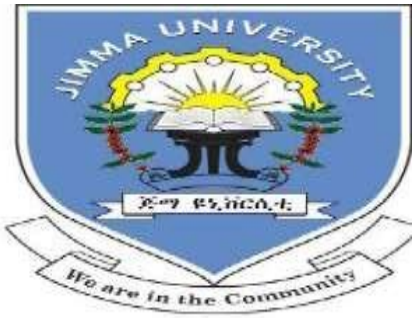

JIMMA UNIVERSITYCOLLEGE OF SOCIAL SCIENCE AND HUMANITIES
DEPARTMENT OF GEOGRAPHY AND ENVRONMENTALSTUDIES

GIS AND REMOTE SENSING BASED ANALYSIS OF THE IMPACT OF RESETTLEMENT ON LAND USE LAND COVER DYNAMICS: A CASE OF LIMU SEKA DISTRICT, JIMMA ZONE, SOUTH WESTERN ETHIOPIA.

BY:
MELAKU TADESSE

A THESIS SUBMITTED TO DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL STUDIES, COLLEGE OF SOCIAL SCIENCES AND HUMINITES, JIMMA UNIVERSITY, IN PARTIAL FULFILLMENT OF THE REQUIRIMENT FOR THE DEGREE OF MASTER OF SCIENCE IN GEOGRAPHIC INFORMATION SYSTEM AND REMOTE SENSING

OCTOBER, 2021
JIMMA, ETHIOPIA

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OCTOBER, 2021
JIMMA ETHIOPIA

APPROVAL SHEET

JIMMA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

This is tocertify that the Thesisprepared by **MelakuTadesse**entitled as GISand Remote Sensing Based Analysis of the Impact of Resettlement on Land Use/Land Cover Dynamics: A Case of LimuSeka District, Jimma Zone;SouthWestern Ethiopia'' Submitted to GraduateStudies of JimmaUniversity, for the award of Master of Science degree in GIS and RemoteSensing.

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ExternalExaminer	Signature	Date
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DECLARATION

Thisistocertifythatthisthesis entitled**GISandRemoteSensingBasedAnalysisoftheImpact of Resettlement on Land Use/Land Cover Dynamics: A Case of LimuSeka District, Jimma Zone, Western Ethiopia"**, submitted in partial fulfillment of the requirements for the award of the degree of Master of Science in Geography and Environmental Studies with specialization in **GIS and RS** at Jimma University, Department of Geography and Environmental Studies done by **MelakuTadesse**isan reliable work carried out by him under our guidance. The matter embodied in this project work has not been submitted earlier for an award of any degree or diploma to the best of our knowledge and belief.

Name of the Student: MelakuTadesse

Signature:_____Date: _____

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ACRONOMYS

EPRDF	Ethiopian People's Revolutionary Democratic Front
ERDAS	Earth Resources Data Analysis System
ETM+	Enhanced thematic mapper
FAO	Food and Agricultural Organization
GDP	Gross domestic product
GIS	Geographic information system
GPS	Geographic Positioning System
Ha	Hectares
ETM+	Enhanced Thematic Mapper plus
LSWA	Limmu Seka woreda administration
LSWARDO	Limmu Seka Woreda Agricultural land Rural Development Office
LULC	Land Use Land Cover
LULCC	Land use lands cover change
LUTM	Land use Transfer Matrix
M a.s.l.	Meters above sea level
MoME,	Ministry of Mines and Energy
MORD	Ministry of Rural Development
NGOs	Non-Governmental Organization
OLI	Operational land imagery
ONRG	Oromia national regional government
SNNP	Southern Nations, Nationalities and Peoples
TM	Thematic Mapper
UNHCR	United Nations High Commissioner of Refuge
USGS	United States Geological Survey

ABSTRACT

This study analyzed the impact of resettlement on Land use /land cover(LULC) dynamics for the last two decades i.e. from the year 2000 to 2020 by applying Geographic Information System (GIS) and Remote Sensing techniques in Limu Seka District, Jimma Zone, south western Ethiopia. Data for this study were generated from remotely sensed image and analyzed using descriptive statistics and image processing. To achieve this study the three sets of land images that are TM 2000, ETM+2010, and OLI 2020 within ten years interval was use for the identification of land use land cover dynamics. In the same time the impacts and deriving forces of resettlement on socio-economic activities in the study area was assessed by using questionnaires with 240 households selected by simple random sampling and key informant interviews. In this study six major land use land cover was identified by using maximum likelihood and supervised classification technique. The finding of the study clearly reveals that grass land and forest cover class lost much of their land due to the expansion of cultivated land and settlement. This indicates that these land cover for the sake of others land use decreased by -298.23km^2 *and* -309.20km^2 *respectively between 2000-2020. In other ways cultivated land and settlement gains from other land use types* +379.50km^2 *and* +242.87km^2 *of land, respectively within the same interval years of 2000-2020. A finding from this study also indicates that the expansion of farm land and settlement are the main possible causes of LU/LC changes in the study area. The largest share 94.6% of the respondents replied that there is LULC change due to settlement. The next largest percentage share of LU/LCC is 79.6% and 68.3% decreased in forest land and water body respectively. A continuous deterioration of forest cover caused scarcity of wood for fuel and construction material. As a result, income obtained from the selling of wood and wood products became declined; and exposed the local communities for hunger. To ensure results of this study it recommended that the government should limit further expansion of extensive farmland and implement rehabilitation practice of degraded lands.*

Key Words: *Land use/land cover, Resettlement, GIS and RS.*

CHAPTER ONE

1. INTRODUCTION

1.1. Background of the Study

Land cover and land use are the two interrelated ways observing earth's surface (Duhamel, 2011). Land cover is a biophysical characteristic which refers to the cover of the surface of the earth; whereas land use is the way in which human exploit the land cover surface (Duhamel, 2011). Currently, across the world, an increasing demand for space for settlement, agricultural investment and industrial activities is being observed. In Africa countries like Kenya, Tanzania, Sudan, Ghana Senegal, Burkina Faso, Egypt and Ethiopia have practiced planned resettlement. This leads to unprecedented land use land cover change (LULCC), and these have caused both socioeconomic and environmental problems. Human use of land has had a profound effect upon the natural environment resulting in an observable pattern in Land Use and Land Cover (LULC) over time (Degifeet al., 2018).

Ever since the 1960s, Ethiopian governments consider the enforced relocation of farmers a practical development tool. Resettlement programs, depicted in literature as the largest in Africa, were basically a response to political unrest, deteriorating ecological conditions and increasing population pressure in Northern and central Ethiopia. Between 1984 and 1986 alone, about 600,000 people were forcefully resettled, mostly to relatively lower populated, more fertile, and largely forested areas of the South-Western Ethiopia, with Kafa region in the center. Kafa with a total population of about 1 million received 250,000 settlers during 1985-88 alone (Behailu, 2010).Planners sought to justify resettlement on the grounds that it would provide lasting solutions to the problem of food insecurity of the affected households. Resettlement was also claimed to provide a more rational use of available land, by readjusting man-land ratios. However, this assumption rested on the myth of vast underutilized lands. Different source indicates that resettlement schemes in Ethiopia, both planned and spontaneous, involved environmental impacts(Mulugeta and Woldesemait, 2011). Government sponsored resettlement programs that were carried out during 1984/85 involved considerable environmental damage by clearing large areas of vegetation to build homesteads, to acquire farmland, and to construct access roads. The scheme failed to adapt farming practices to agro-ecological conditions of the lowlands, and as a consequence the environmental damage involved was quite considerable (Degife*et al*., 2018).

As part of national strategy, ORNS government has been under taken resettlement program as a solution to tackle the problem of food insecurity. The settler mainly comes Zones and Woredas where is high population pressure and shortage of land to the areas where there is relatively productive and low population pressure (Mamude 2019).The study conducted by woldeselasie (2011) stated that, those people who come from their original home places were suffering from lack of agricultural land and crowdedness of large number of people in small piece of land. However resettlement results reshaping people access to natural resources as well as change the living strategies of host community in destination areas.

Assisted by the government, 3,555 households from Eastern Hararghe zone and Western Hararghe zone were formally resettled by the government in Limu Seka district in five kebeles of Jimma zone in 2004. The settlers were selected from highly degraded areas where agricultural production was poor and hence experienced chronic food insecurity (LSWARDO, 2021). Each household was provided with farmland that ranged between 1.5 and 2 ha (LSWA, 2021). The people were resettled in forest areas mostly that were not inhabited by people before the resettlement program (LSWARDO, 2021).Therefore, the study aimed to investigate the spatiotemporal analysis of land use land cover changes due to resettlement and its impacts in LimuSeka district from 2000-2020 by using GIS, remote sensing technology and studying at the socio-economic activities.

1.2 Statement of the Problem

Worldwide experience suggests that resettlement, caused by development projects, conflicts or other socio-economic, political and environmental factors, is a risky process that often leads to Impoverishment and rarely results in sustainable development (Hwang 2010).

Resettlement initiatives have been employed by many African governments to respond to the mismatch of population numbers and environmental conditions, to cope with landscapes which could not sufficiently nurture their inhabitants (Stellmacher*et al*., 2011). In Ethiopia, the majority of the population lives in rural areas and is vulnerable to chronic food insecurity. This is mainly due to drought, low agricultural output, high population pressure and deteriorating ecological conditions that lead to severe resource degradation (Behailu, 2010).

Agriculture is the main source of livelihood for over 80 percent of the population. However, its lower contribution to GDP (less than 50 percent) reflects the low productivity of the sector (Thomas *et al*., 2009). Due to frequent famine and drought in the 1980‘s the Ethiopian government carried out resettlement program and resettled more than half a million people from the northern

part to the south western lowlands of the country. To understand the land use and land cover change of both the origin and destination regions, information is needed to know the interaction between the environmental systems and the social and geophysical factors that drive the change. Program designed by Dergue like collectivization, villegization and resettlement approaches were implemented with devastating effects on forest resources of the country (Bekure, 2011).

Vegetation and forests in Metekel were cleared indiscriminately during resettlement for house construction and other purposes. Most of the wood land has been replaced by arable land for thecultivation of cash and food crops (Mekonnen, 2011). Poor planned settlement program leads to uncontrolled encroachments and farm land expansions which have posed great damage on the vegetation composition and structure of the area (Dejene, 2011).

The lack of current knowledge of the extent and magnitude of land use and land cover change due to resettlement to promote sustainable land management encouraged the researcher to address the problem. Therefore, land use/land cover change and promotion of sustainable land management due to resettlement remain the main problem of the interest of the research. Even though little study has been conducted on the impact of resettlement on LULC change, for instance; (Zemzem, 2010;for B.A in one resttlement site i.e only Maribo,Mengistu, 2016 for M.A*)* their emphasis was mainly on forest cover which could not represent the whole LU/LC change. The methodology applied for these studies couldn't clearly indicate the real status of LULC. Therefore, the current study attempts to fill the existing gap by adopting Land Use Transfer Matrix (LUTM) and socioeconomic data analysis in assessing the impacts of resettlement on each classified functional zones of land use/land cover using GIS and remote sensing techniques with respective of each time period under investigation in Limu Seka resettlement site.

1.2. Objectives of the Study

1.2.1. General Objective

The general objective of this study was to assess the impact of resettlement on land use and land cover dynamics in Limu Seka District, Jimma Zone, Western Ethiopia.

1.2.2. Specific Objectives

To address the main objective of the study the following specific objective is proposed:

- ✓ To examine Land use/land cover dynamics from 2000 to 2020 of the study area
- ✓ To detect conversion of land use/land cover types in the past two decades;
- ✓ To evaluate local people's insight on the impacts of land use/land cover changes and
- ✓ To investigate the driving forces for land use/land cover changes in the study area.

1.3. Basic Research Questions

- ❖ What was the status of LU/LC dynamics in the last 20 years in the study area?
- ❖ Is there conversion of LU/LC types from one to another in the last three decades in the study area?
- ❖ What are the major impacts of resettlement on socio-economic in the study area?
- ❖ What are the major driving forces for land use land cover over settlement?

1.4. Significance of the Study

This study entirely focused in the Limu Seka district resettlement site, therefore the outcome of the study may be contextual, and should not be generalized as if the same holds true for all places with resettlement schemes. However, the results of the study can contribute meaningfully to the following areas of concern: the debate on the effects of resettlement schemes on the biophysical and human environment; production of a theoretical model that represents, more accurately, the sequences of cause and effect in resettlement schemes or programs, in particular in the study area; in order to provide planners and policy makers with important lessons for solving the problems associated with resettlement programs and it was used as an important indicator for decision makers to make environmental impact analysis of current resettlement programs in the various areas.

1.5. Scope of the Study

Scope of the study is spatially limited to Limu Seka District, Jimma Zone of south western Ethiopia. The study emphasized on generating valuable information on LU/LC change due to resettlement. Assessment was made by combining different spatial data sources (remotely sensed satellite images and ground survey). Thus, the data source of the pre-settlement was produced from the satellite imagery, while the current data collected using questionnaire, land use/land cover was generated from ground-based survey and recent Land sat ETM+ and Land sat OLI/TIRS satellite images. The time horizon of the study was from August 2019 to 2021 G.C.

1.6. Limitation of the study

Land use land cover change was analyzed by taking time series spatial data .Due to access and resource limitation to lack of use high resolution image, some of the limitations for this study include, unwillingness of some house hold members to respond to some of the questions due to current lack of peace in the study areas data were collected by DAs and Teachers' as well as completed students, bureaucracy at District level in archive data, believed to have mislaid some crucial data for this study.

1.7 Ethical Consideration

One of the main concerns in scientific research, that incorporates human subjects in the study, is ethical considerations for the research subjects. By taking in to account this reality the researcher is planning to get the acceptance or will of household questionnaire, survey respondents, and key informants. They will also be informed about the objectives and out comes the research quite adequately that it is only for academic purpose. They were also be informed that their personal information was kept confidentially that was not publicized or given to any third party without their full willingness incase when need arises. The researcher was informing the respondents that their response was kept utmost confidential level.

1.8 Definition of Key Terms

Resettlement: - is voluntary or involuntary change of their original place to newly established area for the sake of free land for agriculture and grazing (Gebra, 2004).

Impact:-intended or unintended outcomes of programs which is either negative or positive.

Land is the physical resource which is the foundation for economic, social, infrastructural and other human activities (Lambin, *et al*, 2003).

Land Cover refers to the visible biophysical features and elements on earth's surface and immediate surface (Prakasam, 2010). It includes vegetation, water (surface, ground water), desert,

ice, soil, relief and anthropogenic structures like mining and settlement (IGBP/IHDDP- LUCC and IGBP-DIS, 1997; Di Gregerio, 2005).

Land use is the purposeful actions and involvements of human beings to exploit land resources, everything on the land and inside it to fulfill their needs and wants. It is the modification of the land carrying varies activities and using different inputs that convert the land cover kind to produce, change or preserve the land (IGBP/IHDDP-LUCC and IGBP-DIS, 1997; Di Gregerio, 2005).

GIS (Geographic Information System) is computer based system for collection, storage, processing and displaying geographically referenced data (Burrough, 1990).**Remote Sensing** is explained as a host of processes by which information concerning an object, area and any phenomenon is obtained without any physical contact with it. Moreover, the term is specifically related with measuring the interrelationship between earth surface materials and electromagnetic energy (Milla*et al*., 2005).

1.9. Organization of the study

The thesis is organized in to five chapters. Chapter one introduce back ground of the study, statement of the problem, objectives, research questions, Significance of the Study, delimitation ,limitation and organization of the paper. Chapter two attempts to reviews related literature, Chapter three focuses mainly on research methods, chapter four concentrates mainly on analysis discussion related to impact of resettlement on LULCC rate of change and finally, conclusions and recommendation of the study are presented in the fifth chapter.

CHAPTER TWO

2. LITERATUREREVIEW

2.1. Resettlement: concepts and theories

The definition of resettlement or internal displacement can be modified from African Union Convention for the Protection and Assistance of Internally Displace Persons (Abebe, 2016). Accordingly, it refers to persons or groups of persons who are forcibly or voluntarily forced to flee or leave their places of habitual residence in order to avoid the effects of natural and/or human-made disasters and resettle within internationally recognized state borders. Resettlement is a program that many governments in developing countries have been implementing; however, with mixed results(Picciotto et al., 2018). Resettlement as a policy action or intervention strategy differs from one case to another depending on the objectives of the program. Most resettlement programs have the objectives, firstly of poverty reduction, mainly targeting the poor communities especially the landless and, secondly, regional development targeting those with own resources to invest in agricultural activities. It is quite difficult to define resettlement without referring to other related terms that describe population movement such as migration, colonization and transmigration (Rahmato, 2003).

According to Rahmato, different countries give emphasis to different terms, for instance, transmigration ‘implying government sponsored programs in Indonesia, colonization ‘referring to occupation of uncultivated land in Latin America, and resettlement ‘seems to be the more appropriate expression in the Ethiopian context that implies moving people to new locations. For Rahmato, resettlement is the phenomenon of population redistribution either in a planned or spontaneous manner: relocating people in areas other than their own for the purpose of converting transient populations nomadic pastoralists, transhumant or shifting cultivators to a new way of life, based on sedentary forms of agricultural production‖ (Rahmato 2003:2). According to Abbute (2002), resettlement involves the movement of communities from one environment to the other, and changes or modifies the physical and social environment in which settlers find themselves in and adapt to live. Piguet and Dechassa (2004) also define resettlement as a planned or spontaneous redistribution of phenomena of population.

Worldwide experience suggests that resettlement, caused by development projects, conflicts or other socio-economic, political and environmental factors, is a risky process that often leads to

impoverishment and rarely results in sustainable development(Hwang 2010).The definition of resettlement in this paper is the movement of people from areas where there do not exist factors that are suitable for smooth maintenance of life to areas presumed to be endowed with potentials that could provide opportunities for the same end (Kassahun, 2000).

According to the same source the destination of resettlement is to areas with under-utilized agricultural potential, and movement could take place either as a result of planned/organized intervention or spontaneously. Mengistu (2005) defined resettlement as the process by which individuals or group of people leave spontaneously or un spontaneous their original settlement sites to resettle in new areas where they can begin new trends of life by adapting themselves to the biophysical, social and administrative systems of the new environment. Resettlement is becoming attractive as a way out of pressing problems caused by food shortage, land fragmentation, population pressure, rampant unemployment, marginality of land and decline in productivity (Chambers, 2009).Resettlement could be classified into four types with in two main categories. The first category is non-planned resettlement comprising spontaneous resettlement and emergency or forced resettlement. The second category is planned resettlements which comprises voluntary and involuntary resettlements (Mengistu, 2005).

Usually, planned resettlements are those initiated and/or supported by governments and aid agencies. Planned resettlement projects have been undertaken with aim of relieving population pressure and promoting land consolidation and sound agriculture in areas of high population density (Rahmato, 2003).It may be undertaken as a form of compensation for displaced populations whose lands have been utilized for development projects such as dams, national parks (Dessalegn, 2003).

Similarly, settlements have frequently been planned to rehabilitate populations that have been adversely affected by natural disasters unfavorable climatic conditions and/or political conflict (Dessalegn, 2003a).Others call these displaced people because of natural calamities as environmental refugees. Spontaneous resettlements are those resettlement types that are accomplished by desperate movement of people from place of origin because of push factors (land scarcity, recurrent drought, loss of productivity due to land degradation) to new settlement areas with better potential to sustain life/pull factors (availability of un colonized and productive land) (Mengistu, 2005).Around the world, there also exist involuntary resettlement processes caused by development projects. They are caused by economic mobility, industrialization and urbanization, or

by war, ethnic strife, or natural calamities such as droughts. Often the spatial distribution of people and resources do not coincide. Therefore, much of the impetus for population movements comes from efforts to match the people with the resources they need for sustenance and growth.The African continent is the scene of massive population resettlement processes of all types, including painful involuntary displacements of people. Currently, however, Africa‘s most important forced displacements are not those caused by development programs, but those triggered by social and political causes such as civil wars, ethnic, racial and/or religious persecutions, or by natural causes such as droughts and famines(Boano et al., 2012). These result in millions of refugees - either "international refugees" who cross international borders to find protection, shelter andfoodinanothercountry,or–internalrefugees"whostillremainwithinthebordersof their countries but have abandoned their houses and lands (Cernea, 1997).

Displaced populations are not only themselves deprived of normal livelihood and pushed to the limits of poverty and starvation, but often represent an enormous burden on the host populations, thus compounding the complexity of the displacement-triggered problems. They may lower the hosts’ standards of living and tend to rapidly deplete the natural resources of the areas of refuge (Cernea, 1997).

In Africa, planned resettlement has been tried in countries as diverse as Kenya, Tanzania, Sudan, Ghana, Senegal, Burkina Faso, Egypt, and Ethiopia. While several of these schemes did in fact improve the well-being of participants, in general terms these efforts have fallen short of expectations. The expectations themselves may have been unrealistically high in many cases, given the resources available. Nonetheless, both tangible achievements and indisputable drawbacks to large planned settlement schemes exist, including their high cost, reliance on prolonged public sector intervention, and the constraints they have placed on the private initiative of resettles. Yet such settlements have created new opportunities and have often met the motivations and immediate needs of many settlers. Complex political, social and economic forces have been involved in such programs and, as Pankhurst (2002) argued in his monograph on Ethiopian resettlement, the "stereotypes of resettlement as either purely induced by famine or enforced by Government are equally miss leading simplifications."

2.2. Resettlement in Ethiopia

State-sponsored population resettlement schemes have grown in importance in the past fifty years in Ethiopia. In imperial times, resettlement became part of government planning from 1966 with establishment of the Ministry of Land Reform and Administration. Following this event, thousands of settlers was moved to several dozen schemes, mainly set up on the initiative of local governors, missionaries or NGOs (Pankhurst and Piguet, 2004). According to (MORD, 2003), the type of settlers varied, and included urban unemployed, pastoralists, ex-soldiers and famine victims. The projects were set up with ambitious economic, social and political objectives: to deal with famine, provide land to the landless, increase agricultural production, introduce new technologies, establish cooperatives, remove urban unemployed, stop charcoal burning, settle pastoralists and shifting agriculturalists, form defense on the Somali border and repatriate refugees.

Similarly, the military government of Ethiopia resettled more than half a million settlers because the incidence of famine in 1984/85 mainly from the North, notably Wello, Tigray and Shewa, to areas to the west, especially Wellega, Kafa, Illubabor and Gojjam. Though the resettlement was intended to be voluntary and large proportion of settlers were famine-victims, targets were turned into quotas, food-aid was used as trap, and coercion and victimization became common place. Two kinds of planned settlements were set up: large-scale ˜conventional mechanized collectives in the lowlands on the western border, and small-scale integrated settlements in the highlands, reliant on ox-plough cultivation (Kamphuis, 2010).

The EPRDF government also planned for resettlement program to relocate 2.2 million people in response to the drought and famine occurred in 2000/01. The objective of the scheme remains similar to that of the Derg i.e. ensuring food security. The resettlement scheme planned recently by EPRDF government is believed to involve minimum environmental impacts contrary to past resettlement programs (Walo, 2012).

2.2.1. Resettlement during the Derg Regime

Because of the drought and famine in 1984, the then government set in motion resettlement policy that was initially designed to relocate 1.5 million people from areas in the north most severely affected by drought and famine to areas in the west and south that had experienced adequate rainfall. The government claimed that it was carrying out the program for humanitarian reasons, contending that it would remove the people from exhausted and unproductive land and place them in settlements with rich agricultural potential. In addition, the government argued thatthe new settlements would greatly facilitate efforts to provide social services. The then government viewed

resettlement program as a way out of the pressing problem of famine. It was proposed that the food security crisis would be addressed in a durable way through a dual strategy of relieving population pressure in the highlands, which were perceived as chronically drought prone, over populated an environmentally degraded, and, on the other hand, of making lowland areas, which were perceived to be fertile, under-populated, under-exploited and more productive (Bishaw et al., 2013).

Resettlement was also considered as an opportunity to introduce social and economic change and pursue socialist transformation. It has been also suggested that it would be easier to convince or force people to move during the time of famine. The decision to relocate such huge amount of people could also be explained by such factors as the Land Reform Act of 1975 that made public land available to be used for resettlement purposes and famine recurrence at short intervals calling for solutions in the form of embarking on resettlement in the areas with marked agricultural potential. The 1984/85 famine placed most affected localities in extremely precarious situation. The government responded to the famine by launching large-scale resettlement program (Getachew, 2016). Accordingly, it was initially intended to resettle 1.5million people to address the problem of recurrent food insecurity in risk-prone areas and some 600,000 people were resettled in the lowlands of western, southwestern and southern Ethiopia (Dessalegn, 2003b; Birhanu,2007)

2.2.2. Resettlement during EPRDF Government

Regarding the current government-sponsored resettlement situation in Ethiopia, the Federal Democratic Republic of Ethiopia (FDRE) was initially reluctant to consider resettlement as a viable option for development (Alula, 2009). The government sponsored resettlement schemes are more planned than the cases of the previous government (Shumete, 2013).It seemed that planned resettlement was suspended in the years following the downfall of the Derg regime. However, the EPRDF government appears to be increasingly enthusiastic and in favor of launching planned resettlement schemesduring2002/03. The plan envisages relocating over 2 million people within 3 years' time. The basic assumptions behind the current resettlement program remain similar to those made during previous periods. But the later program is essentially different from the preceding ones in the following respects (Kassahun, 2003; Feleke, 2004).

It would be based on free consent and willingness of re settles; it would be implemented at intra-regional level there by ruling out possibilities of massive movement from one region to another. Resettles retain their land use rights and other immovable properties in the original home villages for about 3 years after being relocated and Resettles can return to their original villages for good whenever they have change of mind. According to (MORD, 2003), the initiation of the voluntary intra-regional resettlement (access to improved land) rests on four major pillars that are important to avoid problems. The document further states the government initiated a pilot resettlement program during 2000/01. This was carried out in response to the disparate movement of people to forests and national parks from hard-hit areas. Accordingly 45,000 households were resettled voluntarily in Amara, Oromia and Tigray regions in the year 2002/03.The resettlement program by EPRDF is intra-regional while that of the Derg was not, The resettlement scheme by EPRDF is based on voluntary basis where as that of the Derg was carried out involuntarily, Discussion with host community and the people to be resettled was held resettlement program carried out by EPRDF while it was not in the Derg regime, the resettles could return to their home land if they have change of mind and their immovable properties such as land are secured for three years in the recent resettlement scheme while it was contrary during the Derg regime,

2.2.3. Resettlement in Oromia Regional State

Like other regions, chronic and frequent food shortage of varying degree is becoming prevalent atdifferenttimesandprovokedlarge-scalestate-organizedresettlementsprograms.Amongthe zones found in the region Borena, Eastern and southeastern part of Bale, East and West Hararge, North and Eastern extremes of Arsi, some parts of North Shewa and some pocket areas of Rift valley of Eastern Shewa are affected by food insecurity problems. 44 Districts found in these areas were identified as severely food insecure areas and nominated for various development interventions, resettlement among others, as part of Regional Food Security Program (ONRG, 2001).

The pre-settlement feasibility study identified Illubabor and West Wellega zones of Oromia Regional State as potential areas for resettlement. The two zones have eight potential resettlement sites with total of 23,700 ha. Limu Seka resettlement site is not among the sites for which feasibility study was carried out. According to official reports of MORD, (2003) about 100,000 people were planned to be resettled in the Region to areas where population density is relatively low and unutilized land is available.

2.3. Impacts of Resettlement in Ethiopia

The large scale resettlement program during the Derg regime has been criticized for a number of problems. First, consultation between policy makers, implementers, the resettles and the host population was minimal. Second, high handedness in implementing plans entailed resettlements often quelled through coercive methods, which thus undermined possibilities for commitment. Third, the resource and socio-economic support necessary for bolstering the chances of meeting the stated targets were not optimally rallied and disorganization and confusion was the result (Kassahun, 2003). In general, impact of resettlement could be classified in to two major categories- social and environmental impacts.

2.3.1. Social Impacts of Resettlement

Many studies have been carried out concerning the social impacts of resettlement in Ethiopia. Resettlement can cause many social impacts, especially if the ethnic and cultural composition of the resettles is heterogeneous. Wolde-selassie (2004) reported that the impacts of resettlement in Metekel carried out in 1980s involved several social impacts. Primarily, the scheme disintegrated the resettles. The author also stated that resettlement program disrupted the resettles production systems and impoverished their livelihood. As a result uncertainties and confusions may happen until painful adaptive adjustments may occur to the new environment. Resettlement can also bring about break-up of families. The 1980s resettlement in Ethiopia caused many families to be broken. The schemes were carried out in lowland areas where the climate is completely different from their original homeland. As a result they experienced difficulties since the new climate is less hospitable that led to excessive mortality due to diseases. They were also suffering from increased control to prevent escape. Village to village travel was only possible through pass letters obtained from village authorities (Pankhurst, 1992).

The scheme has also taken away traditional resources of the indigenous host communities that affected their livelihood because their lives are mainly based on shifting cultivation, hunting, fishing and honey collection, Similarly, Dessalegn (2003b) reported that settlers experienced hardships due to changes in environment and diet. They were also subjected to lowland diseases such as malaria and trypanosomiasis. Therefore, the scheme claimed the lives of many peoples. In larger settlements settlers resented imposed collectivization. Ahmed (2005) reported that the host community particularly the youth started to develop negative attitudes as they view resettles as competitors over the use of natural resources.

2.3.2. Environmental Impact of Resettlements in Ethiopia

Planners sought to justify resettlement on the grounds that it would provide lasting solutions to the problem of food insecurity of the affected households. In fact, even if most settlers had remained in the resettlement areas, the removal of an overall average of 3% of the population in 1980s in the north would have had a negligible effect on reducing population pressure because the resettles abandoned the scheme and returned to their home areas. Resettlement was also claimed to provide a more rational use of available land, by readjusting man-land ratios. However, this assumption rested on the myth of vast underutilized lands. Different source indicate that resettlement schemes in Ethiopia, planned and spontaneous, involved environmental impacts(Destalem, 2016).

Accordingly, Dessalegn (2003b) reported that government sponsored resettlement programs that were carried out during 1984/85 involved considerable environmental damage by clearing large areas of vegetation to build homesteads, to acquire farmland, and to construct access roads. He also indicated that the scheme failed to adapt farming practices to agro-ecological conditions of the lowlands, and as a consequence the environmental damage involved was quite considerable. Likewise, spontaneous resettlement/migration of people from drought-hit areas of Hararghe and Arsi zones to Bale zone of Oromia Regional State may have also caused environmental damage to the new area. The reasons for their migration first and foremost results from years of cumulative effects and sufferings from gradual and consistent natural resource degradation in their home areas and secondly triggered and initiated by recurrent drought conditions that made their livelihood conditions to be below subsistence which allowed them neither survival nor livelihood improvements. In other words: for most of the people who decided to leave their homes in Hararghe and Arsi lowlands, the conditions did not leave them with any other alternative or option. The migration was intensified in May 2002 and most of the resettles have settled in Mana Hangatu, Berbere and Gololcha Districts of Bale Zone. Some parts of these areas fall in Bale mountains National Park and the impact on the wildlife and their habitat may be considerable. Until the end of October 2002, 20,093 people were registered by the respective districts. The number could be more because the flow of people arriving continued despite the regional government trial to stop these migratory movements (Dechassa, 2002).

The Government claims that such disparate movement of peoples initiated the pilot resettlement projects after which large scale resettlement schemes were planned to organize such movements. Likewise, the current resettlement program launched during 2002/03 is suspected of environmental damages. The settlement was experiencing extensive destruction of woody plants. Assefa (2005) reported that the recent resettlement programs conducted in different parts of the country may have involved environmental damages despite differences in scale which includes huge loss of natural forests with great impact on sustainability of the environment contrary to what has been set out in the implementation manual of the scheme. Social tensions due to therecent resettlement have also arisen in one of the site found in West Showa Zone of Oromia Regional State between the host community and the resettles because of competition over resource uses (Misganaw, 2005). He proposed rehabilitating the target population at their home of origin instead of relocating them, which can be accomplished by the huge amount of money invested in the program to avoid such environmental and social impacts.

Similarly Ahmed (2005) reported that the recent resettlement program has resulted in large damage the natural forest of the resettlement areas as well as the killing and fleeing of wild animals. About 5613.7 hectares of forestland in Haro Tatessa resettlement site was removed due to the resettlement program. The study also states that some of the damages caused on forest and wild animals are not easily reversible, even may lead to extinction of some species.

2.4. Land use/land cover dynamics

Land is the major natural resource that economic, social, infrastructure and other human activities are undertaken on. Thus, changes in land-use have occurred at all times in the past, are presently ongoing, and are likely to continue in the future (Lambin et al., 2006). These changes have beneficial or detrimental impacts, the latter being the principal causes of global concern as they impact on human well-being and safety. For instance, deforestation and agricultural intensification are so pervasive when they aggregate globally and significantly affect key aspects of Earth Systems (Lewis, 2006; Zhao et al., 2006).

Land cover is a biophysical characteristic which refers to the cover of the surface of the earth, whereas land use is the way in which humans exploit the land cover. LULC changes are caused by natural and human drivers, such as construction of human settlements, government policies, climate change or other biophysical drivers. Lambin et al., 2006 as cited on Kiros, 2008).In response to the increasing demands for food production, agricultural lands are expanding at the

expense of natural vegetation and grasslands (Lambin et al., 2000).

LU/LC changes are ever changing processes in terms of their types and extent over space and time (Prakasam 2010).These changes inland use/land cover systems have great impact, among others, on agro-biodiversity, soil degradation and sustainability of agricultural production (Lambin et al., 2006).Throughout the world processes related to urbanization, development of transport infrastructures, industrial constructions, and other built-up areas, are severely influencing the environment, and are often modifying the landscape in an unsustainable way(McCormick etal.,2004).

In many cases land-use activities go hand in hand with substantial modifications of the physical and biological cover of the Earth‘s surface, resulting in direct effects on energy and matter fluxes between terrestrial ecosystems and the atmosphere. For instance, the conversion of forest to cropland is changing climate relevant surface parameters (e.g. Albedo) as well as evapotranspiration processes and carbon flows. In turn, human land-use decisions are also influenced by environmental processes. Changing temperature and precipitation patterns for example are important determinants for location and intensity of agriculture. Due to these close linkages, processes of land-use and related land-cover change should be considered as important components in the construction of Earth System models (Schaldach et al., 2009).Moreover, LULC is the primary cause of worldwide environmental change that has been increasing spatially and temporally at an alarming rate (Wubie, *et al.*, 2016). As Ebrahim and Mohammed (2017) briefly state conversion in LULC results in multi-faceted environmental side effects by hampering water provision reservoir storage capacity, agricultural potential and ecology of an area.

The landscape concept used to map and assess LU/LCC allows us to explain relationships between Land-Use practices and Land-Cover patterns, and considers Land-Cover change as driven largely by Land-Use Types. For different-scale LU/CC investigations, the landscape methodology is used on the base of remote sensing data of different spatial and temporal resolution, as well as conventional thematic maps and in-field data, to explain relationships between current Land-Use practices and land-Cover patterns (Milanova et al., 2007).Present-day landscapes are territorially defined units of land surface, characterized by an structurally organized combination of natural and economic components whose close interactions give birth to the present-day landscape /territorial system. Such an approach provides a base for the perception of the world as a system of interrelated territorial samples with different environmental situations.

2.5. Why to study land use/land cover change

The need for optimal use of the land resources and for balance of Land-Cover capability with anthropogenic stress is one of the mega-scale issues of mankind. The way people use the land has become a source of widespread concern for the future of the world. The inabilityofmanycountriestobalanceenvironmentalandproductionneeds,aswellas Land Cover capability and anthropogenic stress; emphasize these mega-scale issues. More than ever, therefore, the need for rational planning of land use/Land cover development and optimal use of the land resources is evident. That‘s why precise and credible data on land use/land cover change and their trends are necessary for understanding global, regional and local environmental problems (Milanova et al.,2007).

Land use data are also needed in the analysis of environmental processes and problems that must be understood if living conditions and standards are to be improved or maintained at current levels. One of the prime prerequisites for better use of land is information on existing land use patterns and changes in land use through time. Information on land use/land cover in the form of maps and statistical data is very vital for spatial planning, management and utilization of land for agriculture, forestry, pasture, urban industrial, environmental and economic production. Today, with the growing population pressure, low man-land ratio and increasing land degradation, the need for optimum utilization of land assumes much greater relevance (Roy et al., 2008).

Land cover change plays a vital role in regional, social and economic development and global environmental changes. It contributes significantly to Earth—atmosphere interactions. Biodiversity loss is a major factor in sustainable development and human response to global change, and is important in integrated modeling and assessment of environmental issues in general. Scientists, researchers and planners have paid much attention to the issues of land cover change over the past decade (Shaikh et al., 2005).

Documentation of the land use and land cover change provides information for the better understanding of historical land use practices, current land use patterns and future land use trajectory. LUCC contributes significantly to earth atmosphere interactions, forest fragmentation, and biodiversity loss. It has become one of the major issues for environmental change monitoring and natural resource management. Identifying, delineating and mapping of the types of land use and land cover are important activities in support of sustainable natural resource management (Zhang et al,2004).Generally, determining the effects of land-use and land-cover change on the

earth system depends on an understanding of past land-use practices, current land-use and land-cover patterns, and projections of future land use and cover, as affected by human institutions, population size and distribution, economic development, technology, and other factors. LULC assessment is an important step in planning sustainable land management that can help to minimize agro-biodiversity losses and land degradation, especially in developing countries like Ethiopia (Kiros, 2008).

2.6. Trend of LU/LCC and resettlement in Ethiopia

As per Ministry of Mines and Energy (MoME, 2003) the total area of Ethiopia covers above 1.12 million km2. About 55% of this area is below 1500m a.m.s.l. which is lowland, whereas the remaining 45% of the area, with an altitude of greater than 1500m is highland (Tefera, 2011). In Ethiopia the land is dominantly used for mixed farming system, by smallholders who farm for subsistence (Tefera, 2011; Geremew, 2013).The country also kwon by several environmental, climatic, and socio-economic problems such as: environmental degradation, erratic rainfall, recurrent droughts and drought-related distressing famines, prevalence of malaria and HIV/AIDS, widespread poverty and poor governance (Tefera, 2011). The aforementioned problems are directly or indirectly linked with Climate change andLU/LCC.

LU/LCC including forest cover change is one of the major environmental problems in Ethiopia (Alemu et al., 2015). Albeit, most of the researches were conducted in the northern highland, there are numbers of LU/LCC studies carried out in Ethiopia, at catchment, zone, watershed and village levels. For instance Zeleke and Hurni (2001) in *Dembecha* area of Gojjam; Garedew (2010) in the Semiarid Areas of Central Rift Valley of Ethiopia; Gebrehiwot et al. (2010) in Koga watershed at the headwaters of the Blue Nile Basin; Tsegaye et al. (2010) in North eastern Afar range lands; Ebro et al. (2011) in Adami Tulu and *Fantale*Districts, in the rift valley of Ethiopia; Tefera (2011) in Nonno District, Central Ethiopia; Molla (2014) in ArsiNegele District, Central Rift Valley Region of Ethiopia; Worku et al. (2014) in Ameleke Watershed, South Ethiopia; Gashaw and Dinkayoh (2015) in *Hulet Wogedamea Kebele*, Northern Ethiopia. Most of these researches reported the decline of grassland and natural vegetation including forests, shrub lands and woodlands due to conversion to croplands, grazing lands, open areas and settlements areas. In the highland parts of Ethiopia there was expansion of agriculture at the expanse of vegetated lands mainly shrub land, woodland and forest land since 1860s (Girma, 2014). However according to the author expansion of agriculture at the expanse of vegetated lands worsened since 1980s.In Ethiopia expansion of agricultural land and loss of natural vegetation are associated with population growth,

poor economic condition, unclear land tenure right and several other biophysical and socio-political factors (Melaku, 2003). According to Sege (1994) and Turner and Meyer (1994) in most developing countries including Africa, Asia and L/America countries population growth and LU/LCC have a strong statistical correlation. In agreement to these different studies undertaken in different parts of Ethiopia also reported population growth as a major cause for LU/LCC.

Population growth was the major cause for the expansion of agriculture and reduction of vegetation covers in Ethiopian highlands (Muluneh, 2010), Borena District South Wello Highland (Shiferaw, 2011); Nono District, Central Ethiopia (Tefera, 2011), West Guna Mountain South Gondar (Tsegaye, 2014) and Northwest lowland of Ethiopia (Alemu et al., 2015). The total population of Ethiopia during the first population and housing census (1984) was 39,868,572. However, during the census of 1994 and 2007 it increased to 53,477,265 and 73,918,505 respectively (Minale, 2012). This implies that between 1984 and 2007 the total population of the country increased by more than 34 million persons. This population growth has led to expansion of agriculture and settlement by clearing forest, grass and woodlands (Minale, 2012).

2.7. Deriving factors for Land Use/Land Cover Change and resettlement

Looking at the driving forces of LULCC is very crucial in addressing the constraints. Land use/cover changes are the outcome of numerous driving forces that command certain environmental, social and economic conditions. Furthermore, the driving forces can be influenced by social out looks and practices like local culture, economic and financial elements, the state of the environment such as land quality, the topography, availability of water, current land policy and development plans. Hence, it is necessary to identify between the driving forces and the controlling variables. The driving forces can be used as a blue print for managing the land cover change. According to (Ellis and Pontius, 2006) assessing the interaction between the drivers of land use change need a good knowledge about the ways and the rest influencing factors and land policy. Land use /land cover change is most often addressed based on selected biophysical and socio-economic elements. To easily construct simulation, the driving forces are mostly considered exogenous to the land use system (Velburg et al., 2004).

The relationship between driving forces and LULCC can be distinguished by quantitative and qualitative methods. Land use/land cover change has become a core and crucial factor that is considered for recent natural resource management and to oversee environmental changes. Land use is the outcome of the interrelationship between socio-cultural settings, the state and its physical

demands and the physical potential of the land (Balak and Kolarkar, 1993). Land use is the purposeful application of land management strategy imposed on land cover by human beings or land managers to user the land cover, reflecting human activities like industries, settlement, cultivation, grazing logging and mining (Zubair, 2006). Is the other hand, land cover is the natural and artificial features of the land surface explained by vegetation cover, water, ice, sand and gravel and the immediate sub-surface composed of living organisms, soil, relief, surface and ground water and human imprints including infrastructures and settlement(Lambin et al., 2003; Baulies and Szejwach,1997).

Land use/cover change varies rapidly from time to time and place to place, and very important for the study of natural resources. Land use land cover change dynamics are the most crucial factors for monitoring, assessing, safeguarding and proper use of natural resources. Land use/cover changes are the critical topics and challenges for environmentally friendly and sustainable economic progress of the place. As human population increases rapidly environmental degradation like deforestation, soil erosion, biodiversity loss, water pollution and global warming are human life from time to time. Change detection in land use and land cover can be assessed on temporal scales, for instance, a decade to evaluate land cover change caused by human actions on land surface (Gibson and power, 2000). Land use/cover change is highly affected by different natural and human activities. For promoting the economic situation of an area in a long- lasting way without keeping the environmental condition safe a wise use of natural resources is a must. This can be effectively by looking at the present and past land use and land cover change patterns of the area concerned area (Chaurasia et al., 1996).

Land use/land cover change is taking place at an alarming rate, wider scale and the factors of change are human and negatively affecting human beings themselves (Agrawal, et,al, 2002). Lambinet, al (2003) and Solomon (2016) summed up driving forces behind land use land cover changes into proximate and underlying causes. Proximate (direct causes) are human activities and immediate actions that arise from the proposed land use and directly influence land cover. As Solomon (2016) further a specifies proximate causes are human actions which have a direct impact on the land use through the use of different resources on the land like wood extraction or clearing it for agriculture. On the other hand, the underlying (indirect)causes are basic elements that pave the way for the proximate causes to operate. The effect is felt from far distant areas, frequently by affecting one or more proximate causes (Lambin et al., 2003).

Moreover, Solomon (2016) citing (Geist and Lambin, 2002; Vancker et al., 2003) states that underlying causes basic engines that work behind the proximate causes encompassing demographic pressure, economic policy, technological advancement, institutional and cultural elements. Most of the time, proximate causes work in small scale, local level (individual farms, households or communities). On contrary, underlying causes can emerge from large-scales, far- reaching, i.e., regional (district, provinces, country) and worldwide scales. Underlying causes are frequently strange(exogenous) to the local societies in direct attachment with the land use and beyond the controlling capacity of the community concerned stated the other way, only some local- level factors are well known by decision makers (Lambin, et.al, 2003; Solomon, 2016). Different scholars point out population pressure, expansion of agricultural land, Settlement and poverty in the front line as causes for land use- land cover change.

2.7.1. Population pressure

The impact of rapid population growth on the land use- land cover change is one of the most widely accepted factors among intellectuals. For instance, Wubie, et.al (2016) citing Turner and Meyer (1994) fast population growth, distribution and the resultant demographic changes are taken as the key elements that are responsible for land use- land cover change. Solomon (2016) clarifies the case in point stating that when population booms the demand for farming land, pasture land, fire wood, and settlement and consequently increases. Moreover, spatial and demographic changes in Ethiopia cause a severe effect on the farm lands and land cover of an area (Kebrom, 1999 cited in Solomon on 2016).

On the top that Kinfe (2011) referring Erle(2007) states that although humans have been using the land for food and non-food products, the present need and demand level and intensities of land use-land cover changes are much greater than any human history in the world highly affecting ecosystem and environmental resources at local, regional and global scales. Furthermore, Ebrahim and Mohammed (2017) high light that population increase poses a formidable impact on land resources due to the rising need for agricultural lands, settlements, energy consumption and building materials.

2.7.2. Expansion of Agricultural Lands

Land is the base of livelihood for agricultural societies like Ethiopia. For many developing countries, agriculture is the primary and pival economic sector for it is the key source of gross domestic product (GDP), export and foreign currency earning and employment. The very key role it plays indicates that agriculture remains one of the main causes of land use- land cover change in rural environment (Muluneh, 2005).

According to Warra, et al., (2013) point out that agricultural and rural settlement land is the major cause of land use land cover change in the Kasso catchment area of Bale Mountain. Moreover, as Wubie, et.al (2016) states that agricultural and residential land is the major factor for land use land cover change in Gumera watershed of Lake Tana Basin. Here, agricultural land shows steady but continuous increase at the expense of forests and grass lands through time (Gete, 2000, Kebrom and Hendland, 2000 cited in Solomon, 2016). Furthermore, as Muluneh (2005) puts increase in agricultural production is the outcome of expansion of cultivated land or agricultural intensification. About 80% of agricultural growth has come from the extension of area under cultivation (Paulino, 1987 cited in Muluneh, 2005).

2.7.3. Demand for fuel wood and construction materials

Deforestation is the outcome of forest resources to a different type of land cover or when the remaining tree cover drops below a minimum threshold of 10% according to the UN- Food and Agriculture Organization (FAO) (Lambin, et.al 2003). The causes for forest loss vary from area to area. For instance, in Latin America, it is the high level of forest processing and pasture for grazing animals that are the main reasons, while crop production by small scale holder is the great concern in Africa. In line with this, Warra, et.al(2013) portray about 73.3% of sample households in Kasso catchment in Bale Mountain rely on wood for cooking, heating and light and consequent loss of original forests and the conversion of forest lands in to crop, settlement and grass lands. A higher figure is seen in the *Gumera* watershed of Lake *Tana*basin by Wubie*et al.* (2016) stating that about 80% of the sample households depend on wood as sorts of all energy. Both studies express that wood is the source of energy for nearby urban areas and the means of generating income for the rural households.

2.8. Application of Remote Sensing and GIS Techniques for LU/LCC

Geographical Information Systems (GIS) in conjunction with Remote Sensing (RS) has been recognized as a powerful and effective tool in LU/LCC analysis (Abdullah et al., 2013). The information from GIS and RS also helps to assess the extent, direction, causes, and effects of the LU/LCC (Reis, 2008; Oumer, 2009; Rimal, 2011). In LU/LCC assessment some studies have utilized RS techniques; others have integrated remote sensing techniques with GIS. GIS is the technology which has been used to view and analyze data from a geographic perspective (Rimal, 2011). It is a useful tool to measure the LU/LCC trends between two or more time by using statistical and analytical functions (Abdullah et al., 2013). It provides a flexible environment for collecting, storing, displaying and analyzing digital data necessary for LU/LCC detection and tools for land use planning and modeling (Reis, 2008; Rimal, 2011).

In the context of LU/LCC, RS means the ability to detect change on the earth‘s surface through space-borne sensors (Abdullah et al., 2013). Application of RS for LU/LCC analysis depends on: (i) sensor capability, (ii) wealth of information captured, (iii) objective of the intended study and (iv) spatial and spectral properties of satellite images acquired by different versions of a particular sensor instrument (Oumer, 2009). Landsat imagery provides a better understanding of land resources. The most important reason for this is a continuous improvement in radiometric and spectral property of images over time (Oumer, 2009). Since the starting of Landsat program in 1972 Landsat Multispectral Scanner (MSS), Thematic Mapper (TM) and Enhanced Thematic Mapper Plus (ETM+) data have been broadly employed in LU/LCC studies, mainly in forest and agricultural areas (Reis, 2008).

2.9 Conceptual frame work of resettlement causes and its impacts

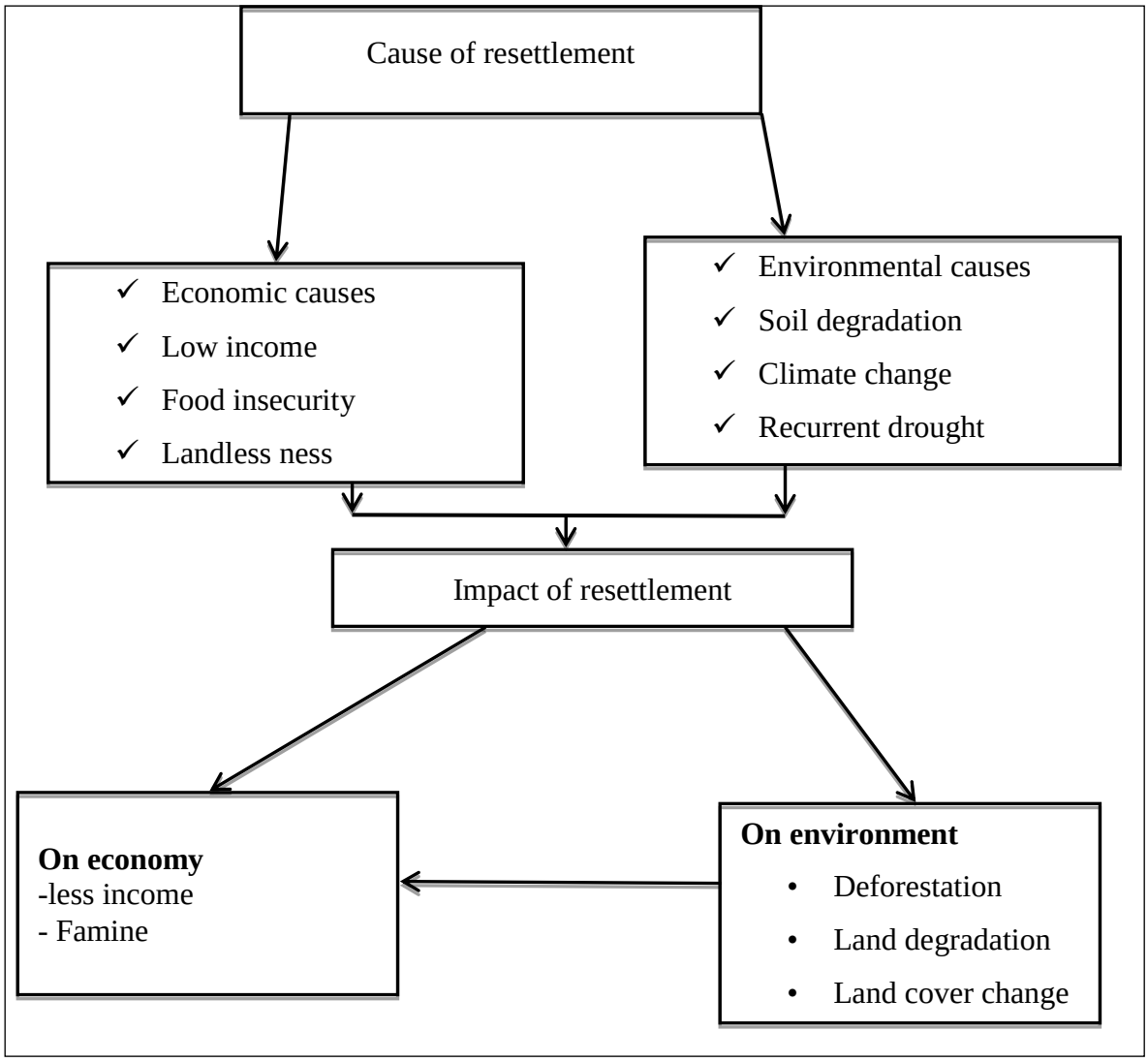

Figure 1: Conceptual frame work

CHAPTER THREE

3. METHODS ANDMATERIALS

3.1 Description of the study area

3.1.1. Location

The study was conducted in Oromia Regional State, Jimma zone, inLimuSekaDistrict. Specifically, LimuSeka District is located in the south western of Oromia regional state;the district is located at about 440km west of Addis Ababa and 110 km from zonal town (Jimma town). The absolute location of the study area lies in between $8^0$6’00’’N to $8^0$51’00’’N latitude and $36^0$32’00’’E to $37^0$21’00’’ELongitude.

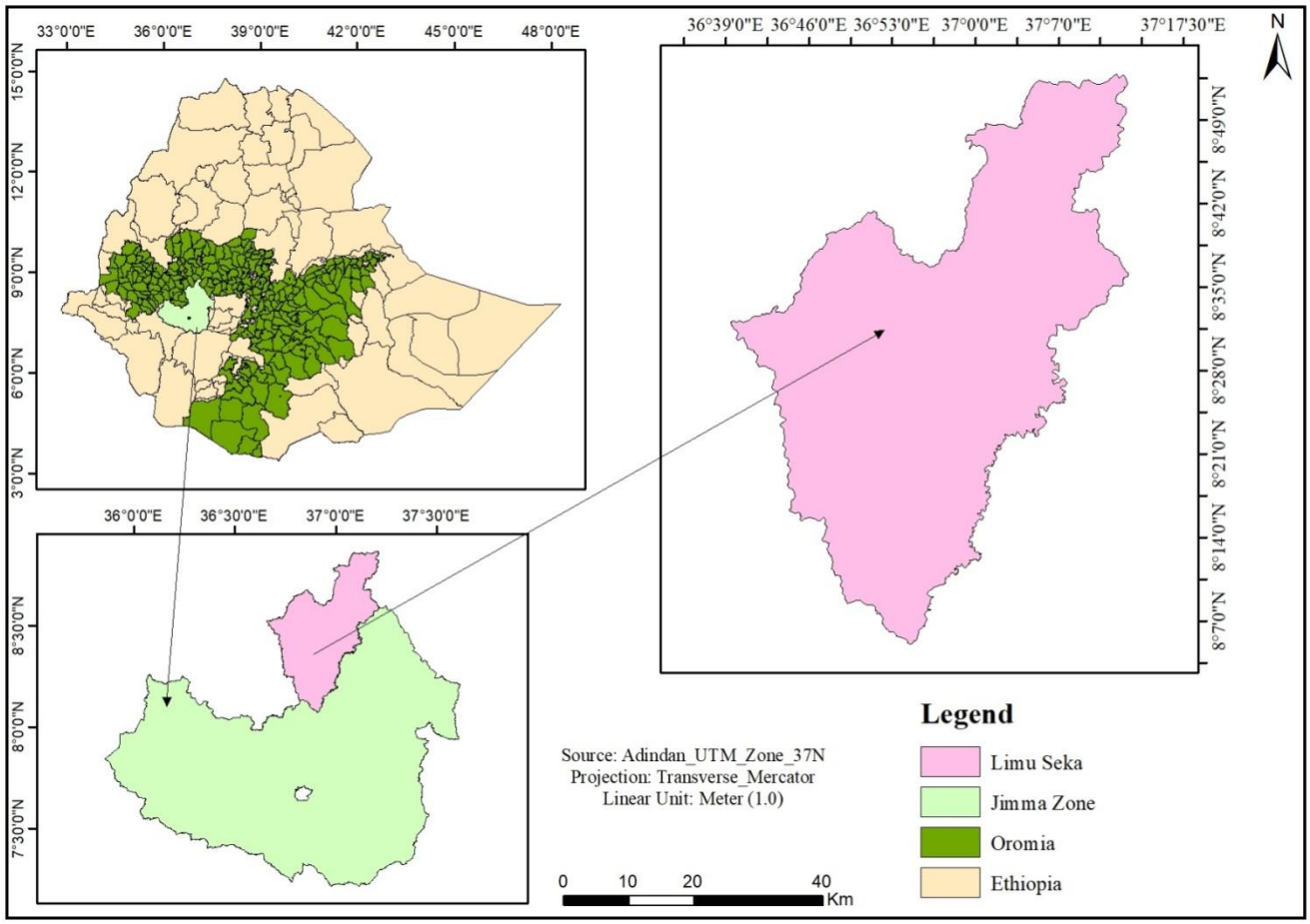

Figure 2: Map of LimuSeka District (Source: Computed from EthioGIS, 2014)

3.1.2. Demography

The 1994 national census reported a total population for this *district* was 122, 370, of whom 60,099 were men and, 62,271women 3,400 or 2.78% of its population were urban dwellers at that time. The 2007 national census reported a total population for this *district* was 187,222 out of this 94,754 are male and 92,468 are female CSA, 2008) 6,082 3.59% of its population were urban dwellers, which is less than the zones average of 12.3%.With a total areas of 2,507.squarekilometer, Limmu Seka District has an estimated population density of 70.2 people per square kilometer, which is less than the zones average of 150.6. The two largest ethnic groups reported in the District were Oromo 95.19% and Amhara 3.4%.The majority of the inhabitants were Muslims with 57.7%, while 32.44 of population were followers of Ethiopian Orthodox Christian and 9.725 were Protestants (CSA, 2015).

3.1.3. Climate and topography

The altitude of this district is between 1,300-2,700 meters above sea level. The district has diverse topography. Of these *Dora Gabena Chalte* and *Atokelela* are amongst the highest points in the district. Since Ethiopian climatic condition is mostly controlled by altitude: the *district* has diverse agro climatic zones which are favorable for the cultivation of different crops. March is the warmest month of the year. The temperature in March averages 33.20^0C. August is the coldest month, with temperatures averaging 14^0C. The area is one of few places of the country which experiences heavy rainfall throughout the year with few variations during winter season. The rainy seasons of Limmu Seka start in late march and ending in October, and then dry season occurring during November to early march. The rain fall is exceeds of 1,800mm per annum.

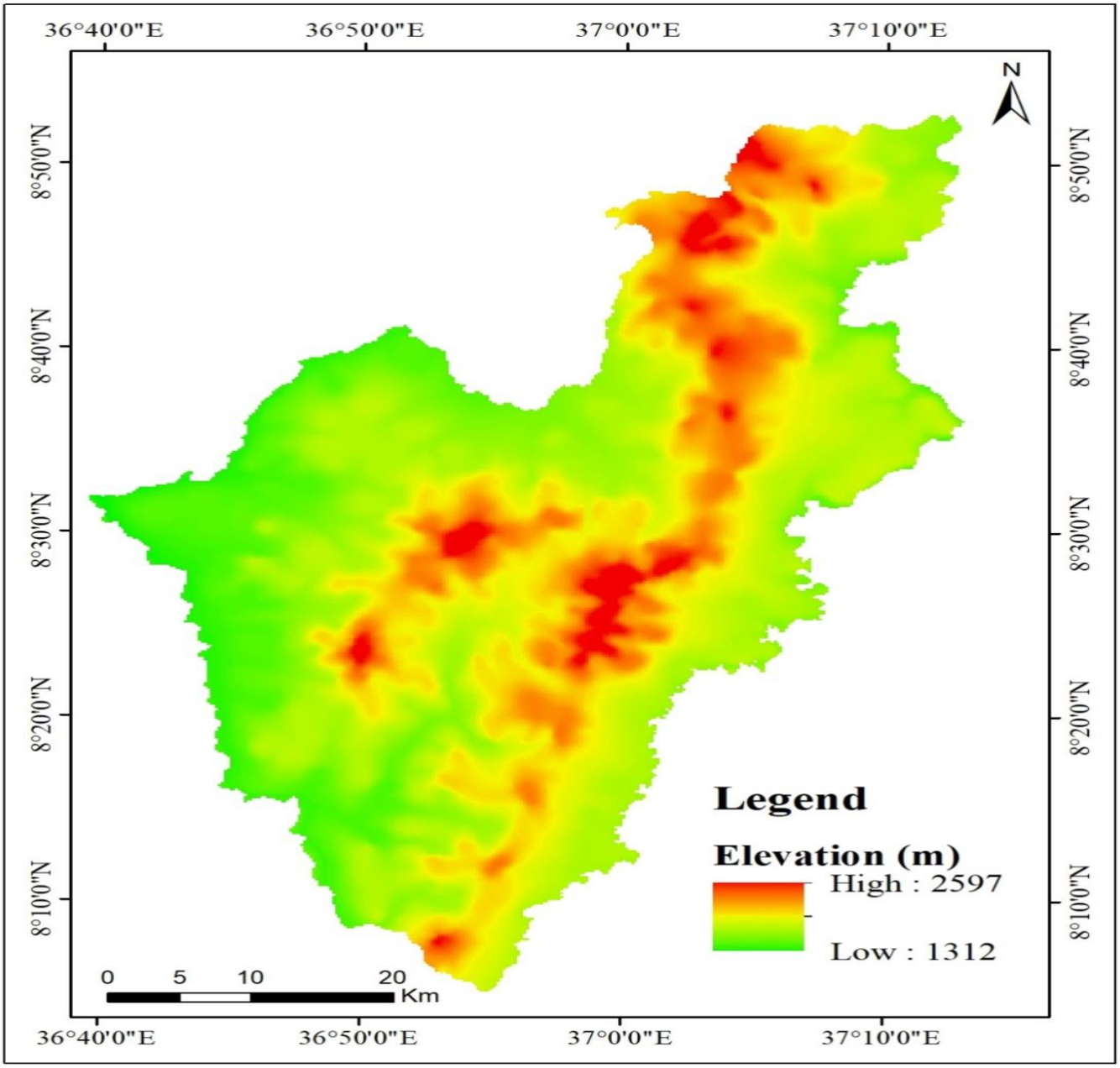

Figure 3: Topography map of study area

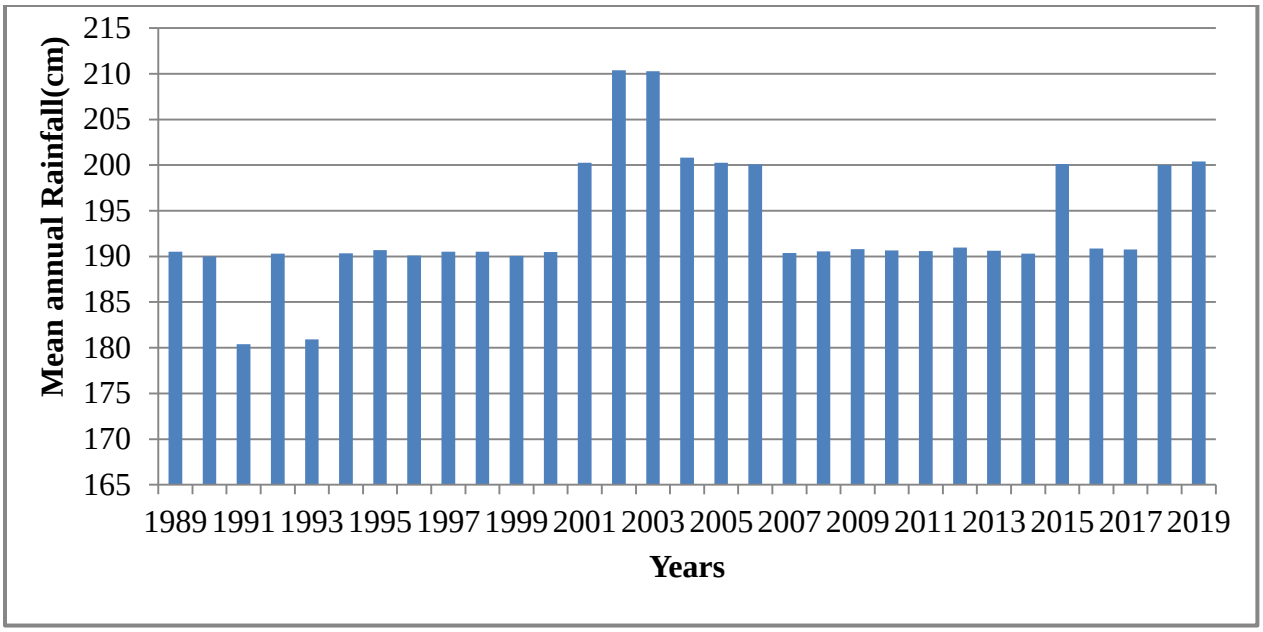

Figure 4: Mean annual rainfall of Limu Seka district

3.1.4. Economic activities

As the largest majority of the people live in rural area which is above the zone's average agriculture is the main stay for the people of the district. Teff, oranges and banana are important crops. Coffee is also an important cash crop for this district. Livestock rearing is another source of income. But the livestock production systems of the settlers differs from that of the nearby indigenous community in that the former raise less livestock and fatten them for sale (LSWARDO, 2021).

3.2.Research Design

The study employed explanatory research design with an application of both qualitative and quantitative research approaches. Mixed approach research, is used to collect and analyze not only numerical data, which is customary for quantitative research, but also narrative data, which is the norm for qualitative research in order to address the research question(s) defined for a particular research study (Baker et al., 2018).

The goal for researcher used the mixed methods approach to research is to draw from the strengths and minimize the weaknesses of the quantitative and qualitative research approaches. The reason for using this method was to compare the results from two different perspectives as relying on quantitative methods alone can hide important facts obtained from qualitative method (Johnson and Onwuegbuzie, 2004)

3.2.1. Methods

3.2.2. Data type and Source

In this study, both primary and secondary data were used. Primary data was collected through household survey, Key Informant Interviews (KIIs) and direct field observation. The secondary data were collected from different sources like published and unpublished materials, books, journals, reports from Limu Seka inhabitant at different times, and resources was undertaken almost throughout the course of the research period. Also to achieve the objectives of the research researcher begun with acquisition of Land sat imagery for the year 2000TM, 2010ETM+ and 2020OLI/TIRS from website of earth explorer (USGS). The reasons behind these years chosen was because of the year 2000 is the year before resettlement took place and the year 2020 is chosen to assess the current status of land use land cover through considering the impacts of population pressure as a result of resettlement. In order to achieve the stated research objectives, different data were collected from different sources and used during the course of the research works accordingly (Table 1).

Table 1: Details of Data sources and its descriptions

NO	Data category	Source	Description	Purpose
1	DEM	USGS	ASTER 30m Resolution	Topography Analysis
2	Land sat images(TM 2000, ETM+ 2010 and OLI/TIRS 2020)	USGS	30m, TM, ETM+ and OLI/TIRS resolution	For LULC change analysis
4	Socioeconomic data	Selected respondents	_	For validation

3.2.3. Software used

For the achievement of this study purpose, different software required is stated below in table 2 with their purpose.

Table 2: Software used for the study

No	Software's	Purpose
1	ArcGIS10.3	Analyzing and visualization of spatial data
2	ERDAS2015	For image classification
3	Google Earth pro	Use as a base map in visual image interpretation, and generate coordinate points for each image for LULC accuracy assessment

3.3.Method of data Analysis

The data collected via various methods of data collection instruments were analyzed, summarized, and presented through qualitative and quantitative methods. The spatial data were analyzed by using different software like Arc GIS 10.3 and ERDAS Imagine 2015. The cross tabulation in the spatial analyst module of the Arc GIS were employed to drive the change matrix. In addition to this, maps, figures and cross tabulations were used.

Regarding the data collected via questionnaire; the data collected through the aforementioned instruments was categorized and organized by theme according to their conceptual similarity. Then, the quantitative data was investigated using different descriptive statistical tools such as frequency count, percentage.

3.3.1 Socio economic data

Primary data was collected through household survey, Key Informant Interviews (KIIs) and direct field observation. Household survey was the main tool used to gather the necessary data from the target respondents. To undertake this survey an interview was held based on the semi-structured questionnaire designed for the study. Initially, the questionnaire was developed in English, and then it was translated into Afan Oromo language. Accordingly possible revision on the questionnaire could be pursued in such a way that both the respondents and interviewees can understand (Dechassa, 2002).

Key informant interviews were held during primary data collection. This was because to collect information from different angles especially data like LULC awareness issues and constraints of the program. The selected key informants were kebele leaders and woreda's agriculture and rural development office experts mainly these experts who participated during the program of resettlement.

Observation can be used as a supplementary technique to collect data and crosscheck the collected data by other means (Robson, 1995). It helps to gain a better grasp on impact of resettlement on land

use land cover and outcomes. In addition, the technique was used to triangulate information collected with other methods and/or obtained from different data sources. The observations were made in a field to take photos as a means of collecting primary information. Secondary Data Sources include reviewing of different relevant published and unpublished literatures of the specific study area and related studies of different areas in general was under taken almost throughout the course of the research period. Similarly, it gives an opportunity to observe realities directly in the research area. Therefore, in this study direct field observation was held by the researcher to observe the socio-economic as well as livelihood conditions of the settlers in the area under study. This method was applied to observe the various impacts of resettlement especially, its impact on land use land cover dynamics in Limu Seka district.

3.3.2 Sample size and sampling techniques

The population of this study comprises all resettlement in the Limu Seka District western region of Ethiopia. However, by considering the scarcity of time and cost, six kebeles from the study area were selected purposively, followed by the selection of household settlers, using a simple random sampling technique.

3.3.3 Sample size determination and methods of data collection

Data were collected through structured and semi-structured questionnaires with 240 household sample settlers and people lived near the settlement areas selected by simple random sampling method. Six kebeles were purposively selected 3 from settles and 3 from nearby population based on their accessibility. In total the number of households of the six kebeles was 4856. Therefore, total sample size required for the study and the sample size of each kebele were determined by the following formula at 95% degree of confidence, for population less than 10,000 Sudman, 1976).

$$n = \frac{(N/1)}{N\ (e)\ 2} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (8)$$

Where: n = total samples included in the study, N = total number of households of selected in six kebeles three from settlers and three from nearby= (4826), e = desired level of precision (0.05).

n = 4856/1 + 4856(0.05)2= 240

Were selected as total sample size for each site (ni) was determined as: ni = Nin/N where n = total calculated sample, ni = sample size of each selected site, N = total households in all selected sites, and Ni = households of each selected site. Therefore,

S/No	Local Site	Total Population	Sample size
1	GemtaTokuma	(1121×240)/4856	55
2	MaddaJalala	(843×240)/4856	42
3	Maribo	(833×240)/4856	41
4	Damme	(711×240)/4856	35
5	Algaa	(993×240)/4856	49
6	Qiltu Muja	(355×240)/4856	18
Total			240

Quantitative data: Frequency and percentage distributions were used to analyze various characteristics of the sample population such as personal information or demographic characteristics.

Qualitative data: The data collected using semi-structured interview, and open ended questionnaires was analyzed and interpreted qualitatively. .

3.3.4 Data pre-process

Image preprocessing which includes, layer stacking, and sub setting of the image based on the boundary of Limu Seka district was applied. All the mentioned activities are mainly to improve the interpretability of an image by increasing apparent distinction between the features in the scene. Remotely sensed data pre-processing techniques was employed using ERDAS IMAGINE 15 software. Image enhancement is the procedure applied to image data in order to make more effectively display or record the data for subsequent visual interpretation. The main purpose of image enhancement is to improve the interpretability of information in images for human viewers, or to provide better input for other automated image processing techniques (Anand, 2018).

3.3.5 Image classification

In remote sensing, image classification is the task of extracting information classes from a multiband raster image or extracting information based on the reflectance of the object and it serves specific aims; which is converting image data into thematic data. It is possible to assemble groups of similar pixels into classes that are associated with the informational categories of interest to users of remotely sensed data. These classes form regions on a map or an image (Campbell and Wynne, 2011). Image classification also used for land use/land cover mapping, there are main steps in classification processes, majors are finding proper training samples, selection of a class scheme suitable for the current region and classification theme, classification itself and post classification

with accuracy assessment (Bobrinskaya, 2012).

In order to achieve the objective of the study, surface features was classified as water body, settlement, vegetation, cultivated land, bare land and grassland. Classification of LU/LC types was done through supervised classification with maximum likelihood classification algorithm. ERDAS Imagine version 2015 software was used for classification, then land use/land cover polygons was made in Arc GIS 10.3 environment to extract and reclassify the LULC types of the area.

3.3.6 Accuracy Assessment

One of the most important final steps in classification process is accuracy assessment. The aim of accuracy assessment is to quantitatively assess how effectively the pixels are sampled into the correct land cover classes (Sophia *et al*., 2017). The accuracy is essentially measure of how many ground truth pixels were classified correctly. When looking at the land cover map, it is important to remember that no map is a perfect representation of reality. It is important to keep in mind that the map was most accurate for viewing geographic patterns over larger areas. The result of an accuracy assessment provides an overall accuracy of the map based on an average of the accuracies for each class in the map (Habtamu, 2011).

It is also desirable to calculate a measure of accuracy for the entire image across all classes present in the classified image. The collective accuracy of map for all the classes can be described using overall accuracy, which calculates the proportion of pixels correctly classified (Anand, 2018).

The overall accuracy is calculated as given below:

$$OAC = \frac{\Sigma Xij}{N} * 100 \quad \text{.....(2)}$$

$$UAC = \frac{Xii}{X_{+i}} * 100 \quad \text{.....(3)}$$

$$PAC = \frac{Xii}{X_{i+}} * 100 \quad \text{.....(4)}$$

$$Khat = \frac{(Obs - exp)}{(1 - Exp)} \quad \text{.....(5)}$$

Where: OAC= over all accuracy, K_{hat}=Kappa statistics,

UAC=user accuracy, X_{i+}= column total, and

PAC=producer accuracy, X_{ij}= diagonal values,

N= total number of samples, X_{+I} = row total and obs= (OAC),

Xii=number of categories, Exp =correct classification;

Google earth is used to check the accuracy assessment. The accuracy of classification was carried out by means of overlaying of the classified maps and the test samples. The image classification accuracy is further assessed by calculating Kappa coefficient k'.Kappa analysis generates a kappa coefficient or K_{hat} statistics, the values of which range between 0 and 1.***Kappa coefficient*** **(K_{hat})** is a measure of the agreement between two maps taking into account all elements of error matrix (Anand, 2018).

There is no common standardized consent for reference sample size determination. The minimum sample size for each LULC category necessary for 85% interpretation accuracy is set to 20 and for 90% accuracy to 30 (van Genderen and Lock, 1977). Therefore, by considering the size of study area and six LULC classes a minimum of 25 samples per LULC category and 150 samples were used. During the field survey, sample reference data positions were collected using GPS and cross checked with Google Earth.

3.3.7 Change detection

Change analyses are usually done to demonstrate the patterns of changes and to make useful decisions. After classification of images between the subsequent LULC periods were made. Conversion matrixes between 2000-2020 periods were also done to uncover the gains and losses of each LULC category between the periods, which was done using the GIS environment; additionally, the percent of change (Ebrahim and Mohamed, 2017) two periods is calculated as follows:

$$\text{Total LU/LC Gain/loss} = \text{Area of the final year} - \text{Area of the initial year} \quad \ldots\ldots\ldots\ldots (6)$$

$$\text{Percentage of LU/LC Gain/loss} = \frac{(\text{Area of the final year} - \text{Area of the initial year})}{\text{Total area of the study area}} * 100 \quad \ldots\ldots\ldots\ldots (7)$$

Land-use/land-cover change detection was performed by involving the images of 2000, 2010 and 2020 using GIS techniques. Post classification is among the most widely used approach for change detection purpose (Milkessa*et al.,* 2020). The analysis of LU/LCC maps involved technical procedures of integration using the Arc GIS software techniques.

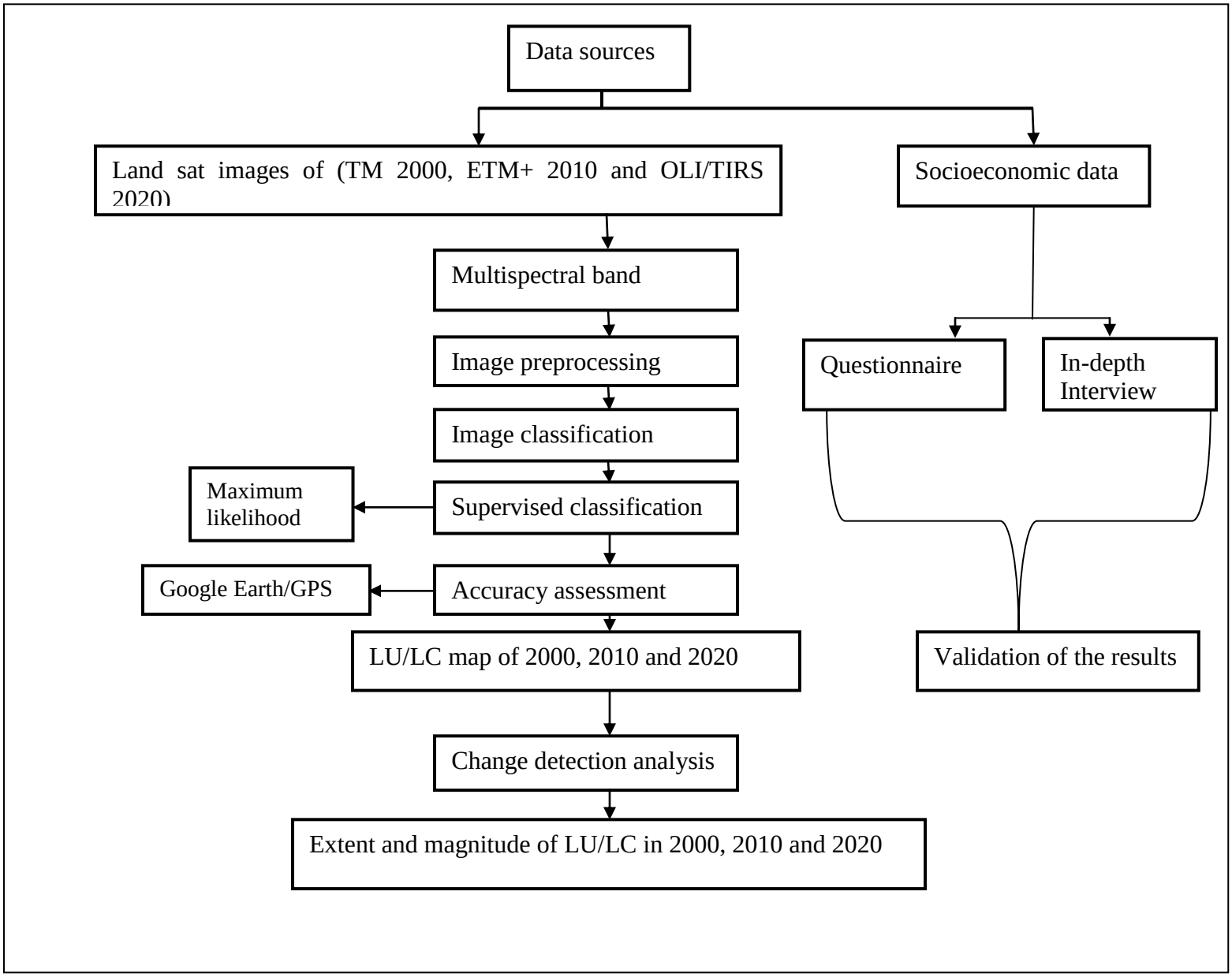

Figure 5: Flow diagram of the study

CHAPTER FOUR

4. RESULTS AND DISCUSSIONS

In this chapter, the researcher presents the analysis and discussion of collected data from both spatial and socio economic data. The study assessed that change in land use/land cover due to resettlement and the major findings of the study were analyzed and discussed in line with its objectives that lead to draw conclusion and recommendation.

Table: 3 Descriptions of land use/ land cover in the study area

LU/LC types	Descriptions
Grassland	Areas dominated by permanent grass cover with mixed bushes and small shrub which is used for grazing livestock usually owned by individual as well as communal.
Forest	Area covered with both natural and man- made forest.
Cultivated land	Areas of land that ploughed or prepared for crop production. The category includes areas currently under crop, fallow land and land prepared for planting.
Settlement	An area considered with different categories of human settlement and construction areas like building and town.
Bare land	The area that is currently free from any kind of LU/LC and degraded area.
Water body	Part of the earth's surface covered with water (such as river, stream and lakes)

Table 4: Areal extent of Land Use/Land Cover Change type of the study area

LU/LC types	2000		2010		2020	
	Area (ha)	Area (%)	Area (ha)	Area (%)	Area (ha)	Area (%)
Settlement	30.30	1.21	33.05	1.32	273.17	10.90
Cultivated land	680.23	27.13	781.07	31.16	1059.73	42.27
Forest	779.24	31.08	548.42	21.88	470.04	18.75
Grass land	922.23	36.79	1065.22	42.49	624.00	24.89
Bare land	34.16	1.36	37.34	1.49	42.14	1.68
Water body	60.91	2.43	41.95	1.67	37.97	1.51
Total	2507.05	100.00	2507.05	100.00	2507.05	100.00

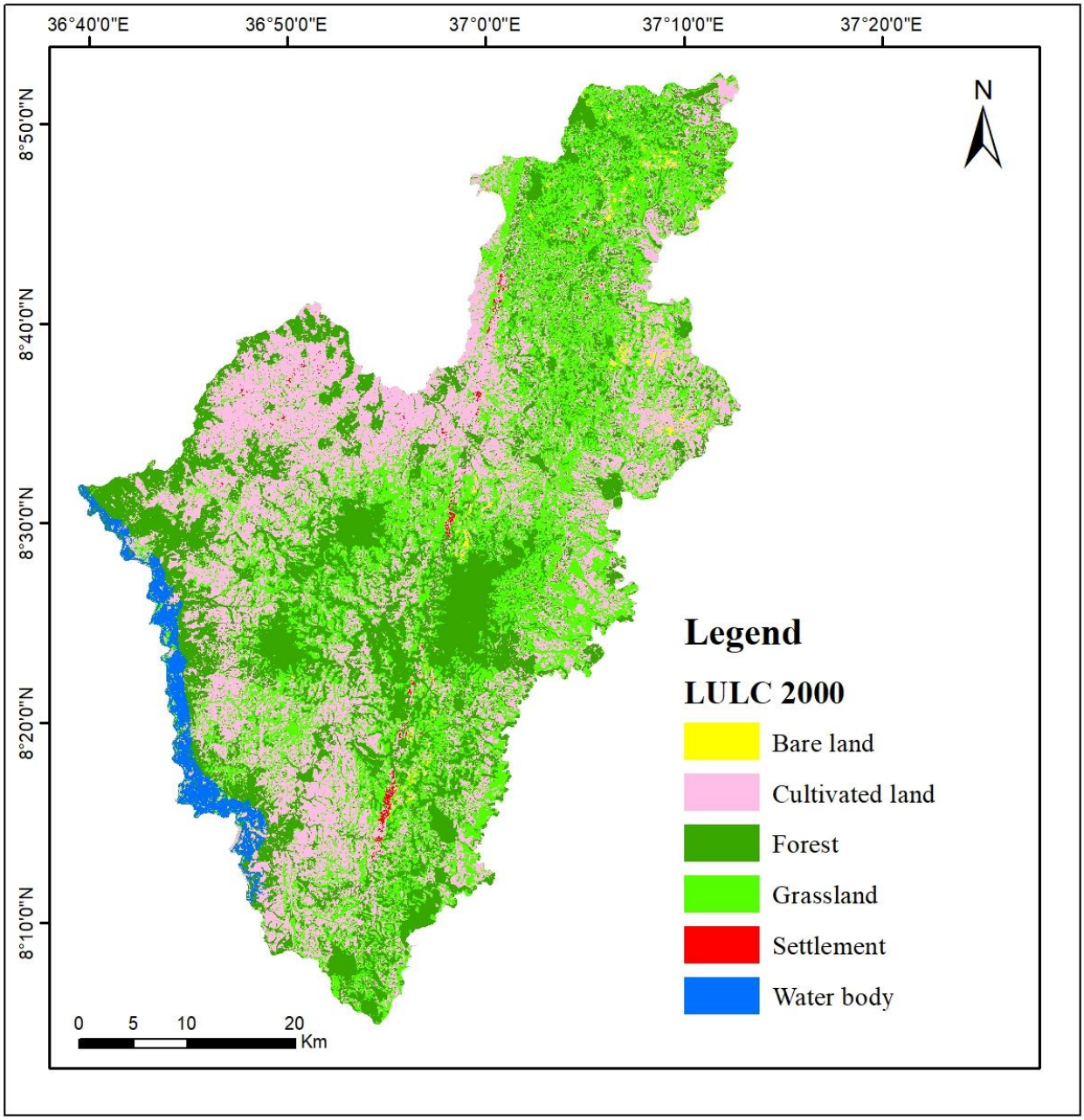

Figure 6: Land use/land cover map of the 2000

Land use and land cover of the study area were classified in to six classes these are settlement, grassland, farm/cultivated land, water body, forest and bare land. Among these land use/land covers grass land was the main land-use class with a total areas of 922.23km^2 (36.79%) then followed by forestland which accounts 779km^2(31.08%) the third largest share cultivated land 680.23km^2

(27.13%), water body, bare land and settlement all shared 60.91km^2 (2.43%), 34.16km^2 (1.36%), 30.3km2(1.21%) of the total area, respectively in the study area. This shows that 1,762.14 km^2(70.29%) of the total area of the district was covered by grassland, forest and water body in 2000 and the remaining 744.91km^2 (29.71%) was covered by cultivated land, bare land and settlement which shows that most of the area was covered by intact green vegetation in this period of the area. This clearly indicates that most of the area covered by green vegetation before the onset of resettlement. This result is in line with (Adane 2016).

Table 5: LU/LC map of the year 2000

LU/LC types	**2000**	
	Area (km^2)	Area (%)
Settlement	30.3	1.21
Cultivated land	680.23	27.13
Forest	779	31.08
Grass land	922.23	36 .79
Bare land	34.16	1.36
Water body	60.91	2.43
Total	2507.05	100

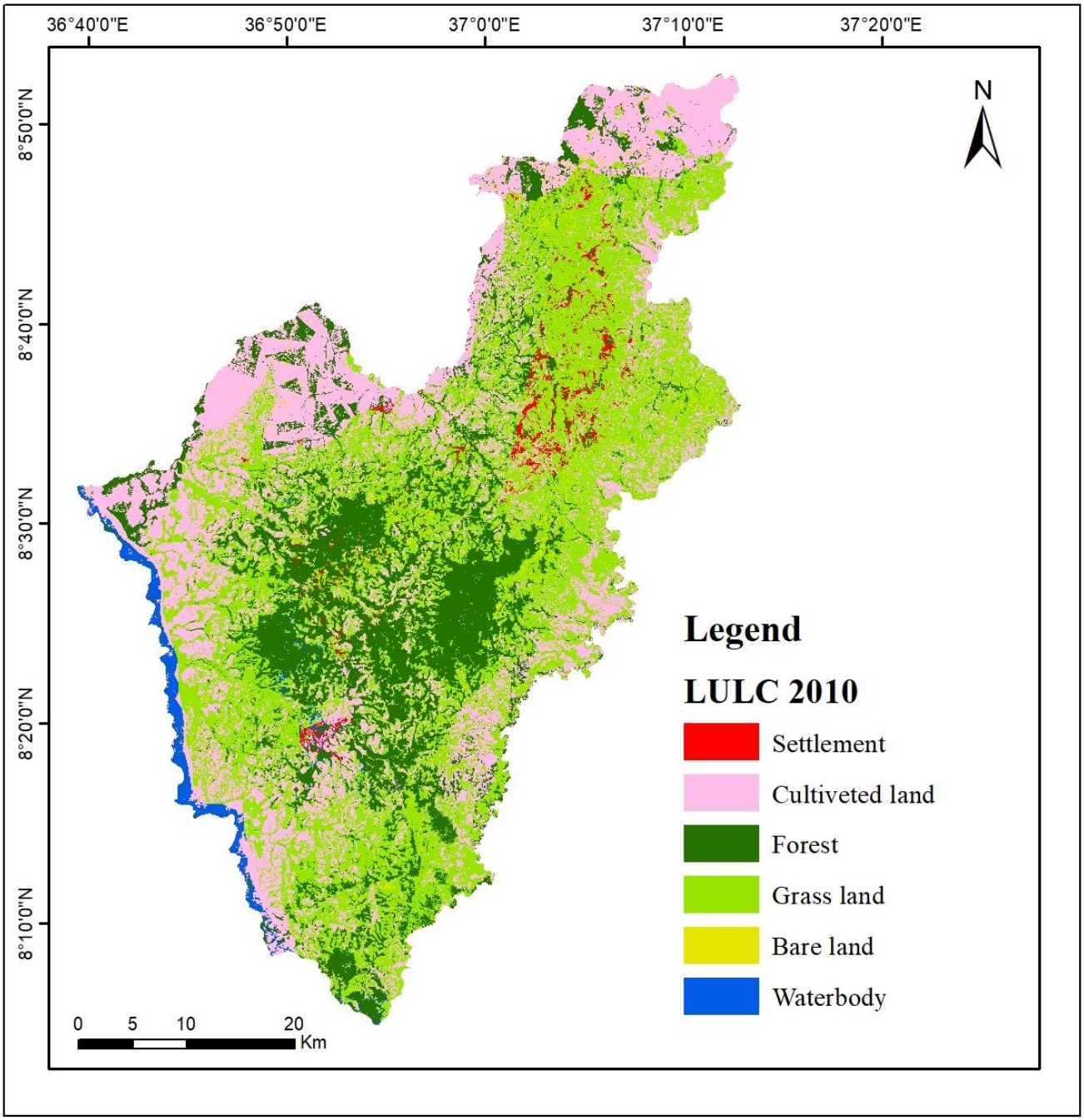

Figure 7: Land use/land cover map of the 2010

Land use land cover classification of the year 2010 from Land sat ETM+ 2010 shows that the majority of study area during that period was covered with grassland which accounts1065.22km^2 (42.49%) and secondly cultivated land 781.07km^2 (31.16 %) and of the total area, forest, water body, bare land and settlement accounts 548.42km^2 (21.88%), 41.95km^2 (1.67,%),37.34km^2(1.49%), 33.05km^2 (1.32%) of the total areas, respectively.

Table 6: LU/LC map of the year 2010

LU/LC types	2010	
	Area (km2)	Area (%)
Settlement	33.05	1.32
Cultivated land	781.07	31.16
Forest	548.42	21.88
Grass land	1065.22	42.49
Bare land	37.34	1.49
Water body	41.95	1.67
Total	2507.05	100

As shown in table 6 cultivated land gained 100.87 km^2or (4%) from different land types with in interval of ten years. The main influential factor to change land use land cover at that time was the recent onset of resettlement program on the study area, because majority of inhabitants in the district highly depend on agricultural activities.

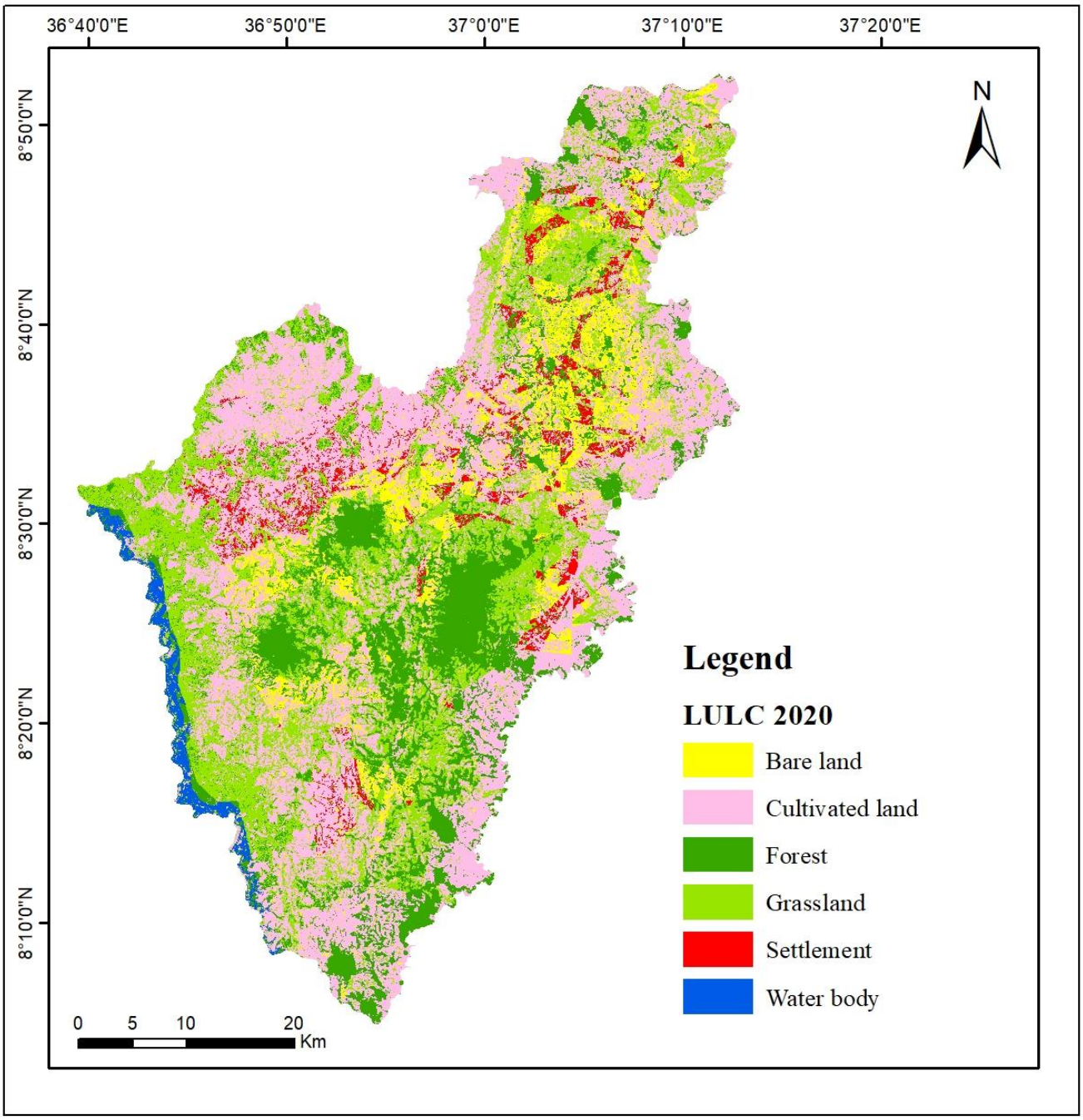

Figure 8: Land use/Land cover map of the 2020

Land use land cover classification of Limmu Seka district in the year 2020 from Land sat OLI/Operational Land Imagery indicated that cultivated land covered the major land areas which accounted 1059.73 km^2 (42.27%) and grassland secondly accounted624km^2 (24.89%) of the study area. Others forest, settlement, bare land and water body which accounts 470.04km^2 (18.75%), 273.17km^2(10.9%), 42.14km^2 (1.68%), 37.97 km^2 (1.51%) of the total area, respectively.

The land use/land cover classification of the area for the year 2020 cultivated land is rapidly increased because of resettlement as illustrated in (Figure 6 and Table 7). This result was a line with the result forwarded by (Feyisa,2016) reported that the decline of grassland and natural vegetation including forests, shrub lands and woodlands due to conversion to croplands, grazing lands, and settlements areas.

Table 7: LU/LC map of the year 2020

LU/LC types	**2020**	
	Area (km^2)	Area (%)
Settlement	273.17	10.9
Cultivated land	1059.73	42.27
Forest	470.04	18.75
Grass land	624	24.89
Bare land	42.14	1.68
Water body	37.97	1.51
Total	2507.05	100

According to (Warra, 2013) point out that agricultural and rural settlement land is the major cause of land use land cover change. This indicates that cultivated land covers the largest area in 2020 which shows the result from conversion of other land cover classes to farmland. Again settlement was also increasing continuously from 2000-2020 especially from 2004-2020 because of the onset of resettlement program in the study area.

4.1.1. Accuracy assessment of classified land use land cover

Classified LULC maps from remote sensed imageries may contain some errors. Therefore, accuracy assessment was employed to find out those errors so as to ensure reliability of the produced LULC maps. The classified maps were assessed and compared with a referenced data and ground truth using an error matrix. The overall accuracies for the three reference years 2000, 2010 and 2020 are 98.1%, 88.78% and 95.73% with the Kappa statistics of 0.89, 0.83 and 0.91, respectively. The Kappa statistics value greater than 0.80 (i.e., 80%) represents a strong agreement and a value between 0.60 and 0.80 represents a substantial agreement (Landis and Koch, 1977). Hence, the maps met the accuracy requirements for change detection analysis and there is a positive correlation between the remotely sensed classified samples and the reference data (Anderson et al., 1976).

Table 8: Error matrix of land use and land cover for 2000, 2010 and 2020

LU/LC class	2000		2010		2020	
	Producers Accuracy (%)	Users Accuracy (%)	Producers Accuracy (%)	Users Accuracy (%)	Producers Accuracy (%)	Users Accuracy (%)
Settlement	93.8	99.6	89.4	85.5	98.9	98.9
Forest	94.5	98.3	99.3	99.8	98.6	99.8
Cultivated Land	98.8	95.9	98.9	97.4	97.3	98.22
Water body	100	99.4	100	99.4	100	98.4
Bare land	99.5	99.5	43.2	97.2	92.6	98
Grass land	99.9	98.7	66.5	88.8	100	78.9
Overall Accuracy	98.1%,		88.78%		95.73%	
Kappa coefficient	0.89		0.83		0.91	

4.1.2. Land Use/land cover change detection

The change in areal coverage for each category is clearly visible on the maps (Figure 8). The result shows that there was a big change on cultivated land class. This shows that cultivated land class increased by about 15% of total land among different LU/LC types. This is mainly resulted from the expansion of agricultural land due to resettlement. The detail information of LU/LC change is presented in Table 7.This finding is in agreement with a number of studies. For instance; (Degefa, 2019) pointed out that the major land use/land cover converted in to cultivated land mainly for the expansion of land for agricultural farmland.

Table 9: LU/LC change between the year 2000 to 2020

LU/LC types	2000-2010		2010-2020		2000-2020	
	Area km^2)	Area (%)	Area(km^2)	Area (%)	Area (km^2)	Area (%)
Settlement	2.76	0.11	240.12	9.58	242.87	9.69
Cultivated land	100.84	4.03	278.66	11.11	379.50	15.14
Forest	-231.12	-9.20	-78.38	-3.13	-309.20	-12.33
Grass land	112.99	5.70	-441.22	-17.60	-298.23	-11.90
Bare land	3.18	0.13	4.80	0.19	7.98	0.32
Water body	-18.95	-0.76	-3.98	-0.16	-22.94	-0.92

The land use/land cover map of the years under investigation shows that cultivated land was the most dominant land use/land covers classes during the year 2000 to 2020. Even if several changes appear during the two decades of the study period, the major change was occurred on loss of forest, grassland and water body. The total extent or composition of individual LULC classes and their dynamics is presented in Table 9.

As presented in table 7, during the years between 2000 and 2020 the total areas of cultivated land and settlement increased by (+15% and +9.69%) while forest, grassland and water body are decreased by (-12.33), (-11.9) and (-0.92), respectively (Figure 8).This leads to decreasing of forest coverage and grassland. This result is in agreement with (Abel and Tesfaye, 2020).

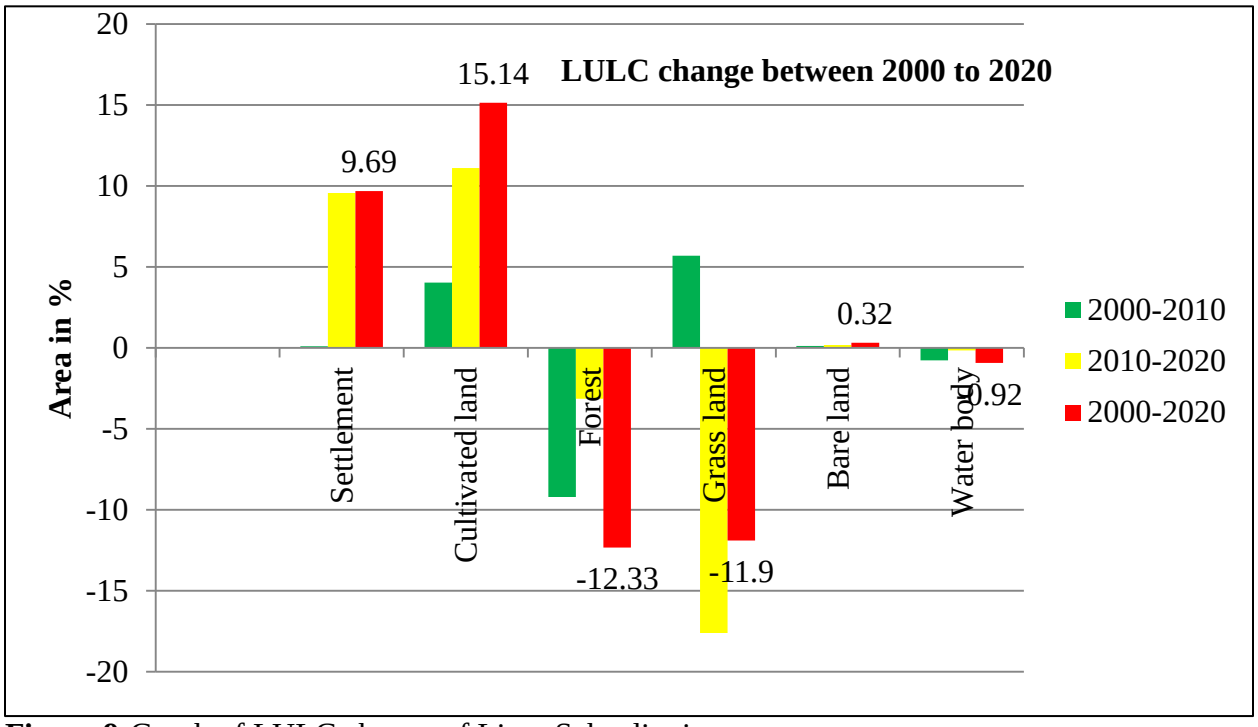

Figure 9: Graph of LULC change of Limu Seka district

4.2.Conversion of land use/land cover types

In this study, Land Use Transfer Matrix (LUTM) and post classification method were used to detect land use/land cover change from 2000 to 2020 (Figure 10). The LUTM method is derived from the quantitative description of state transition system analysis. Land use land cover matrix was produced by overlaying two land use land cover maps of the same area but different year to show the probability that one particular land use land cover category changed in to other land cover category. It is used to predict the likely possible change between different particular states. In this study, from initial to final year transitional land cover matrixes were produced for each three periods of the studies in which column stands for the initial state of land use land cover categories and the row stand for the final state of land use land cover categories. The finding from land use land cover matrix shows that the two LU/LC types that changed positively are settlement and cultivated areas.

Table 10: Land-use/land-cover change matrix of the year 2000 and 2010in km^2

		2010						
	LULC Types	Settlement	Cultivated land	Forest	Grass land	Bare land	Water body	Total
2000	Settlement	0.05	13.7	0.82	14.53	1.19	0.01	30.29
	Cultivated land	4.48	420.55	49.01	394.3	11.87	5.7	885.9
	Forest land	13.2	92.08	378.05	131.22	2.84	3.87	621.26
	Grassland	15.28	208.37	117.63	450.34	12.45	7.54	811.61
	Bare land	0.05	26.24	1.26	61.65	8.97	0	98.17
	Water body	0.01	20.52	1.59	12.98	0.01	24.71	59.83
	Total	33.06	781.46	548.35	1065.03	37.33	41.83	2507.05

As the land use/land cover matrix indicated in Table 10, about 92.08$km^2$of forestland and 208.37$km^2$of grassland in 2000 were converted in to cultivated areas in 2010. The largest percentage share of land conversion from one type to another is the conversion of grassland into cultivated land i.e. cultivated land class gained about 360.91$km^2$from that of different land use land cover. This result is in line with (Bewket and Teferi, 2009).

Table 11: Land-use/land-cover change matrix of the year 2010 and 2020 in km^2

		2020						
	LULC Types	Settlement	Cultivated land	Forest	Grass land	Bare land	Water body	Total
2010	Settlement	11.46	5.15	11.10	4.12	0.07	0.01	31.91
	Cultivated land	32.55	684.14	74.95	159.48	19.48	10.85	781.46
	Forest	45.10	61.86	301.54	137.89	1.36	1.67	549.43
	Grassland	179.02	187.21	77.19	300.98	18.77	1.88	1065.05
	Bare land	4.44	34.65	2.09	14.71	1.47	0.00	37.36
	Water body	1.59	6.36	3.69	6.69	0.01	23.49	41.83
	Total	274.17	1059.36	470.56	623.88	41.17	37.91	2507.05

The land use/land cover matrix indicated in Table 11 shows that the settlement area gained about 45.10$km^2$and 179.02$km^2$of extra land from forest land and grassland, respectively. This finding is in agreement with several studies. For instance; (Seid, 2007) pointed out that the major land use land

cover converted in to built-up areas is vegetation cover and cultivated lands. In addition 61.86km^2 of forest land and 187.21km^2 of grassland converted to cultivated land. Generally with in aten years interval settlement and cultivated land expanded from1.32-10.9 and 31.6-42.27 percent, respectively.

Table 3: Land-use/land-cover change matrix of the year 2000 and 2020 in km^2

LU/LC Types		**2020**						
		Settlement	Cultivated land	Forest	Grassland	Bare land	Water body	Total
2000	Settlement	0.90	0.35	0.01	0.06	29.88	0.00	31.21
	Cultivated land	0.29	876.77	1.28	7.49	0.29	0.01	886.13
	Forest	2.18	7.33	459.16	199.53	10.85	0.03	679.07
	Grassland	270.00	172.44	3.43	305.57	0.10	0.05	751.58
	Bare land	0.03	42.57	0.90	95.53	0.02	0.04	99.09
	Water body	0.15	0.07	7.05	15.68	0.02	36.99	59.96
	Total	273.55	1059.52	471.83	623.85	41.16	37.12	2507.05

The current resettles' livelihood strategies are found to be crucial driving force for the existing rapid land use/land cover changes. Agricultural activities and firewood/charcoal production are among such fundamental conversion forces. The farmers are currently alarmingly converting the land into plots of farmlands in order to increase their crop output and cope with the problems of food shortfalls. The combined effect of these factors certainly results in rapid conversion and/or modification of the district's LU/LC. The rate of change for the two periods from 2000 to 2020 indicates that the trend of sub-villegization is more and more increasing. The two largest percentage share of land conversion from one type to another are grassland270.00 and 172.44Km^2 and forest covers 2.18 and 7.33Km^{2}in to settlement areas and cultivated land. This finding is in agreement with several studies. For instance; (Kumar *et al.,* 2014) and (Redman ad Jones, 2011) indicates that the process of rapid villegization takes place in developing countries significantly contributes to bringing opportunities to new urban developments. This results in line with previous results by author (Bekele, 2017and Matamyo*et al.*, 2019).

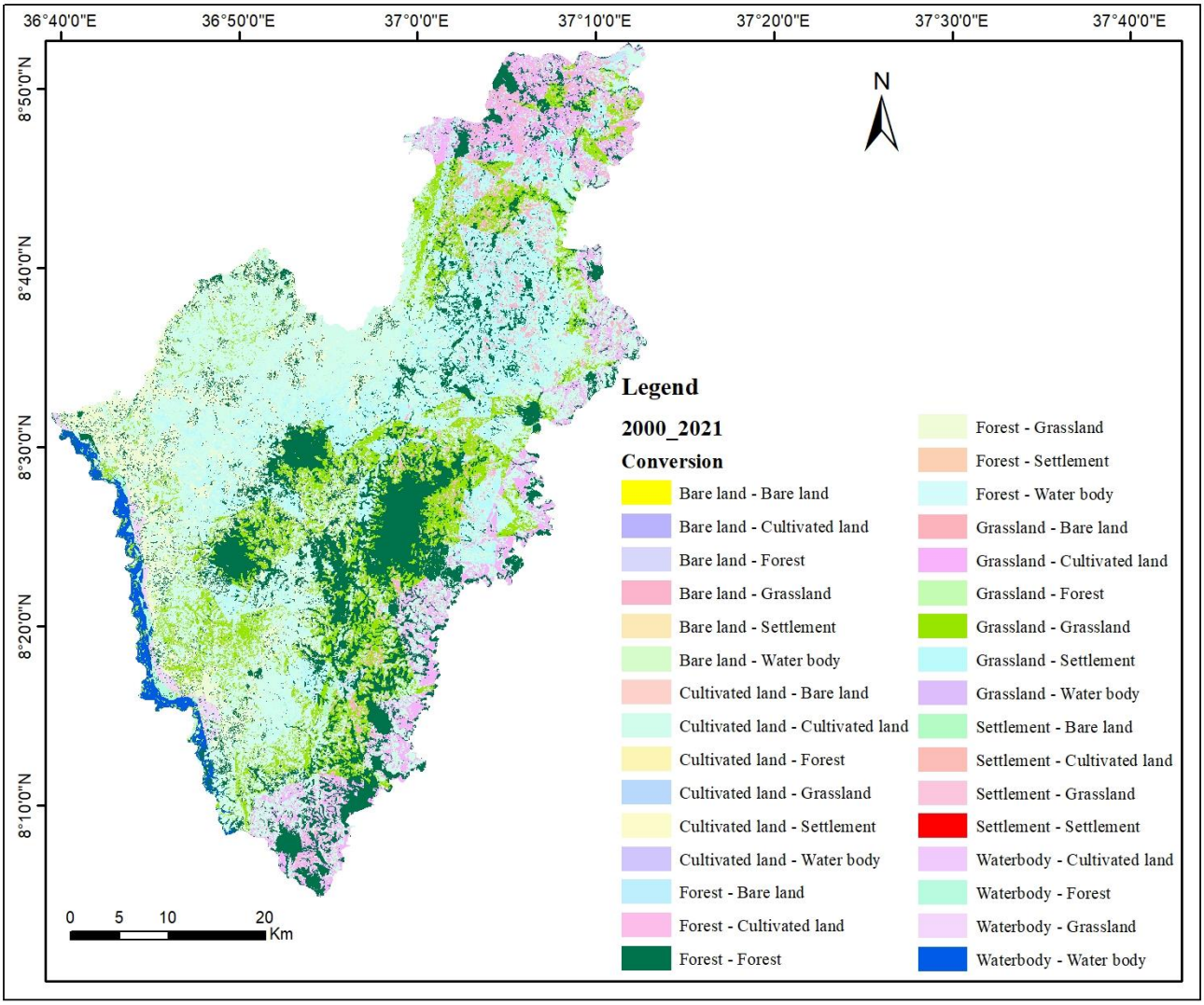

Figure 10: Land use/ Land cover conversion from 2000 to 2020

4.3.Socio economic data

4.3.1 Local people's insight on the impacts of land use/land cover changes

4.3.2 Background of the respondents

Gender: More than half percent of the total respondents 59.2% were male; whereas 40.8% were female.

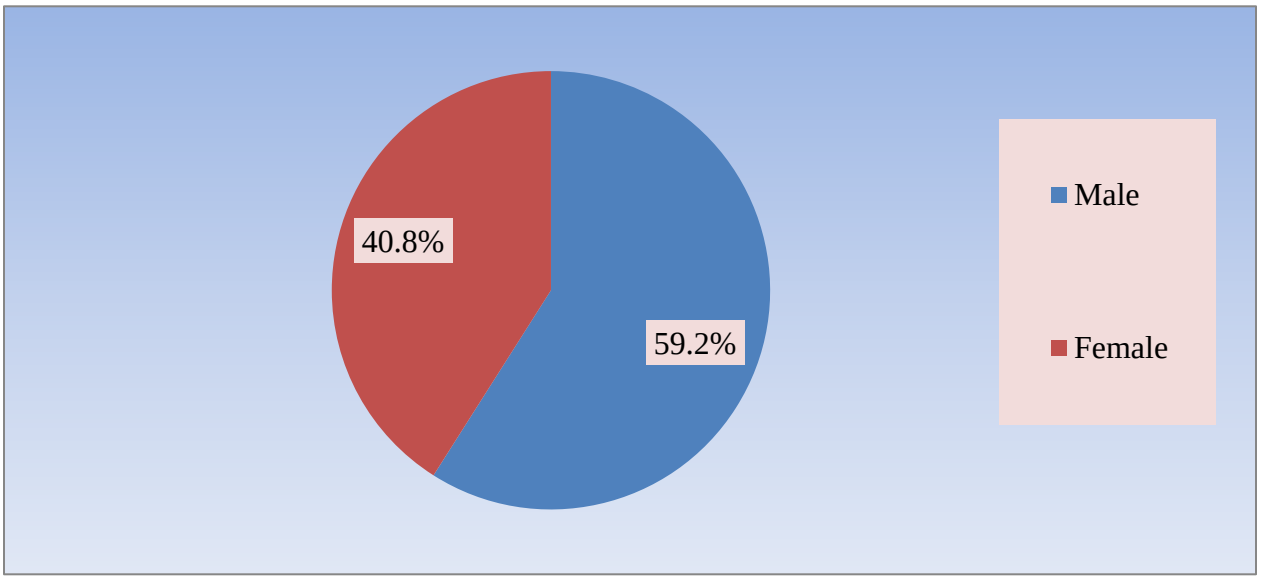

Figure 11: Gender of Respondents.

Table 4: Marital Status of the respondents

Marital status of the respondents: The marital status of respondents in the study area indicated that 164 (68.3%) of them were married, whereas, 62 (25.8%) are single. The rest 14 (5.8%) respondents were divorced. From the result, it can be concluded that marital status could determine the status of land use/land cover (Table13). According to the view of the respondents, the large the family size, the more the expansion of agricultural land through clearing vegetation cover is highly observed.

Marital Status	Frequency	Percent
Single	62	25.8
Married	164	68.3
Divorce	14	5.8
Total	240	100

Educational background: Regarding the educational attainment of the selected respondents, 47.9%, 31.4%, 9.9%, 9.1 and 1.7% have completed their elementary, secondary, no schooling, college diploma; degree and above, respectively. When we look at the educational attainment of each stratum the attainment of the households, nearly half percent i.e., 47.9% of them were Elementary or 8th grade completed. This implies that they could able to give detail and relevant information about the impact of resettlement on land use/land cover.

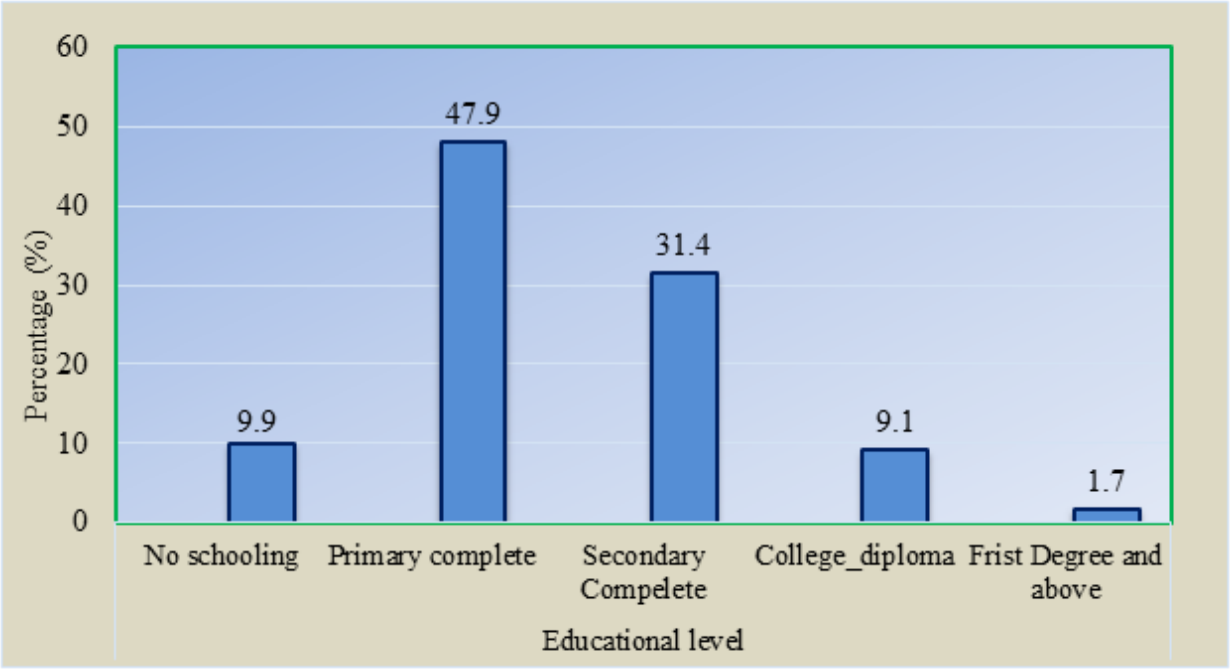

Figure 14: Educational back ground of the respondents

Table 15: Age group of respondents

Age	Frequency	Percent
18-30	58	24.2
31-45	114	47.5
45-60	58	24.2
>60	10	4.16
Total	240	100

Table above shows that about 114 **(**47.5%) of the house hold respondents were with in age group of 31-45 years followed by those in the age group of 18-30 and 45-60, 116 (48.34%) and 10 (4.16%), respectively. One can understand from this result that the majority of the households lie between the productive age groups who have a great potential in production activities.

For two hundred and forty (240) respondents questionnaires were administered to 59.2% and 40.8% of men and women, respectively spread across the age range of 18 to>60 years to give such vital information about the community in the study area. According to their opinion, changes in land use patterns are caused by different factors including improved sources of income in the study area. According to personal observation and respondents' response, the major impacts of resettlement on land use/land cover in the study area were as follows.

4.3.2 Impacts on local people's income

As explained by the selected respondents, the continuous declining of forest cover caused scarcity of wood for fuel and other construction materials. As a result, income obtained from the selling of wood and wood products declined. In the same way, the largest portion of vegetation cover has changed into cultivated land; due to this income from forest product became highly decreased in the study area. As a result, people of the study areas who were previously depend in selling of fire wood and charcoal making slowly changes their livelihood to daily laborer and in some cases to off farm activities such as extracting sands, poultry and fattening of animals, like Oxen and Goats. Furthermore, resettles attempt to produce various kinds of perennial crops including banana, orange, mango, and avocado, coffee, chat, and eucalyptus trees. The perennial crops cover paramount proportion of the area occupied by the individual farms. This is because most of them disposed to cover their farmlands by temporary crops, rather than perennial ones, in order to fulfill their food requirements.

According to Aklilu (2006), production and sale of charcoal and fire wood are notably important, but 'illegal' and environmentally devastative source of livelihood. Moreover, several re-settler households in the district had partly lived on Productive Safety Net Program (PSNP). This program is one of the giant government programs to deliver social transfers to the poor farming households through public environmental protection works or as a direct support for households that are labor-constrained. As noted in Devereux and Guenther (2007), PSNP in Ethiopia, the program aimed at smoothening food consumption, protecting household property and building community assets.

4.3.3 Scarcity of firewood

Participants of the selected respondents' explained that the destruction of the land use land cover classes has negatively affected their benefit obtained from the natural resources. One of these effects is scarcity of fire wood and different construction materials. This effect is particularly serious in the low-income households whose livelihood is directly related to the collection of fire wood and

production of charcoal for both their consumption and source of income through selling to the residents of the nearby towns. As a result, in particular rural women have been forced to walk long distance for fire wood collection especially this one was occurred before 3-4 years after the clearance of forest for sugar factory. This reduces the time available for farming and household activities. Moreover, the scarcity increased the price of available firewood to the point where there is no longer affordable for some households including in the nearby towns. This situation caused many households to turn to animal dung and crop residues as alternative source of fuel. However, the removal of biomass from fields in turn reduced the organic matter being added to the soil, which would other wise have improved the soil structure and soil fertility.

This finding is in agreement with a number of studies. For instance; (Meyer and Turner, 1995; Bezyayehu, 2008; and Mohammed, 2011) pointed out that resettlement critically affect agriculture and agricultural productivity as one of the major source of food insecurity in developing countries such as Ethiopia. Similarly, the shortage of construction materials forced households' to depend largely on less durable and easily affected *Eucalyptus* trees for house construction and agricultural tools.

4.3.4 Impact on vegetation cover

As population size increased from time to time in Limu Seka district, the needs for agricultural land was also increased due to the majority of District's populations are earning their life in agricultural activities. According to the key informants, due to absence of clear forest tenure system the forest trees of the natural vegetation were indiscriminately destroyed. As a result, indigenous trees such *as Juniperousprocera*, *Millettiaferuguneaand Ximeniaameriicana*which were once occupying the area are on the way to disappear. As a result local people are highly encountered with grazing problem in the study area (Plate 1).Animal rearing is also practiced mixed with crop cultivation in *Limu Seka District*. Domestic animals such as cattle, goat, sheep, donkey, chicken, and bees are kept on traditional basis. This subsector was providing the community with milk, butter, hides and skins, honey, and traction and transportation powers. It also serves as a means of security against crop failure. According to the key informants and personal observation, natural vegetation was cleared and became bare land; as a result, local communities are seriously affected with lack of grazing areas which is becoming cause of their conflict in the study area.

Plate 1: Partial view of the overgrazed area (due to the clearance of natural vegetation in the study area)

In many parts of the study area indigenous trees are replaced by exotic trees like eucalyptus. As it was explained by the key informants, the decline of forest cover caused a decline in the number of wild animals. For instance, animals such as tiger, lion and antelope which were commonly found in the watershed before 25 years ago disappeared. Thus the conversion of forest land to other type of land use leads negative impacts on the ecosystem as well as the livelihood of the society in the study area.

The result from this study particularly responses from key informants clearly reveals that in Limu Seka District there were bare and grass lands that have been considered as a common property among the people of different kebeles. But, no one has used it for cultivation, for forestation or for settlement in the district before a year. But now, the situation was already changed. As key informants observed, the bare land and grassland is converted to cultivation land due to population growth. However, these lands were used by individuals and illegal settlers by their own initiation mostly by youth `without getting any permission from authoritarian body. This finding is line with (Solomon, 2016) that population growth also increases the demand for livestock products and therefore leads to increased livestock numbers, causing overgrazing and consumption for crop residues by animals.

The other factors are illegal settlement came to this area using their relatives with legally resettled in 1985 from northern part of the country (Welo) and 2004 settlers from West and East Hararge Zone come to this area based on their interest without any permission of the local government was one chronic causes of wide spread cause of land use land cover change in the area. As key informants

stated conflict has been recurrently out breaking among former settlers and the home-grown on land use. This conflict leads to a lot of people to lose their life and others were fled to the north part because of the conflict over land and other natural resources especially in the boundary of Dame and Buludo. Additionally according to LSWARDO before three –four years (2009-2011) Arjo- Didesa sugar factory crossing the Didesa river and expanded its territory to plant sugar cane due to this purpose the forest of the study area cleared by youths legally organized to use for different purposes example, charcoal making, for fuel wood, house construction, and for different furniture purpose on other ways this is another major effects/deriving forces of LULCC in this area on the other hand most resettles settled in this place the sugar factory paid land compensation to those people during that time. Resettles who take this payment after leaving their place they can use different lands legally and illegally by distributing in different corners of the district this is another impact of resettlement on LULCC in study area.

4.3.5 Positive impact of resettlement

According to key informant response the positive impact of resettlement in local community is increasing in human settlement had brought about different social factor opportunities these are fattening livestock, planting a good species of chat, soybean, sesame, groundnut, sorghum (Harermashila), market, specially the opening of schools in different kebeles, health centers, building of roads, example Koma to Maribo 32 km gravel road are some advantages for the host communities after the onset of resettlement program.

4.4 Respondents response on justification for LULCC change

Table 5: Percentage distribution of respondents on justification for LULCC change due to resettlement

LU/LC Change	Increased	Percent	Decreased	Percent	No change	Percent
Chang in cultivated land	196	81.6	13	5.41	31	12.9
Change in forest land	17	7	164	68.3	59	24.6
Change in water body	35	14.6	164	68.3	41	17
Change in grass land	20	8.3	191	79.6	29	12
Change in bare land	92	38.3	136	56.7	12	5
Change in Settlement	227	94.6	-	-	13	5.4

According to the respondents' response on land use land cover change on their area, the largest share 94.6 percent of the respondents replied that there is land use land cover change due to settlement while only 5.4% stated that there is no change as such. The next largest share of LULCC is 79.6 % and 68.3 % decreased in forest land and water surface respectively. When we compare this result with satellite image analysis, the trend of change is similar. The increasing of cultivation land in terms of areal coverage other land use land cover change units have been converted to agricultural lands which are the clear indicator of population increase due to resettlement program. Due to ever increasing of cultivated lands farmers exert pressure on forest and grass lands it leads to land use land cover change.

4.4.1 **Causes of land use land cover change**

Table 6: Percentage distribution of respondents on causes of land use/land covers change

Cause for change	Number	Percent
Population growth	166	69.16
Land tenure insecurity	42	17.5
Lack of proper management	21	10
Improved access to basic infrastructure	11	4.6
Total	240	100

According to table 15 above the causes of land use land cover change, 69% of the respondents confirmed that population increase is the cause for the change followed by17.% land tenure insecurity and10% lack of proper management the rest 4.6 % improved access to basic social infrastructure. Furthermore, the finding is in agreement with Ebrahim and Mohammed (2017) high light that population increase poses a formidable impact on land resources due to the rising need for agricultural lands, settlements, energy consumption and building materials.

Table 7: Percentage distribution of respondents on the effect of land use/land covers change

Effect of land use/land cover change	Number	Percent
Soil erosion	76	31.7
Degradation of water shade	56	23.4
Deforestation	103	42.9
Increase waste land	5	2
Total	240	100

The respondents were asked to identify the environmental problems which are common in their localities following the land use/land cover change. Accordingly table 15 indicates that out of the total respondents who stated that deforestation is the common effect on land use land cover change and constitute 42.9% followed by 31.7 % respondents understanding that the effect is soil erosion, degradation of water shade and increased in waste land respectively constitute 23.4 and 2 percent. The change in LULC has negative impact on natural environment and cultural landscape such as Loss of plants and animals' species, increase waste land due to deforestation, land degradation, hydrological impact, surface runoff, and poverty and socio economic conflict among local communities. These can affect significantly food security and rural livelihood system in Limmu Seka woreda.

Table **8**: Percentage distribution of respondents on the cause of soil erosion

Cause for soil erosion	Number	Percent
Land fragmentation	52	21.7
Absence of fallowing	99	41.3
Overgrazing	89	37
Total	240	100

The respondents were asked to identify the causes separately for their choice on the effects of the land use/land cover change. Table 4.15 indicates that out of the respondents who stated that soil erosion is the main cause of LULC change. About 41.25 percentages of the respondents are replied that absence of fallowing followed by 37% over grazing and the rest 21.7% land fragmentation. Due to rapid settlement expansion, agricultural extension and other factors had increased shortage of land cover resources are causes of land fragmentation, absence of fallowing, and overgrazing removal of forest cover leads to soil erosion.

Table 9: Percentage distribution of respondents on resettlement cause of deforestation

Cause of deforestation	Number	Percentage
Expansion of agriculture onto forest areas	126	52.5
An increasing demand for firewood	46	19.1
Cutting of trees for construction	40	16.6
Cutting of trees to generate income	28	11.6
Total	240	100

As it is true in most developing countries including Ethiopia, the most dominant factor for the deforestation is expansion of agricultural land and responded by 52.5 % of the total respondents followed by increasing demand for firewood 19.1% and construction covers 16.6% respectively. The effect of settlement expansion leads to new farm land this resulted an expansion of agriculture onto forest areas. In the study area in order to fulfill the timely demand for themselves and their families requirement some farmers both hosts and Resettlers were engaged in cutting and selling wood and wood products illegally as a means of generate income. This is in line with what Kurimoto (2005) also stated that resettlement program establishing during the previous and current regimes are the deriving phenomena to deforestation which have brought about adverse effects on land use land cover changes.

Table: 19 Percentage of major house holds' source of energy

Source of energy	Number	Percent
Fuel wood	176	73.3
Kerosene	-	-
Biogas	22	9.2
Other	42	16.8
Total	240	100

The table above clearly indicates that almost all of the households energy source is fuel wood mostly emanated from nearby forest lands and only 9.2% of the household's energy source is biogas which is introduced recently in the District general and sample kebeles in particular. Fuel wood is the major means of energy for cooking; no one reported that kerosene as a source of energy. This activity shows that depend on forest product for fuel wood it leads to deforestation.

Table 10: Percentagedistribution of respondents for land productivity status

Land productivity status	Number	Percent
Increased	46	19.2
Decreased	171	71.25
No change	23	9.6
Total	240	100

The survey conducted also includes the productivity of their farm in comparison with 16 years before. 71.25%, percent of the respondents confirmed that there is decrease in land productivity while 19.2.1 and 9.6 percent replied increase and no change respectively.

Table 11: Percentage distribution of respondents on land improvement measure

Land Improvement measure	Number	Percent
Yes	129	53.75
No	111	46.25
Total	240	100

During the survey, respondents were asked whether they invest on land improvement measure or not, according to Table 19, 53.75 percent of the respondents said that they do invest on their land while the rest 46.25% said they do not.

Table 12: Percentage distribution of respondents' reason on the failure to invest on land

Reason for not investing on land	Number	Percent
My income does not allow me to do so	53	47.3
Land tenure insecurity	41	36.9
Other	17	15.3
Total	111	100

111 of the respondents who replied that they did not invest on land improvement measures, 47.3% of them told their income are not sufficient to invest on their land and 36.9%t replied that land tenure insecurity is their major problem.

Table 13: Distribution of respondents who participated in conservation activities

Conservation activity	Number	Percent
Terracing	35	27.13
Contour ploughing	55	42.63
Traditional ditches	39	30.3
Total	129	100.0

For the rest of the respondents (129) who replied that they invest on their land, detail question were asked to identify which type of land improvement measures they had applied. Majority of respondents i.e., 42.63 % of them were using their land through contour ploughing, traditional ditches followed by those using terracing accounted for 27.13%.

4.4 Results from socio economic data

Land use land cover change is the core concept in setting strategies for natural resource management and to pinpoint the impact of environmental change. As James, (2001) stated that land cover can be generally classified in to urban, agricultural land, range land, forest land, water; wetland, Barren land, Tundra and perennial snow or Ice. These types of land cover can be changed from one to another due to the human activities specially resettlement and natural phenomenon. The land cover in Limmu Seka *woreda*is evolved from one land cover to the other by the impact from human activities. The study identified six major land use land cover change which were influenced by the people in the *woreda*. These classified land use land cover change are: Cultivated land, forestland, grassland, settlement, bare land and water body.

Causes of LU/LC changes in the resettlement sites

According to the views of the main causes of LU/LCC in Limu Seka district are population pressure, expansion of agricultural land, demand for fuel wood, charcoal making and construction materials. The discussions here in before indicate that resettlement facing rapid LULC changes at present. Enormous extents of vegetated land uses (shrub-grassland and grassland) were converted to farmlands and settlement areas due to resettlement program in study area. However, expansion of farmlands and establishment of settlement sites devastated natural plants accelerating the LULC intensifies the conversion and/or modification processes of the land use types. They may be forced to encroach into vegetated lands for cropping, grazing, and settlement. Similar to some tropical countries of the world rapid population growth, agricultural land expansion, and fuel wood and forest encroachment was the major driving force for land cover dynamics in Ethiopia (Kebrom, 2000). In this regard land cover is highly changed especially in developing countries which have agriculture based economy and rapidly increasing population.

LULCC in the study area is facilitated by different causative factors which may lead to environmental problems in one way or another LULCC is the result of population increase in the study area mostly due to resettlement .The analysis result both spatial and socio economic shows that most land use land cover change is cultivated land because of most of the host and resettles livelihood is depend on agriculture .Almost 94.6 percent of the respondents agreed that there is land use land cover change due to settlement. As explained by the selected respondents especially these activities leads to the declining of forest cover caused scarcity of wood for fuel and other construction materials this affects, the life of people depend on income obtained from the selling of wood and wood products in the study area. The other one is lack/ absence/ of clear forest tenure system leads to indiscriminately

destroy the forest trees of the natural vegetation. As a result, indigenous trees such *as Juniperousprocera, Millettiaferuguneaand Ximeniaameriicana* which were once occupying the area are on the way to disappear. The destruction of forest cover caused a decline in the number of wild animals. For instance, animals such as tiger, lion and antelope which were commonly found in the watershed before 25 years ago disappeared.

The other factor that identified from key informant is competition on land especially former common property of bare land and grazing land currently used by youths and illegal settlers in illegal way is on one hand leads to conflict in the study area and on the other hand leads to lack of grazing land in the study area is the other element of land use land cover change. Since, the majority of the population in the study area depends on agriculture i.e. mixed with rearing, fattening animals etc.

More than 52%, 73 %, and 71 % respondents respectively replied that expansion of agriculture onto forest areas; fuel wood consumption and decreasing of land productivity were the major effects of land use land cover change in the study areas.

The last issue discussed was community participation on land improvement measure according to the respondents' response 53.75% of them participated in conservation activity while 46.25 % did not invest on land improvement system this shows that still it needs public awareness on land use land cover in general and land improvement measure in particular. This result is in line with (Sahlu, 2004).

CHAPTER FIVE

5 CONCLUSIONS AND RECOMMENDATIONS

5.3 Conclusions

Consecutive satellite images and GIS technologies, in combination with field observations, have been used to examine the impact of resettlement on LU/LC dynamics in the district of Limu Seka Southwestern Ethiopia. For this reason the satellite image of study area from the year 2000TM, 2010 ETM+, and OLI 2020 was down loaded and classified by using supervised maximum likelihood classification technique. Generally six land use land cover classes were identified these are forest, grassland, bare land, settlement, cultivated land and water body. The accuracy of the three years of image was checked by calculating producer accuracy, user accuracy, over all accuracy and kappa co efficient. The study revealed that both LU/LC conversion and modification processes mainly attributed to the loss of forest in the study area. Grassland and forest cover were found to be the most shrinking land use type in the area. It was reduced from 922.23-624.00 and 779.24- 470.04 km^2 respectively. This change involved a gradual modification of the grassland to grassland or conversion to farmland. A significant conversion from natural vegetation cover to Grass land and settlement area was observed more profoundly between 2000 and 2020 by the time the cultivated land expanded from 680.23km^2 (27.13%) to 1059.73km^2 (42.27%).

Communal grazing and bare land used as source of animal feed before re settlement was using by illegal settlers and host youths was changed to cropland. A continuous declining of forest cover caused scarcity of wood for fuel and construction material. As a result, income obtained from the selling of wood and wood products declined. In the same way, the largest portion of vegetation cover has changed into agricultural land; due to this income from forest product became disappeared in the study area. The largest share 94.6 percent of the respondents replied that there is land use land cover change due to settlement. Others 79.6 % and 68.3 % agreed that decreased in forest land and water surface respectively. Due to absence of clear forest tenure system the forest trees of the natural vegetation were indiscriminately destroyed. As a result, indigenous trees such as *Juniperous*procera, *Millettia*ferugunea and *Ximenia*ameriicana which were once occupying the area are on the way to disappear. As a result local people are highly encountered with grazing problem in the study area.

5.3 Recommendations

Based on the findings of the study the following recommendations were forwarded:

- As can be observed from this study, due to the expansion of cultivated land because of resettlement, other natural resources were damaged. Therefore, the district's Forest and Natural Resource Conservation Office and woreda's Agriculture and Rural Development Office should aware and initiate the farmers about natural resources use and conservation.
- Reforestation activities should be promoted through actively involving the local peoples.
- The District administrators in cooperation with responsible government authorities should struggle to minimize illegal settlement and illegal farmland expansion and device alternative options. Like, for instance, introducing modern farming technologies and providing necessary assistance for farmers by district's agricultural expertise so that the farmers can get large productivity from small plot of land.
- The federal and regional government should design environmentally friendly alternative investment options. Besides, ensure alternative fuel energy sources to reduce burden of natural vegetation.

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APPENDICES

APPENDIX I

Questionnaire filled by sample households of the study area.

Jimma University

College of social sciences and Humanities

Department of geography and Environmental studies

Dear respondents, the main purpose of this questionnaire is to collect primary and relevant data on the topic GIS and remote sensing- based analysis of the impact of resettlement on LU/LC dynamics. Thus you are kindly requested to give the necessary information on issue related to the study. The researcher believes that the success of this study depends on your honest and genuine response to the question. Please, feel confident that your response waskept confidential and the information you provide wasused for academic purpose only.

A. Personal information

1. Age_____

2. Sex: male female

3. Educational level _____

4. Marital status: single ☐ married☐divorced ☐widowed ☐

B. Questionnaire related to LU/LCC

2.1. What kind land use/land cover change in your area over the past 17 years due resettlement

Increase/decrease in:

No.	Change in	Increased	Decreased	No Change
1.	Chang in cultivated land			
2.	Change in forest land			
3.	Change in water surface			
4.	Change in grass land			
5	Change in bare land			
6	Settlement			

2.2What are the causes for land use/land cover change in your area?

A. Population growth

B.Land tenure insecurity

C. Lack of proper management

D. Improved access to basic infrastructure

2.3. Following the lands use/land cover change, which environmental problems are very common in your area?

A. Soil erosion

B. Degradation of water shade

C. Deforestation

D. Increased waste land

2.4If your choice for question number 2.4 is soil erosion, what are the major causes?

A .Land fragmentation

B Absence of fallowing

C.Overgrazing

2.5 If your choice for question number 2.4 is deforestation, what are the major causes?

A. Expansion of agriculture onto forest areas

B.An increasing demand for firewood

C. Cutting of trees for construction

D. Cutting of trees to generate income

2.6 What is your major source of energy?

A. fuel wood B. kerosene C. Biogas D.Other

2.7 Do you consider your crop production from your plots has increased over the past 16 years?

A. Increased B. Decreased C. No change.

2.8 Do you invest on land improvement measures?

A. Yes B. No

2.9If your answer for question 2.9 no what is the reason?

A. My subsistence income will not allow me to do so

B. Fear of further redistribution

C. Other

2.10If your answer for question 2.9 yes in what way?

A. Terracing

B.Contourploughing

C. Traditional ditches

II. KEY INFORMANT INTERVIEW

1. How the land usage was looks like in your areas over the past of 16years?.
2 Have you noticed any change in the land use/land cover in your area over the past 16 years?
3 Is there any change observed in your area with regard to vegetation cover, settlement areas, cultivation land, bare land and land use pattern over the past 16 years?
4 Did the changes also modify the land cover types in any ways?
5 What are the driving forces of land use/land cover changes in your area?
   Example, lack of proper management, increasing demand for farming technology, population growth, advancement of technology, to expand farming land
6 Has the quality of the forest, grazing and crop land changed over the last 16 years?
7 What are effects of land use/land cover change in the areas? Example:
   A. Soil erosion /land degradation B. Deforestation C. decreasing of crop yields.
   D. Migration and extinction of wild animals.
8. Is there any positive impact of resettlement on local people?

Appendix II Ground control point for verification of LU/LC from Google earth

S/no	Name	X_Coordinate	y_coordinate	Elevation
1	Water Body	259003	904789	1365
2	Water Body	258683	905353	1375
3	Water Body	258503	905952	1384
4	Water Body	258545	907168	1384
5	Water Body	257711	908360	1389
6	Water Body	257873	908892	1360
7	Water Body	257956	909322	1366
8	Water Body	256808	910219	1380
9	Water Body	256913	910932	1411
10	Water Body	257273	911202	1377
11	Water Body	257633	912132	1356
12	Water Body	255567	914045	1400
13	Water Body	254922	914145	1399
14	Water Body	253880	913665	1356
15	Water Body	253156	914392	1364
16	Water Body	252607	915236	1367
17	Water Body	252607	915848	1361
18	Water Body	252533	917051	1346
19	Water Body	252160	918477	1349
20	Water Body	251929	921734	1346
21	Water Body	251681	922489	1347
22	Water Body	251383	923322	1338
23	Water Body	251581	925306	1348
24	Water Body	251151	926149	1338
25	Water Body	251201	927588	1345
26	Forest	259621	928457	1865
27	Forest	260272	928869	1907
28	Forest	259779	929441	1799
29	Forest	260383	930060	1803
30	Forest	260796	930362	1898
31	Forest	260605	930822	1804
32	Forest	259970	931632	1586
33	Forest	259545	931820	1561
34	Forest	260986	931679	1728
35	Forest	261351	932632	1658
36	Forest	262415	932870	1799
37	Forest	269575	929489	1657
38	Forest	269305	930377	1637

39	Forest	271241	930298	1695
40	Forest	272384	927409	1752
41	Forest	266085	932949	1785
42	Forest	264828	936719	1999
43	Forest	263453	935950	1779
44	Forest	262473	936044	1691
45	Forest	264801	937367	1998
46	Forest	265238	938240	1874
47	Forest	264731	938869	1766
48	Forest	267791	940661	2000
49	Forest	267381	941971	1876
50	Forest	265119	941322	1882
51	Grassland	256032	932237	1464
52	Grassland	255843	933670	1492
53	Grassland	254382	933107	1399
54	Grassland	251892	932777	1374
55	Grassland	251033	932200	1360
56	Grassland	250936	931490	1356
57	Grassland	252012	927998	1366
58	Grassland	252520	924654	1381
59	Grassland	253324	924019	1389
60	Grassland	260806	924531	1863
61	Grassland	279233	908357	1600
62	Grassland	279053	909102	1591
63	Grassland	278633	910272	1589
64	Grassland	274553	909222	1738
65	Grassland	279106	907193	1598
66	Grassland	276336	906127	1598
67	Grassland	273833	906732	1695
68	Grassland	290388	936570	1614
69	Grassland	286673	957008	2131
70	Grassland	287117	958698	2190
71	Grassland	289433	955388	1949
72	Grassland	293593	963104	1599
73	Grassland	293983	964964	1542
74	Grassland	288023	965467	1735
75	Grassland	293357	960648	1667
76	Cultivated land	254706	949946	1386
77	Cultivated land	254658	950565	1373
78	Cultivated land	254622	951165	1383

79	Cultivated land	254721	952772	1349
80	Cultivated land	255356	953343	1360
81	Cultivated land	255960	953708	1375
82	Cultivated land	255923	954488	1341
83	Cultivated land	257865	953708	1480
84	Cultivated land	258928	953359	1507
85	Cultivated land	259357	954486	1400
86	Cultivated land	259303	955395	1388
87	Cultivated land	261008	954565	1520
88	Cultivated land	261263	953948	1576
89	Cultivated land	262929	954280	1577
90	Cultivated land	262818	951819	1599
91	Cultivated land	262834	950327	1572
92	Cultivated land	263929	951026	1574
93	Cultivated land	264897	952962	1516
94	Cultivated land	264866	955486	1465
95	Cultivated land	267660	953883	1434
96	Cultivated land	266739	954423	1456
97	Cultivated land	268422	953280	1437
98	Cultivated land	269057	951454	1477
99	Cultivated land	275201	953438	1491
100	Cultivated land	277693	955428	1522
101	Settlement	283149	949105	1787
102	Settlement	283149	949264	1781
103	Settlement	283276	949412	1800
104	Settlement	283361	949295	1800
105	Settlement	283329	949137	1801
106	Settlement	283253	948849	1813
107	Settlement	283218	948576	1821
108	Settlement	282821	947179	1699
109	Settlement	282757	946819	1675
110	Settlement	282598	946882	1657
111	Settlement	282903	946519	1694
112	Settlement	283435	946957	1742
113	Settlement	283493	947232	1778
114	Settlement	286308	949052	1968
115	Settlement	286276	949343	1968
116	Settlement	286313	949787	1970
117	Settlement	287012	947211	1999
118	Settlement	286715	947052	1973

119	Settlement	286103	946809	1914
120	Settlement	284339	945840	1800
121	Settlement	286541	944919	2034
122	Settlement	287155	945618	2021
123	Settlement	282523	943565	1667
124	Settlement	282424	943369	1669
125	Settlement	282022	943237	1658
126	Bare land	284829	942791	1878
127	Bare land	285670	940912	2000
128	Bare land	285661	940700	2007
129	Bare land	285632	940644	2007
130	Bare land	285647	940354	2013
131	Bare land	283205	939965	1863
132	Bare land	284033	939789	1931
133	Bare land	284802	940318	1988
134	Bare land	285075	940284	2001
135	Bare land	287451	940965	1818
136	Bare land	287736	942441	1777
137	Bare land	289532	944871	1663
138	Bare land	289280	945310	1682
139	Bare land	289028	945325	1698
140	Bare land	287387	944569	1998
141	Bare land	287326	945037	2029
142	Bare land	288093	945899	1774
143	Bare land	289612	951976	1825
144	Bare land	292326	952652	1730
145	Bare land	290060	954794	1875
146	Bare land	289878	954881	1898
147	Bare land	289898	955012	1906
148	Bare land	288880	957179	2065
149	Bare land	288438	957380	2094
150	Bare land	288013	957623	2128