (2006-2016) agricultural LULCs lost early extent almost by half and above from 3264.21 (43.84%) to 952.65 ha.(12.79%) and from 799.02ha.(10.73%) to 627.03 ha.(8.42%) for the open land from 745.83(10.01%) to627.30 (8.42%) for bare land. The remaining LULCs: forest lands show slight difference from 853.83 (11.46%) to 827.73 (11.11%) and built up land gain new areas from 1781.64 (23.93%) to 4409.82(59.23%) land of the study area

Table 8 gain and loss of LULC class of LTLD town in different periods

LULC category	**1996-2006**		**2006-2016**	
	Change in ha.	**Percent change**	**Change in ha**	**Percent change**
Bare land	+112.23	+1.5	-118.53	-1.59
Open land	-147.78	-1.98	-171.99	-2.31
Built up land	+967.77	+13	+2628.18	+35.3
Agricultural	-885.69	-11.9	-2311.56	-31.05
Forest land	-46.53	-0.63	-26.1	-0.35

The highest increment expansion of the built up area was accompanied by high migration of people from neighboring city and or town. Following this most part of agricultural, open and forest land become highly decreases because of housing, investment, industry At the same time, laborers came to the area as new settlers from other place. As a result of this the town particularly the built up area expanded year after a year. For the second study period (2006-2016) with the built up land keeping high rate of expansion the others LULC classes had lost their former coverage. Open land lost 107.37 ha. (1.54%) agricultural land 1820.7 ha (24.87%) and forest land 45 ha (0.6%) of land.

4.1.3 Land use Land cover matrix of LTLD Town

4.1.3.1 LULC class's matrix between1996 and 2006

Table 9 and 10 shows result of change detection matrixes which give the details on the transformation of one LULC class into another LULC class between some specificintervals of time. In all the tables the values found in the diagonal views of the table indicate the unaffected values of each LULC class which were not changed to another LULC category while the non diagonal values shows the changed value from a LULC class into another LULC class. In table 8it has been shown the LULC transformation dynamics from 1996 to 2006. Values in the columns correspond to the area of each LULC class in 1996 and the row represents changed area of each LULC class in 2006 from the 1996. As it is clearly observed in the table, the bare land out of its total area coverage 659.07in 1996, 134.46ha (1.81%) of it remained unchanged. While, 225 ha (3.02%) was changed into open land, 434.43 ha. (5.84%) into the built up, 9.81 ha (0.13%) into agricultural land, 40.68 ha (0.55%) in to the forest land in 2006.

The total area of forest land in 1996 was 547.83 ha. From this 419.22 ha (5.63%) remained unaffected. But, 95.85 ha (1.29%) was transformed into bare land, 369ha (4.96%) into built up, 77.49ha(1.04%) into agricultural land and 73.89 ha. (0.99%)intoopen land in 2006. Open land which constituted 1437.21 ha in 1996 was transformed into the bare, built up, agricultural and the forest LULCs by 118.08 ha (1.59%), 214.65ha (2.88%), 62.82ha (0.84%) and 10.44 ha (0.14%) respectively. The remaining 141,84 ha (11.09%) was unchanged.

Agricultural land in 1996 covers 3764.9 ha land of the study area. From this, in 2006 15.3 ha (0.21%) has been changed into bare land, 567.18 ha (7.62%) into an open land, 642.33ha (8.63%) into the built up land and 260.64 ha (3.50%) into the forest land. While 2279.52 ha (30.62%) of it was unaffected.

Built up LULC category with the total area of 1035.43 ha in 1996 was transformed by 144.09 ha (1.94%) into the bare land, 39.69 ha (0.53%) into an open land, 50.67 ha (0.68%) into the forest and 191.88 ha (2.58%) into agricultural land with 825.57 ha (11.09%) being unchanged.

Table 9 LULC class's matrix between1996 and 2006

	Year 1996											
	LULC category	Agricultural land		open land		Built land		Forest land		Bare land		Total	
		Ha	%	ha	%	ha	%	ha	%	ha	%	ha	%
year 2006	Agricultural land	2279.52	30.62	191.88	2.58	77.49	1.04	62.82	0.84	9.81	0.13	2621.52	35.21
	open land	642.33	8.63	825.57	11.09	369	4.96	214.65	2.88	434.43	5.84	2485.98	33.4
	Built up	260.64	3.50	50.67	0.68	419.22	5.63	10.44	0.14	40.68	0.55	781.65	10.5
	forest land	567.18	7.62	225	0.53	73.89	0.99	141.84	1.91	39.69	3.02	1047.6	14.07
	Bare land	15.3	0.21	144.09	1.94	95.85	1.29	118.08	1.59	134.46	1.81	507.78	6.84
	Total	3764.97	50.58	1437.21	16.82	1035.45	13.91	547.83	7.36	659.07	11.35	7444.55	100

4.1.3.2 LULC class's matrix between 2006 and 2016

Table10 shows the change detection matrix between 2006 and 2016. As illustrated in the table with 128.43 ha (1.73%) being unchanged, 27.09.11 ha (0.36%) into agricultural land, the bare land was converted into an open land by 7.38 ha (0.10%), 110.88 ha (1.49%) into the built up and 6.93 ha (0.09%) into the forest land in 2016

From the total1176.66 ha of an open land in 2006, bare land took 118.8ha (1.60%), built up land gained 896.94 ha (12.05%), agricultural land gained 48.6 ha (0.65%) and the forest land borrowed77.85ha (1.05%) in 2016. The remaining 34.47 ha (0.46%) of the open land was not changed into another LULC class.

The built up land covers 1766.34ha. Out of this 169.11 (2.27%) transform in to bare land, 13.59 ha (0.18%) was changed into an open land, 69.21 ha (0.93%) into agricultural land and 36.72 ha (0.49%) into the forest land in 2016. 1477.71 ha (19.85%) was not changed. From the total area of agricultural land which was 3186.29ha in 2006 760.86 ha (10.22%) was converted into bare land, 303.03 ha (4.07%) into an open land, 1622.97 ha (21.80%)

into the built up and 40.68 ha (0.55%) into the forest land with 458.82 ha (6.16%) unchanged in 20016.

The forest land in 2006 constituted 1034.46 ha of land. Of this total cover, 93.78 ha (1.26%) was transformed into the bare land, 72.27 ha (0.97%) was into an open land, 472.32 ha (6.34%) into the built up and 21.87 ha (0.29%) into the agricultural land in 2016. While 374.22 ha of the forest land remained unchanged.

Table 10 LULC classes matrix between 2006and 2016

	Year 2006											
Year 2016	LULC category	Agricultural land		Built up land		Forest land		Open land		Bare land		Total	
		Ha	%	Ha	%	ha	%	Ha	%	ha	%	ha	%
	Agricultural land	458.82	6.16	69.21	0.93	21.87	0.29	48.6	0.65	27.09	0.36	603.72	8.39
	Built up land	1622.97	21.80	1477.71	19.85	472.32	6.34	896.94	12.05	110.88	1.49	4580.75	61.53
	Forest land	40.68	0.55	36.72	0.49	374.22	5.03	77.85	1.05	6.93	0.09	536.4	7.21
	Open land	303.03	4.07	13.59	0.18	72.27	0.97	34.47	0.46	7.38	0.10	430.74	5.78
	Bare land	169.11	2.27	760.86	10.22	93.78	1.26	118.8	1.60	128.43	1.73	1270.98	17.08
	Total	3186.29	34.85	1766.34	31.67	1034.46	13.89	1176.66	15.81	280.71	3.77	7444.53	100

4.2. Urban sprawl map

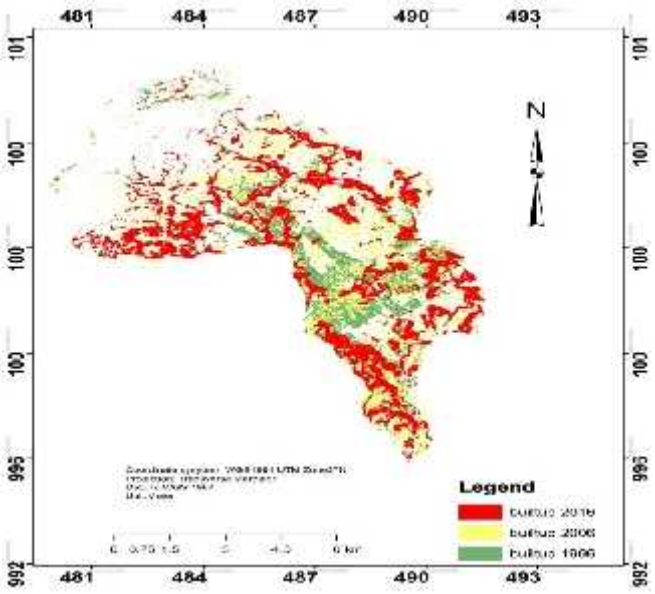
4.2.1. Expansion of urban built up area

Mapping urban built up area is one of the best way which give a visual impression of urban sprawling rate and direction. It is generally considered that the built up is the best parameter for the purpose of quantifying urban sprawl condition (Barnes *et al*., 2001; Epstein *et al*., 2002) urban built up maps of the study area were produced at different periods to illustrate the urban built up growth and its direction.

In fig 7 three of the different images of the study area were overlaid to compare the extent of expansion in the built up between them. As it is visually analyzed the built up was expanded for the last 20 years of the study period almost in all directions consuming land from the other LULCs.

The built up area in the year 1996 was only 813.87 ha of the total land. This was grown to 1781.64 ha in 2006. It was increased by 13.0%. Big increment was recorded in 2016 with a total land cover of 4409.82 ha which means grown by 48.3% from 1996 and 35.3% from 2006,. Beside the time interval between the study periods high rate of expansion of the built up land was recorded in between 2006 and 2016 which was 10 years difference and 35.3% increment.

Fig 7 Expansion of built up area of Legetafo Legedadi town 1996-2016



As it displayed in fig 7 built up area of LTLD town become increase through the stud period 1996-2016. Most of the built up area development follows the major road. During the initial period of the study built up area of the town is very dispersed beside LegetafoLegedadi is found as two separated kebeles under farmer association. After July 2006 Legetafo Legedadi become town administration under Special zone of Oromia Surrounding Finfine (SZOSF). Nevertheless, town become expand and develop time to time by increasing number of population, built up area expansion like industry, residential house concentrated around major roads which is ribbon spatial form of development.

4.3 Socioeconomic and impact analysis urban sprawl

4.3.1 Demographic Characteristics

The demographic variables of the respondents such as sex, age, educational status, marital status, household occupation, family size were collected as socio-demographic characteristics of a given population have its own implication on the problem of urban sprawl

Sex composition of the population has strong impact on households division of labor and decision making that in turn influences the livelihood of the community. Generally male respondents found to be higher than female with male constituting 57 percent of the total and female 43 percent of the respondents. This is because habitually, landholding and land use decision-making are mainly the responsibility of male partners. Hence, the uneven proportion between female and male respondents does not influence the objective of the study.

The age distribution of the respondent is significant to understand which age group is more vulnerable to the loss of livelihood. It is indicated that the majority of the respondents are found in the working or operational age group. Out of the total respondents about 53 % of sample respondents are belongs to adult age group (20-40 ages). The survey showed that out of 264 respondents139 (53 %) belongs to the age group of 20-40 years, 94 (about 35 %) were aged between 41-60 years, 31 (12 %) were aged >60 years. In general the age group structure indicates high proportion of the

respondents found in the age of 20 to 40 years, reproductive age which indicate presence of potential for population growth rate which is one of the cause of urban sprawl that means increased number of population leads to unplanned city or town expansion.

The majority of the households in the town have low educational background. This has made recruitment to governmental or non governmental institutions a problem. The table below reveals the educational level of respondents who cannot read and write account for 85(32%). These 85 respondents have filled the questionnaire with the help of the data collector or the researcher. About 64 (24 %) of the respondents completed primary school education while about 41 (16 %) completed secondary school education. Those who have certificate and diploma level of education constitute about 29(11.0 %) and 25 (9.0 %) respectively while the remaining 20 (8.0 %) had first degree and above.

Family is central to income maintenance, economic status and social adjustment. Therefore, marriage statistics has socio economic implications.145 (55%) households were married, while the others 72 (27%) respondents were single or never married, 35(13%) household were divorced, 12(3%) respondents were widowed. Hence, the respondents could give their answer from their experience of administering family and caring responsibility.

Table 11: **Summarized Demographic conditions of the respondents**

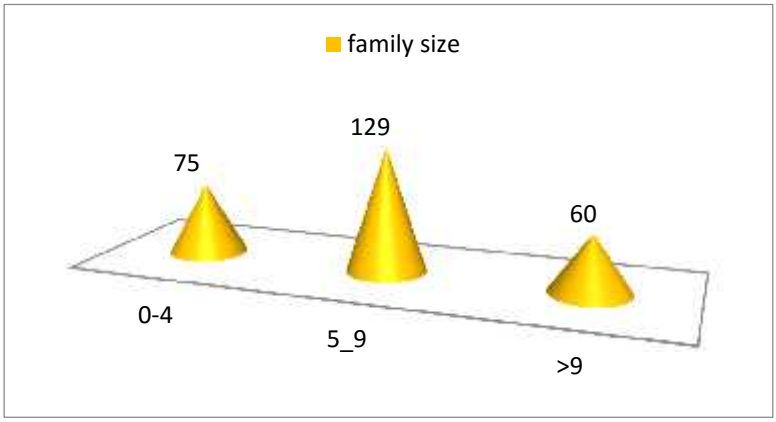
	Socio-demographic variables	**Number of respondents**	**Percentage**
		264	**100**
	Sex	**264**	**100**
	Male	185	57
	Female	79	13
	Age	**264**	**100**
	20-40	139	53
	41 – 60	94	35
	>60	31	12
	Marital status	**264**	**100**
	Married	145	55
	Single	72	27
	Divorced	35	13
	Widowed	12	5
	Educational status	**264**	**100**
	Unable to read and write	85	32.0
	Primary	64	24.0
	Secondary	41	16.0
	Certificate	29	11.0
	Diploma	25	9.0
	degree & above	20	8.0
	Total	**264**	**100**

Source: Computed based on the data obtained from field survey

4.3.2 Family size

Figure 8 below shows the average household size in the study area. It is used as a measure of crudeness of population and has great implication on impact of urban sprawl on their livelihood and most of sub urban people are highly in problem to manage their family by the resource they get. The uppermost number of household size is found to have 129 (5-9) member of household. The next highest household size is 75(0-4) member and the third was 60(>9) or greater than nine. Generally one can conclude from the fig, majority of the sample households have large size family and the average family size of the respondents was 5-9 people.

Figure 8 family sizes of respondents

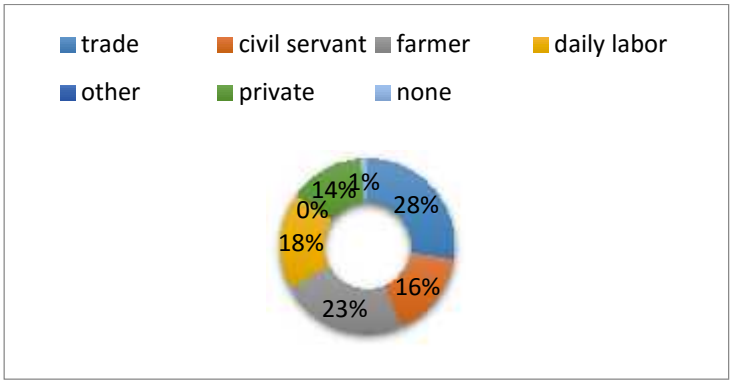


Source: field survey (2017)

4.3.3 Household occupational status

The sample household respondents have different occupational status. These include trading, civil servants, farmers, daily laborers and others like private work. As indicated in the fig, out of the total 264 sample households 27 percent are traders 23% are farmers, 18 % are daily laborers, Civil servant or government employer and private worker constitute 16 and 15 % of sample respondents respectively. The remaining 1 % of the respondents is without job. Generally the fig shows the number of farmer is decrease from time to time or in other word agricultural land is being replaced by trade activity or built up area.

Figure 9 Household occupational status



Source, Field Survey (2017)

4.3.4 Households average monthly Income

Income is another socioeconomic factor that leads people to migrate from their birth place in search of jobs and which causes difficulty to plan population growth rate of towns. Information on the income of the household heads was very difficult to obtain due to different reasons such as low level of education which culminates fears of being taxed especially for traders, inability to keep the record of their sales and the majorities have variable and irregular income. However, majority of the respondents (30 %) earn 500-1000 birr per month and (24.0 %) of them earn between 1001-1500 birr. About 19.0 and 12.0 % of respondent earn 1501 - 2000 and < 500birr per month respectively. While, the rest 9.0 and 6.0% of them earn 2001-5000 and >5000 birr per month respectively.

Table 12 Average monthly income

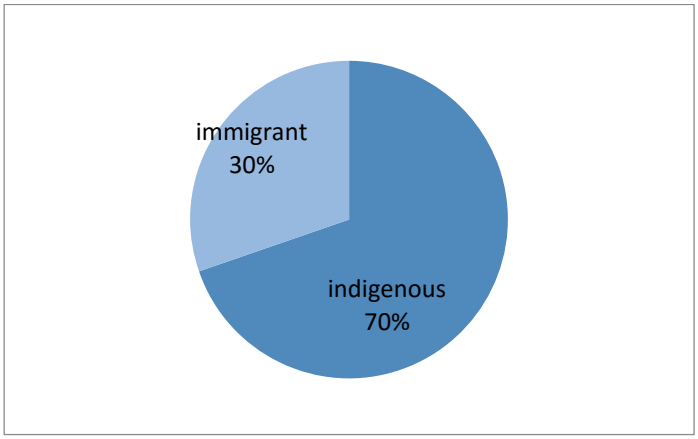
No	**Average monthly income (ETB)**	**Frequency**	**Percentage**
1	<500	31	12.0
2	501-1000	80	30.0
3	1001-1500	64	24.0
4	1501-2000	49	19.0
5	2001-5000	25	9.0
6	>5000	15	6.0
	Total	**264**	**100**

Source: Computed based on the data obtained from field survey

4.3.5 Length of residence in the town

The length of residence of respondent in the town shows that the town is birth place of majority of respondents or indigenous and accounts 70 %. While other 30% were the immigrants especially from Addis Ababa and surrounding area. As indicated in fig 10 there is high migration in town which is one of the indicators of the problem of urban sprawl.

Fig10 Length of residence in the town



Source: Field Survey (2017)

4.4 Socio economic profile of respondent household heads

4.4.1 Land ownership status

Is it indicated in the table 13out of the total respondents, 69.0 % have land while the rest 31.0 % of respondents do not any land.

Table 13 Land ownership status

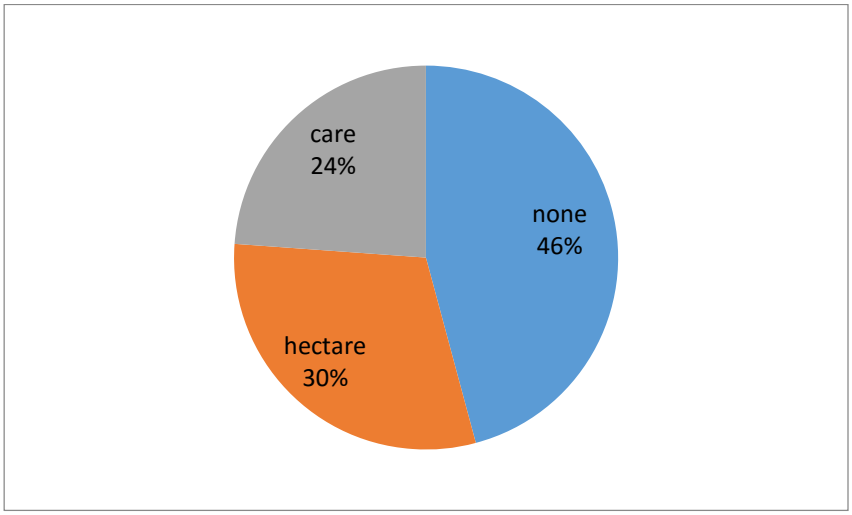
Land Ownership status	frequency	Percent
Yes	181	69.0
No	83	31.0
Total	**264**	**100.0**

Source: Computed based on the data obtained from field survey

4.4.2 Landholding Size in Hectare

As it is indicated in fig 11 below most of the respondents are without landholding in hectare which accounts for 121(46%) of households and 80 (30%) have land in hectare while the remaining 63 (24%) of the respondents have land in care.

Figure 11 Landholding Sizes of Respondents



Source: Field Survey (2017)

4.4.3 Land use categories

The respondents are also using their land for different purposes such as crop cultivation, fruits and vegetables, grazing land, housing and for mixed purpose. Out of their total land, crop land constitutes 31.0%, crop land, grazing land together and fruit and vegetable account 20 %, 11 % for housing and grazing land 8 %. Therefore, the land of the farmers is helping for means of livelihood or income for the farmers. This implies losing the land they hold directly affect their source of living except replaced by another means of earning.

Table 14 Land use categories

Land use type	**Number of respondents**	**Percent**
crop land	82	31
Fruits and vegetables	54	20
crop land and Grazing land	52	20
housing	30	11
Grazing land	26	10
none	20	8
Total	**264**	**100**

Source: Computed based on the data obtained from field survey

4.5 Expansion of LTLD Town

4.5.1 Reaction towards Urban Expansion

The respondents are also asked whether Legetafo Legedadi town is expanding or not and as it depicted in table 15, 98 % said yes the town is expanded and only 2 % responded the town is not expanding.

Table 15 Reaction towards Urban Expansion

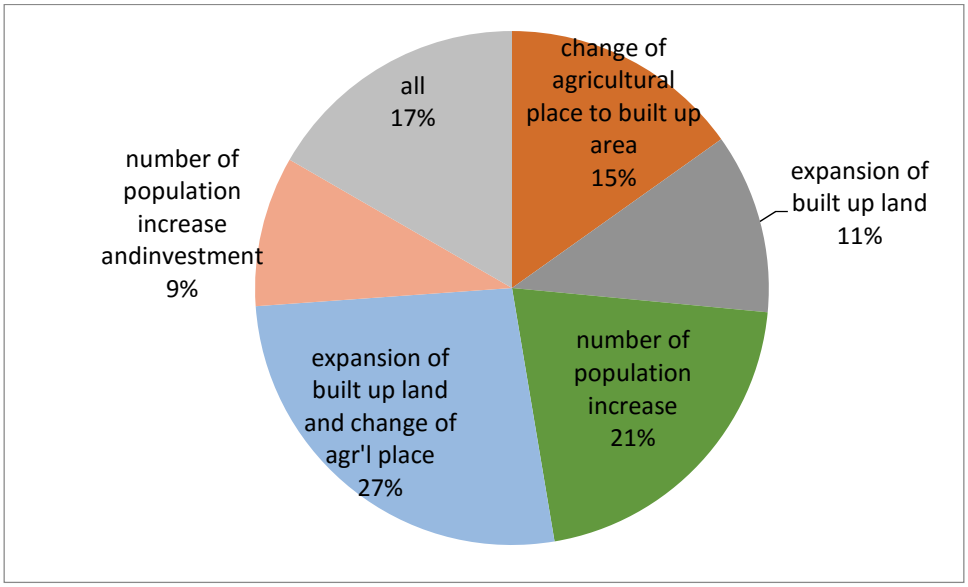
Understanding about urban expansion	**Number of respondents**	**Percent**
Yes	258	98.0
No	6	2.0
Total	**264**	**100.0**

Source: Computed based on the data obtained from field survey

4.5.2 Type of change observed in LTLD

As indicated in fig 12 below most of the respondents (27%)observed the replacement of agricultural land in to built up areas together with expansion of built up land, number of population increase by itself accounts 21%,followed by number of population increase, expansion of built up, investment, infrastructure agricultural place to built up area together accounts 17%.(15%) number of respondents mentioned change of agricultural land to built up area expansion of built up land also constitutes 11% and 9% of number of population increase and investment. Therefore it is possible to conclude that change in agricultural place to built up area is the main change observed which affect the life or livelihood of farmers who are dependent on land and the country whose economic activity is highly dependent on agriculture. The second which describe most frequently is population growth which cause low job opportunity to people who live in the town and also one of the root cause of sprawl.

Figure 12observed type of change

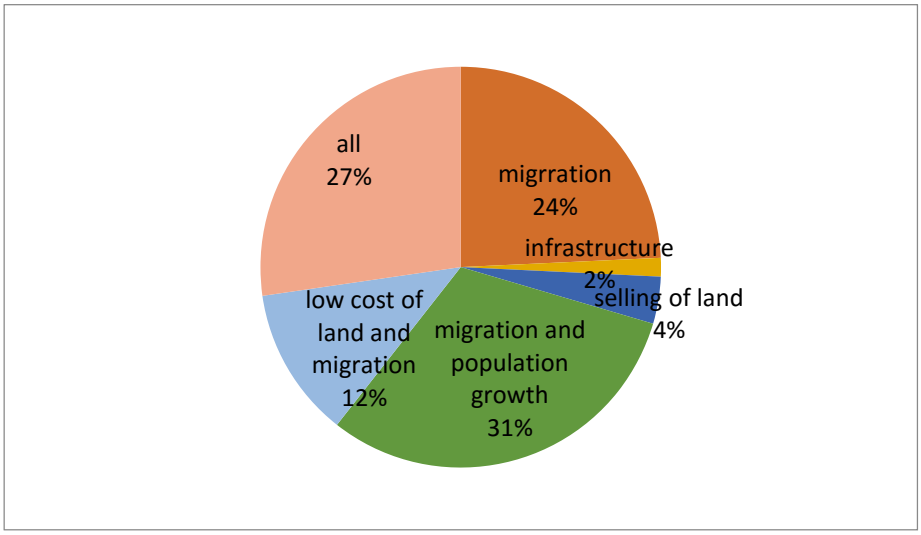


Source: Field Survey (2017)

4.5.3 Factors of expansion

As it indicated in fig 13 population growth and migration together accounts as the major cause of expansion of LTLD town by having 31%. Low cost of land, migration, population growth, infrastructure and selling of land all together constitutes 27%. Migration takes 24%. The combination of low cost of land and migration has 12%, 4% of the respondents say selling of land and infrastructure accounts 2%. Rapid increase in the number of population and migration make towns become out of plan and cause illegal house construction (house doesn't have plan) leads to leapfrogging development.

Fig 13 factor of urban expansion



4.6. Impact of Urban Sprawl in LTLD Town

4.6.1Eviction from Land

As it indicated in table 16, either Land was taken from 90% of the respondents fully or in part out of their total land; while only 10 % of the households claimed that their land was not taken.

Table 16 Land taken from respondent

Land taken from respondents	Number of respondents	Percent
Yes	235	90
No	29	10
Total	**264**	**100.0**

Source: Computed based on the data obtained from field survey

4.6.2 Vacated type of land

Table 17 describe that of land taken from farmers (84%) have been serving them as agricultural land (6%) for residential and agricultural purpose and the rest have been serving them for grazing and one or more of the previously stated purposes. Hence, the effect of urban expansion on surrounding farmland directly affects the livelihood of the farmers through changing their farming activity, which is not possible without land and also it change land use land cover of the town.

Table 17 Vacated type of land

Vacated type of land	**Number of respondents**	**Percent**
Agricultural land	223	84
Residential land	5	2
both residential and agricultural land	16	6
grazing land	3	1
Agricultural, residential and grazing land	6	2
Agriculture and grazing land	4	2
Both residential and agriculture with grazing land	7	3
Total	**264**	**100.0**

Source: Computed based on the data obtained from field survey

4.6.3. Temporal dimension of land taken

As displayed in table 18 most of the respondents claimed that their land was taken in the past 10 years (2006-2016) while few or (4%) claimed their land was not taken. This implies in this past 10 years expansion of urban or town to the surrounding rural area might be major factor for their land to be taken for different purposes.

Table 18 when land was taken from the Respondents

Year of land taken	**Number of respondents**	**Percent**
Over the last 10 years (2006-2016)	254	96
Over previous 10 years (1996-2006)	–	4
Total	**264**	**100.0**

Source: Computed based on the data obtained from field survey

4.6.4 The Effects of Urban sprawl

The respondents are also asked whether their life is affected by sprawl as it displayed in table19, about96.1 percent stated that the expansion of the town is affecting their life. While only 3.9% responded expansion of the town is not affecting their life.

Table 19 Reaction of the Respondents towards the effects of Urban Expansion

Understanding effects of urban sprawl	**Number of respondents**	**Percent**
Yes	254	96
No	10	3.9
Total	**264**	**100.0**

Source: Computed based on the data obtained from field survey

4.6.5 Types of Effects of Urban sprawl in LTLD Town

As it indicated in table 20 the respondents 70% reacted that loss of farm land due to urban expansion followed by loss of livelihood 12%. However, it is a risk for farmers who are dependent on land for means of income directly or indirectly. Generally, loss of land, social fragmentation and loss of livelihood are the impacts urban sprawl in the study area.

Table 20 Types of Effects of Urban Expansion

Types of effect of urban sprawl	**Number of respondents**	**Percent**
Loss of land	184	70
Social fragmentation	13	5
loss of livelihood	31	12
loss of land and loss of livelihood	16	6
loss of land social fragmentation or exclusion	8	3
loss of land, social fragmentation or exclusion and loss of livelihood,	11	4
Other	1	0
Total	**264**	**100.0**

Source: Computed based on the data obtained from field survey

Most of the respondent are work in land administration and environmental management bureau while other are in municipal bureau. Majority of the answer given by experts are relatively similar with each other. They believe there is a change in different land use land cover class from those class expansion of built up land is highly increase which is estimated to 20% for different purpose and decrease in agricultural and forest land. The major cause for this change is population growth, the need for market place, industry, poor management of land which increases number of illegal buildings and people desire to have fixed asset (land). They agree that change in land use land cover have impact on lives of urban dwellers by displacing the native dwellers or farmers from their place. Difficulty to manage the land, impose forces to give attention on this issue other than different affairs for the administration of the town. Depletion of natural resource, highly minimize production of crop like teff and wheat in addition to this it causes different environmental problem like pollution. Finally creating awareness, administering master plan properly(creating good governance), rule and low must apply effectively and the concerned body of government, town administration and community work together are the suggested solution to overcome problem cause due to expansion of built up area.

CHAPTER FIVE

5. CONCLUSION AND RECOMMENDATION

5.1. Conclusion

The study is concerned with investigating the impact of urban sprawl on land use land cover changes in general and built up expansion in particular that have occurred in Legetafo Legedadi town from 1996 to 2016. The analysis was carried out based on data of two decades. The obtained data reveal the existence of an increase in built up land from the beginning to the end of the study period by 48.3% which implies considerable land use land cover change in the town. The impact of sprawl on agricultural land is higher than other land uses it decrease by 42.95% through study period. Besides, open and forest lands are also decrease by 4.29% and 0.98% respectively from 1996 to 2016. The increase in the built up land has been resulted from intensified land use transformation due to urban land use encroachment of rural lands especially that of new residential development in the town and migration of people into the town particularly for housing purpose

It was concluded that the built up showed great horizontal expansion and uncoordinated grow that the expense of other land use land cover (LULC) classes resulting burden on the administration to provide the necessary infrastructure. Hence, the increased urban sprawl leads to higher loss of agricultural land or sprawling development of town negatively affect pattern of land use and livelihoods.

The socio economic impacts of urban expansion has to do with its impact on, impact of on the agricultural land which is the economic base for the rural residents. The smaller the farm land become the more urban expansion consumes agricultural land. This in turn affects the capacity of farmers to produce enough to feed themselves and to provide the market. Besides the displacement of people to urban areas negatively affect the livelihoods of the farming community.

Moreover, urban expansion has caused deforestation as people cut trees for different purposes such as for settlement and agricultural cultivation which in turn bring climatic change.

5.2. Recommendation

Since the built up expansion in the town was an ordinary occurrence it is necessary to think the future impact of urban sprawling on the natural resources and problems of the provision of social services by the planners. Uneven growth of towns leads to unlawfulness in the society and exert pressure on the natural resources as well as provision of services equally for all. Generally, the following core points are recommended

- ✓ One of the causes of horizontal expansion of the town is rapid population growth resulted from natural increase and rural-urban and urban to urban migrations; therefore improvements in National, regional, family planning, Lege tafo Lege dadi town administration by introducing incorporated Urban land Management tackle in to account concerns on the surrounding Farm lands.
- ✓ The city is expanding horizontally and its impact is clear. Hence, the Legetafo Lege dadi town administration should consider vertical development of the town.
- ✓ Improvements in the land use planning of town including spatial planning for economic and efficient use of scarce land recourse.
- ✓ To make ease the provision of different services among the community the municipality should follow up the construction of buildings for housing and other purposes in accordance with what is planned.
- ✓ The use of GIS and remote sensing based urban land management and urban sprawl controlling
- ✓ The concerned bodies of government and the town administration and the community would work together to solve the problem.
- ✓ Creating good governance to apply rule and law effectively and properly

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APPENDIX I

JIMMA UNIVERSITY

COLLEGE OF SOCIAL SCIENCES AND HUMANITIES

SCHOOL OF GRADUATE STUDIES

Dear respondent,

I would like to inform you that this questionnaire is prepared for an academic purpose only, which is to collect information for MSc Thesis in the Jimma University School of Graduate studies in Geography and Environmental Studies Specialized in Geographic Information System and remote sensing. The outcomes of this study may help the efforts made by the responsible bodies to find possible solution for the town.

Therefore, your response is very important for the success of the study because all information that you provide determines the analysis and conclusion of the research. Hence, you are kindly requested to give your response by selecting (circling) your answer from the given alternative choice or describing your opinion. Please be informed that your response is kept in confidential. So I kindly request you to fill this questionnaire without hesitation.

Thank you for your co-op!

Annex 1. Questionnaire to be filled by selected Household heads

Part I Background information

1. Kebele---------- 1. Lege Tafo 01 2. Lege Dadi 02

2. Sex ---------- 1. Male 2. Female

3. Age ----------

4. Education level ------ 1. Unable to read and write 4. Certificate
2. Primary (1-8) 5. Diploma
3. Secondary (9-12) 6. Degree and above

5. Family size: ----------

6. Household Occupation 1.Trading 2. Civil service 3. Farming

4. Daily laborer 5. Others----------

7. Marital status of the households 1.Married 3.Divorced.

2. Single 4. Widowed

8. Average monthly income (in birr)

1. Less than 500 2. 500-1000 3. 1001-1500 4.1500-2000 5. Greater than2000

9. Duration of stay in the town ----------

Part II Socio-Economic Profile of respondent household head

10. Do you have a plot of land? 1. Yes 2.No

11. If your answer for question No.10 is yes, how many Hectare of land do you have? ----------

12. For what purposes have you been using your land?

1. Crop- Land 2. Grazing land

3. Fruits and vegetation 4. If any other please mention----------

Part III Factors that contributed for the expansion of Legetafo Legedadi Town

13. Do you perceive the expansion of Legetafo Legedadi town to the surrounding area?

1. Yes 2.No

14. What type of change you observe because of the expansion? ----------

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15. If your answer for the question No 13 is yes, what do you think are the factors that contribute to such expansion of the town? ----------
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16. Is there any portion of your land that has been taken in the last 20 years for different purposes?

    1. Yes 2. No

17. If your answer for question No.16 is yes, what types of land was it?
    1. Agricultural land 2. Residential land

    3. Both residential and agricultural land 4. Grazing land

    5. If any other specify_____

18. If a plot of land has been taken from you because of urban expansion/induced development, when was it taken?

    1. Over the last 10 years (2006 – 2016) 2. Over the previous 10 years (1996– 2006)

Part IV. Effects of the expansion on the area

19. Do you think that the expansion of the town has an impact on your livelihood?
    1. Yes 2.No

20. If your answer for question No.19 is yes, what are the impacts?

    1. Loss of land 2.Social fragmentation

    3. Loss of livelihood 4.If any other please specify----------

21. What do you feel the effect of development induced on your area especially on LULC? Please explain? ----------
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Appendix II

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Questions to be filled by expert

A. Observed changes in the land use/cover of the town

1. Have you observed any change in the LULC in the town in the past?

2. What type of change was occurred (increase or decrease in the bare land, open land, built upland, agricultural land and/or forest land)?

3. Estimate the percentage of increase or decrease of each LULC category

4. What do you think is the cause for the increase or decrease of the LULC classes that was increased or decreased?

B. Observed impacts of the LULC change

1. What major impacts you observed related to the LULC change on

i) The lives of urban dwellers

ii) The administration of the town

iii) The natural resources

iv) The production of goods

v) The environment

2. Do you think that the major cause for the observed impacts was the expansion of the built up land? If it was in what way?

3. What possible solution you suggest to overcome the problems occurred particularly with the expansion of the built up area?

Appendix III

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Interview Guide Questions

1. Respondent's occupation---------- position if any----------
2. Age----------
3. Educational level----------
4. How long did you reside or serve here ----------
5. What do you witness about the process of expansion of Legetafo Legedadi town to the Surrounding areas?
6. What do you think are the factors that contributed for rapid expansion of Legetafo Legedadi town during the last 20 year?
7. What is your view about the positive impacts of urban expansion on LULC?
8. What is your view about the negative impacts of urban expansion on LULC?
9. What do you think the government should do to improve the life of the local people affected by expansion?
10. What are the solutions you propose for the challenge faced as a result of expansion of the town?

Appendix IV

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Questionnaire for Focused Group Discussion

1. What do urban sprawl deals with?
2. What do you think the factors for urban sprawl in your area?
3. When do you think major changes are taken place and what are the cause for changes?
4. What merit and demerit you believe are the result of urban expansion in the town especially in terms of change in LULC?
5. Who is the concerned body to reduce the negative impacts of urban expansion for you?
6. What possible solution you suggest to overcome the problems occurred with urban expansion?