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Dynamics of Land Use/ Land Cover Changes in Girar Jarso Woreda, Oromia Regional State, Ethiopia

Asfaw Worku Bedane

Advisor: Professor Feyera Senbeta

A Thesis Submitted to the School of Graduate Studies of Addis Ababa University, Center of Environment and Sustainable Development Studies in Partial Fulfillment of the Requirement for the Degree of Master of Art in Dynamics of Land Use/ Land Cover Changes Analysis

Addis Ababa University,

Addis Ababa, Ethiopia

February, 2022

Addis Ababa University

College of Development Studies (CDS) Department

of Environmental and Sustainable Development

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This is to certify that the thesis prepared by Asfaw Worku Bedane entitled: investigate land use/ land cover change analysis in Girar Jarso woreda. Oromia Regional State, Ethiopia and submitted to department Center of Environmental and Sustainable development Studies in partial fulfillment of the requirement for the Degree of Master of Art in Dynamics of Land Use/ Land Cover Changes Analysis complies with the regulation of the University and meets the accepted standards with respect to originality and quality.

Approved by Board of Examiners

Internal Examiner **Dr. Shimeles Damene** Signature----------------Date--------------------

External Examiner **Dr. Asmamaw Legass** Signature----------------Date---------------------

Advisor **Professor Feyera Senbeta** Signature-----------------Date--------------------

Declaration

I, the undersigned, declare the project is my original work, not presented for any degree in any universities and that all the source, used for are appropriately acknowledged. The project is original and has not been submitted for the award of any degree or diploma to any University or institution.

Name of student;

Asfaw Worku Bedane ------------------- Signature------------------------Date------------------------

This Thesis has been submitted for examination with my approval as University Supervisor

Name of advisor;

Professor Dr. Feyera Senbeta Signature------------------------------Date----------------------

Acknowledgement

First and foremost, I would like to thank the Almighty God for His generosity throughout my work to complete the study successfully. Next, I might wish to express my sincere and deepest gratitude to my supervisor. Professor Feyera Senbeta for his unreserved support, encouragement, and guidance at various stages and kind support and useful suggestions, criticism, comments and Follow up from problem identification up to the completion of this work to bring the research into the right shape and to make this study come to complete the study. His critical comments have contributed immensely to the completion of the thesis. Secondly, I would like to acknowledge Dr.Teshome Adugna for his financial assistance, overall support, and encouragement from the conception stage of attending the MA, Program to during the finalization of the study.

I have no words to precise my heartfelt gratitude to my family for uninhibited, encouragement, and support during this study period. I would also like to reserve a special thanks to my lovely family Shitaye, Sena, Milkyas, and Derara, for their support and encouragement during my Project work and to all others who directly or indirectly contributed to the success of the study.

Finally, I would like to express my thanks, to all the respondents and my respected friends who devoted their time to providing me with their useful comments and responses.

Last but not least, I would like to thank all my friends, especially Tesfaye, Girma, and Firomsa, for their encouragement during my thesis work by giving me time and support for my office work. Honestly, I thank you.

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Acronyms

BoFED	Bureau of Finance and Economic Development
CSA	Ethiopian Central Statistical Authority
DIP	Digital Image Process
EMA	Ethiopian Mapping Agency
EMA	Ethiopia Metrology Agency
ENVI	Environment for Visualization of Image
ERDAS	Earth Resource Data Analysis System
ETM+	Enhanced Thematic Mapper Plus
FAO	Food and Agricultural Organization
FGD	Focus Group Discussion
GIS	Geographic Information System
GJWAO	Girar Jarso Woreda Agricultural Office
GJWFEO	Girar Jarso Woeda Finance and economic office
GLCF	Global Land Cover Facility
GPS	Global Position System
Ha	Hectare
IBC	Institute of Biodiversity Conservation
IGBP	International Geosphere-Biosphere Program
IHDP	International Human Dimension Program
Khat	Kappa Coefficient
KIIs	Key Informal Interviews
LCI	Land Cover Institute
LST	Land surveyor in training
LULCC	LULC Change
MSS	Multi Spectral scanner
RS	Remote Sensing
TM	Thematic Mapper
USGS	United States Geological Survey

Abstract

Land-use land-cover change has become a significant environmental concern at the local, regional and global levels. Land use/ land cover changes are caused by population pressure further because of the expansion of agricultural lands through unplanned and inappropriate land management practices. Even though, LULC change analysis has been implemented in urban areas to assess urban growth; has not been properly employed to tackle problems related to LULC changes in most parts of the countryside in Ethiopia. Therefore, this study aims to dynamic Land use/ land cover change analysis using GIS and remote sensing techniques in Girar Jarso woreda focusing on the trend, the rate, extent, and distribution of various land use and cover changes, from 1984 to 2020. To achieve the intended objectives study has used the Maximum likelihood supervised classification method for LU/LC analyses and Post Classification techniques for LU/LC change detection supported with interview and focus group discussion. The result of this research indicated that cultivated land has increased from time to time and, it occupied 79% and 84% of the total landmass of the woreda in 2008 and 2020, respectively. A similar settlement also showed a large increment with the 36 years from 1984 to 2020, which means settlement accounts for 5% in 1984 and increased to 7% in 2020. On the other ways as a result of the LULC change analysis between 1984 and 2020 indicated that grassland, vegetation, and wetlands dramatically decreased. Grassland decreased from 1487 hectares in 1984 to 1032 hectares in 1996 and further decreased to 381 in 2020. Similarly, vegetation was reduced in size from 11785.1 ha to 8867 ha between 1984 and 1996 and natural vegetation further decreased to 4421.4 ha in 2020. The result of the study revealed that observed land use and land cover changes are caused by population pressure and the expansion of agricultural land. Therefore, birth control methods and Environmental education emphasizing the economic and environmental role of the LULC change correlating its long term promising survival importance to those communities and with a green economy policy of Government should be planned and implemented based on common consensus with the community.

Keywords: - Dynamics of land use/ land cover changes analysis environmental conservation.

CHAPTER ONE

INTRODUCTION

1.1 Background

Land-use land-cover change has become a significant environmental concern at the local, regional and global levels. However, for thousands of years, human activities against land are grown significantly and changed the entire landscape while most of the changes have occurred within the tropics. Additionally to the present changes, LULC plays important role in global environmental change, because the changes have affected the sustainability, biodiversity, and interactions between the globe and the atmosphere (Ayele, et al., 2018). Eventually, Wang, et al., (2020) shows that threats from the natural process, increasing frequency of disasters, and other unknown potential effects of worldwide environmental change still arrest human progress in achieving sustainable development goals.

A study by Gessesse and Bewket (2014) shows that the top increase in the demand for land for agricultural activities could be biomass energy and construction materials. Thus, with the rise in food and fuelwood demands resulting from population pressure, local farmers are forced to push farmlands at the expense of vegetation cover decline; forest, scrublands, and grasslands within the more marginal and fragile landscapes. However, in Ethiopia, increased population pressure and related food needs are essential to driving for the conversion of natural forests to grassland and arable land (Tesfahunegn, 2016). So, changes in land use, mainly the conversion of natural forests to agricultural lands and settlements, are the most widely practiced activities in Ethiopia were the prime factors responsible for the widespread expansion of cultivated lands at the expense of the forest and grass covers (Fentie, et al., 2020). A result of this increase in the human population and its related demands for agricultural land has affected natural ecosystems such as forests and pastures.

Gessesse and Bewket, (2014) show the demographic characteristics mainly increment and density have been indirect factors for LULC conversion through the growing needs for added lands for farming and grazing. Similarly, as, Kahsay, (2004) shows natural forest destruction is agricultural expansion, both through shifting cultivation and the spread of sedentary agriculture; the demand for increasing amounts of construction material, Specially, fuelwood, and charcoal, the implication decline in water body resources, forest lands, scrublands, grasslands; while croplands and rural settlements, bare lands, and built-up areas showed increment (Agidew and Singh, 2017). Besides, the expansion-related demand for agricultural lands and rural settlements has negatively affected the existing LULC of forest and grazing lands due to population pressure. In Ethiopia, land use/ land cover changes are caused by population pressure as well as the expansion of agricultural lands through unplanned and inappropriate land management practices to meet the food demands of the rapidly growing population (Agidew and Singh, 2017). To, the land cover has been changed for many years, and currently, the percentage of forest cover of the cover is less than 4% (Ayele et al., 2018). As a result, it is worthwhile to link food security policies with sustainable land management policies because both are closely interrelated with each other.

The change in land cover in many parts of the country at large was an outcome of natural and socioeconomic factors and their exploitation both in time and space. Therefore, most significantly, rising agricultural and settlement expansions were the key drivers of land cover change within the country (Ayele et al., 2018). As a result, successively puts immense pressure on LULC change .assessment has become the core component of current natural resources management and environmental change monitoring strategies (Kaul, and Sopan, 2012).

LULC change has persistently occurred mainly thanks to the mismatch between the demands and availability of land resources. The absence of proper regulatory measures and improper land management practices; plans and policy implementation in the realm have also significantly contributed to LULC changes in Ethiopia and beyond. In particular, in the central highlands of Ethiopia such as Girar Jarso Woreda LULC change has been on-going for many years like elsewhere in the country. However, LULC analysis has not been properly made to tackle the problems related to LULC changes in the study area. On top of this, the appliance of remote sensing and GIS-based change detection approach is highly useful to critically determine what proportion, where, and what style of LULC has changed over a given time.

1.2 Statement of the problem

As indicated by Gubena, (2016) Ethiopia is highly vulnerable to grave environmental degradation mainly due to the unwise use of natural resources and poorly planned development projects, prompted by rapid population growth. As the result, the environment has not featured on the development agenda in the past, since project evaluation and decision-making mechanisms have focused only on short-term technical feasibility and economic benefits. Besides, the event of the agricultural sector partially depends on land productivity. However, literature and knowledge witness that poorly planned development endeavors and unwise use of natural resources have vulnerable and gathered Ethiopia's past economic, environmental, and rank. though the cause for Ethiopia's environmental degradation is, in general, numerous and interlinked; chronic financial condition, growth, as well as the dearth of relevant knowledge base, inconsistency on Associate in Nursing institutional level (Gubena, 2016).

As, Bufebo and Elias, (2021) show, LULC change is one of the challenges that aggravate environmental problems. Hence, appropriate measures need to be employed to reduce the dramatic change in inland use and to harmonize environmental conservation with human livelihood hence, appropriate measures need to be employed to reduce the dramatic change in inland use and to harmonize environmental conservation with human livelihood. Besides, its geographical and climatic diversity, Ethiopia is one of the regional centers of biological diversity and genetic resources in the world (Zerihun, 1999; cited IBC, 2009).

In other ways, in Ethiopia, land degradation is a serious problem affecting agricultural productivity. Hence, overgrazing and the expansion of farming into marginal lands caused by an increasing population pressure without increasing economic productivity have been leaving the land bare. Present key problems in land degradation include loss of vegetation cover and biodiversity followed by escalating erosion, declining soil fertility, expanding salinization also as aridity through hydrological cycle disruption caused by unsustainable anthropogenic practices exacerbated by climate change (BSAP, 2005; cited Environmental Protection Authority 2011). Therefore, typical pressure factors Environmental implications such as climate change, biodiversity loss, scarcity of basic forest products, habitat alteration, a decline in quality and availability of water, and crop yield reduction are the consequences of the LU/LC change (Bufebo and Elias, 2021).

Even more, the rapid population growth and the demand for natural resources have put great pressure on the biodiversity of the country. So this is illustrated by the present trends of population growth and deforestation need to be abated by using family planning and appropriate land use practice respectively to reverse the deterioration of natural resources and to prevent the decline or loss of biodiversity (Soromessa et al., 2004).

Even the perception of the local community towards protected land degradation and loss of biodiversity is insignificant. Moreover, the problem of LULC change within the study area includes loss of plant diversity, land degradation, water body degradation, loss of forest, and loss of agricultural productivity. Specifically, the shrinking of the forest cover has a giant and cumulative impact on local and regional global climate change, carbon sequestration, water quality, quantity control, etc.

Due to such problems, I observed the consensus climate change in my study woreda was increasing temperature, reduced water availability, increased atmospheric evapotranspiration, and changing rainfall levels. Thus climate change has different factors that are worsening our life so, the world is now asking the question of what will be done? To answer this question, I believe that everybody should question himself to mitigate the observed problems. Therefore, as an environmentalist, I prefer to start from what I observed as a problem of LULC change in the study area that was the loss of plant diversity species, soil erosion, land degradation, the security of drinking, decline of a forest, loss of agricultural productivity, loss of biodiversity and species extinction were the main problems that observed in the study woreda.

On the other hand, there are still inadequate land management practices remain a heavy challenge for several years in Ethiopia. Likewise, Girar Jarso Woreda is one of the Woreda in the North Shoa Zone of Oromia Regional State has the largest population pressure on the land use system owing to small-scale agricultural investments that extensively drive LULC changes in the study area. Like elsewhere within the country, the LULC change phenomenon is common because of population pressures on natural resources, such changes are developed partially in the study area can represent dynamic LULC changes in most parts of the Ethiopian highlands for the reasons, Rapid population growth has forced farming families to expand their fields onto the Poor Land Management practice.

As a result, large areas, which were once under forest cover, are now exposed to heavy soil erosion resulting in massive environmental degradation and a serious threat to sustainable agriculture development and human health that was declining agricultural productivity.

Therefore, land degradation is a serious issue in the Oromia region which leads to depletion of land resources and which in turn induces a drop in agricultural production, loss of biodiversity, water quality depletion, poverty, food insecurity, and social instability. Due to such kind of problem, I strongly believe that these problems should be identified and fixed through a scientific approach. In the study area threats related to LULC change haven't been clear and comprehensively studied methods to ameliorate their impacts are still limited. Therefore, to fill this gap, a study was conducted on dynamic land use/ land cover change, Girar Jarso Woreda focusing the trend, the rate, the extent, and distribution of various LULC changes, using Remote Sensing and GIS technologies supported by focus group discussion, key informants interviews, and observation.

1.3 General Objective

The main objective of this study aims to dynamic land use/ land cover change, Girar Jarso Woreda focusing on the trend, the rate, extent, and distribution of various land use and cover changes.

1.3.1 Specific objectives

The specific objectives of the study aimed;

- assess trends of LULC change over 36 years (1984 to 2020) in the study area
- analyses rate and extent of LULC change during the study period
- Study the major causes for LULC change in the study area.

1.4 The Research Questions

- What is the current status of LULC change in the study area?
- What is the trend of LULC change in the study areas?
- To what extent does LULC change detection in the study area?
- What are the major underlying driving factors of LULC in the study area?

1.5 Significance of the Study

The findings of the study are very useful to possess an in-depth understanding of the status of land use/ land cover change trends and to look at the land use and land cover change trends for policy implication. The results of the study will provide a higher understanding and awareness to policymakers for efficient strategy development. The study also will function as a stepping-stone and make a modest contribution for people who have an interest in research trends in LULC change status.

Additionally, the finding of the study will provide information to decision-makers on the consequences of soil and water and forest degradation problems because the input within the study attenuates land defecates. Moreover, it'll help the planner (government bodies) and local communities as a source of data and will draw lessons from past experiences to can correct the future.

1.6 Scope of the Study

The study was focused mainly ashore use land cover change detection and their effect by integrated GIS and remote sensing data and giving hints about the importance of mapping LULC change. Spatially the scope of the study was concentrated in Girar Jarso Woreda north Shoa zone of Oromia Regional state line and therefore the accuracy assessment was carryout and putting results, and at last, recommendations were raised supported the findings. Therefore, to beat this problem, the current study would contribute to decision-makers as information and identifying different LU/LC classes and changes. The study was land use /land cover change detection ground truth and verification are very essential but it's difficult to an addressee in an exceedingly short period of your time and with small finical support. Additionally increasing LST ends up in environmental problems like temperature change and seasonal fluctuation.

1.7 Limitation of the study

The study was tried with all possible efforts in acquiring required inputs within the kind of primary and ancillary data collection, interpretation, and analysis. However, the study has encountered certain limitations and attempts are made to work out a number of them and it was unfeasible to seek out satellite images of earlier dates covering the full study area, although 1984 was supposedly the earliest satellite image. To solve such a problem elder focus group discussion and observation were triangulated to identify the reality of my data in the study area.

1.8 Ethical consideration deletion

The participants within the study were briefed about the aim and nature of the research by enumerates. About this, the participants were asked for land use planning and sustainable land management practice for a whole period of their time. They understood the positive advantage of the study purpose and replied causes and consequences of the LULC changes in the study area. How land use /land cover changes from time to time in advance.

1.9 Organization of the thesis

The thesis is organized into five chapters, within which the primary chapter gives an insight into the choice of the subject and its importance. The introduction, statements of the matter, objective research question, the significance of the study, the scope of the current work, limitation, and ethical consideration is identified during this chapter. Chapter two introduces the study within the context of existing literature toward land use and land cover change and offers a quick idea about the literature review that has been performed before undertaking the studies. Chapter three presents the study area description and the methodology employed. The fourth chapter deal with the results and discussion which contains land use/ cover maps of 1984 to 2020, presents an analysis of all available data and discussed the key findings of the study. Finally, Chapter five presents a summary, conclusions, and recommendations of the study.

CHAPTER: TWO

LITERATURE REVIEW

2.1 Rational and concept definition of land use land cover

Different books use LULC ideas interchangeably, though they are different. LULC refers to the physical characteristics of the earth’s surface, captured inside the distribution of vegetation, water, desert, ice, and various physical choices of the land, as well as those created only by human activities like settlement (Billah and Anisur, 2004; cited Wogderes, 2014).

However, the various authors plan land use because the theoretical employment and management of strategy are placed toward land cover sort by human agents or land managers.

Global definition LULC changes have an impact on the composition of the atmosphere which results in the change of climate and weather conditions at the local and global levels and it has become an important element in the development of strategies for natural and environmental resource management.

According to, Lambin et al., (2003) LULC is defined by the attributes of the earth’s land surface captured in the distribution of vegetation, water, desert, and ice and also the immediate subsurface, together with the collection, soil, topography, surface, and groundwater, and it additionally includes those structures created only by human activities similar as mine exposures and settlement.

Land Use and Land Cover (LULC) are important components of the environmental system and changes in it reflect the impacts of human conditioning on the environment. These impacts need to be determined to get a transparent image of the extent to that completely different LULC practices to affect hydrologic regime and water quality (Bello and Gbadegesin, 2018).

As Di Gregorio and Jansen (1998) cited LULC, which we define as the observed biophysical cover of the earth's surface is an expression of human activities and, as such, changes with changes in use. Thus, land cover change can provide a baseline for applications that include forest and grassland monitoring, planning and investment statistics, biodiversity, global climate change, and control against desertification.

Usually, LULC Change is the leading edge and hot topic of global change the mutual influence between LULC change and human society acts on the human survival environment and food safety (Chang, et al., 2018). Consequently Land cover is a fundamental variable that impacts and links many parts of the human and physical environment. This shows that affects biological diversity, changes in ecosystem services, soil erosions, and results in natural disasters, and the land use land cover changes are mainly triggered by natural disasters and human activities (Mulat, 2020).

2.2 Causes, of LULC changes

Our planet earth is endowed with variant natural resources that sustain life for millennia. However, LULC changes area unit the foremost necessary environmental challenges in numerous elements of the world. Globally, there had been an increase of cropland and pasture throughout the 1970–1990 and 1700–1990 periods, severally (Lambin et al., 2003; Gashaw et al, 2018).

According to the United States environmental protection agency (USEPA, 2004), the general causes of LU/LC changes identified are:

- Natural processes, such as climate and atmospheric changes, forest fires, and pest infestations.
- A direct effect of human activity such as illegal construction of roads and houses and deforestation (deforestation).
- The indirect effects of human activity are like the diversion of water which results in the lowering of the water table.

According to Alemayehu, et al., (2019), LULC changes the forces and processes behind the changes. As a result, farmers' perceptions of LULC amendment drivers' conversion are triggered by a combination of things, proximate, underlying, and biophysical driving forces.

Rai, et al.,(2018) rumored LULC may be an elementary variable that affects several components of social and physical environmental aspects has been referred to as one in each of the key drivers of touching scheme services. Thus, land use-land cover amendment is driven by many interacting factors that act at international, regional, and native levels. These drivers are chiefly originated from anthropogenic-induced activities (Harden 2014; Bekele and Yirsaw, 2019).

As indicated by Gessesse and Bewket, (2014) LULC changes are the results of human influences, biophysical drivers, and natural processes. Likewise, agricultural activities subsistence rain-fed farming and fragile farming are the foremost livelihoods of the agricultural community, since agricultural land growth at the expense of different land covers is the way and away from the foremost widespread proximate driver of land use dynamics and connected land cover and scheme changes. Therefore, these can increase rates of forest conversion, unsustainable agricultural land use, and severe geological processes are the foremost vital factors characterizing land degradation inside the highlands of African countries (Mekuria 2005; Hassen and Assen, 2018). Consequently the main driving forces of human-induced amendment in LULC type a complicated system of dependencies, interactions, and feedback loops at totally different spatiotemporal scales (Agarwal et al. 2002; Verheye 2007; Hassen, and Assen, 2018).

In other ways, the amendment detection analysis supported remotely perceived knowledge showed that 294 KM^2 areas of grass, forest, plantations, shrub, and fenland covers were becoming tilth between 1973 and 2007 (Gessesse and Bewket, 2014). Hence, as the result of these intensive areas of private woodlots, grazing lands, communal woody plants and woodlands, state forests, and plantations were modified to farmland. what is more, wood extraction to fulfill the demand for fuel and pole woods is one in each of the most drivers for clearing the intensive space of vegetation over and trees in high land African country felling of trees for fuel, charcoal, and construction materials while not replacement could also be an essential drawback contributory to the loss of varied sorts of vegetation usually and native tree species significantly (Gessesse and Bewket, 2014).

Local-level studies undertaken inside the highlands of African countries counsel that a presence of nice LULC changes was caused by a combination of varied factors looking at every vicinity condition (Hassen and Assen, 2018). As a result of this, inflated deforestation and poor farm management practices have a diode to accelerated geological process and land degradation inside the Ethiopian highlands.

Moreover, common areas wherever high population pressure exists whose livelihoods directly rely on the exploitation of natural resources in rural areas (Hassen and Assen, 2018).In other ways, Jnr, S.D., (2014) show Land degradation has negative consequences on agriculture, unsustainable agricultural practices, in turn, promote land degradation (Olsson et al., 2005), with agriculture being the main economic activity in Ethiopia. Eventually, the effects of land degradation can be significant (UNEP, 2012; Jnr, S.D., 2014). Hence, LULC change is intensified by the conversion of natural ecosystems for food production, urbanization, and other socioeconomic benefits (Alawamy et al., 2020). Therefore, LULC is driven by human behavior and will even be managed by products and services for humans and livestock, and it can undermine environmental health (Oumer, 2009).

LULC changes affect directly and indirectly the environment, economy, and society at various spatial and temporal levels (Briassoulis, 2004). Accordingly, LULC patterns play a vital role within the establishment and spread of invasive plants. So, understanding LULC changes is helpful for early detection and management of land-use change to cut back the spread of invasive (Chang, et al., 2016). Thus, the continued growth of ground combined with growth completely coupled to the increase of valley erosion and surface runoff potential in most a section of the high area presently experiencing each positive and negative socio-economic and environmental consequence of LULC dynamics (Mulatu et al., 2019)

Therefore farmland/settlements and bushlands/degraded lands were increasing appreciably, whereas grasslands and forest areas are diminished. Research conducted by Fasika and Leykun, (2018), indicates that the most proximate driving forces of LULC amendment inside the watershed are smuggled work and fuelwood extraction, growth of plantation, growth of the settlement, agricultural growth, and construction of infrastructures. Furthermore demographic, economic, technological, establishment and policy, and biophysical factors represent the most underlying drivers of the LULC amendment.

Furthermore, Yohannes et al., (2017) indicated that lack of enforcement of environmental laws and rapid intensification of upstream agricultural activities have led to overexploitation of the water resources thereby threatening aquatic and terrestrial biodiversity resources of the park. The unique bird species discussed above have now become endangered as a result of different habitat disturbance factors (Yohannes et al., 2017).

In general, the GIS and remote sensing-based amendment detection matrix analysis technique might offer helpful baseline data to understand the spatiotemporal patterns of land use transitions caused by the key driving forces thereby property land management designing is possible (Hassen and Assen, 2018).

2.3 Trends of LULC changes

According to Frederic et al., (2006) since the past, humans have modified landscapes in attempts to spice up the quantity, quality, and security of natural resources crucial to its well beings like food, fresh water, fiber, and medicinal products. With the increased use of innovation, human populations have, slowly at first, and at an increasingly rapid pace, later on, increased their ability to derive resources from the environment, and expand their territory. Many authors have known three different phases of the management of hearth, domestication of accumulation, and fossil-fuel use as being polar in enabling accrued appropriation of natural resources (Frederic et al., 2006).

Land cover dynamic has the world concern of the 21st century, with the dramatic implication for human survival. The modification among the physical also as biological characteristics of the land that is thanks to management together with conversion of grazing and forest land into farming land, pollution and land degradation, removal of vegetation, and conversion to non-agricultural uses (Quentin et al. 2006; Prakasam 2010; Shiferaw 2011; cited Meshesha et al., 2016).

LULC changes analysis is one every of the foremost precise techniques to grasp however the land was utilized within the past, what sorts of changes square measure to be expected among the longer-term, likewise thanks to the forces and processes behind the changes (Alemayehu et al., 2019). Hence, factors driving LULC modification to embrace an increase among the human population and population response to economic opportunities (Lambin et al., 2001). Deforestation and forest degradation square measure influenced by a combination of underlying driving forces, together with unclear tenure, poor economic conditions, increment, market (wood extraction), and socio-political factors (Bekele, 2003; Christiansson, 2008; and Alemayehu et al., 2019).

The main trends of change have been the combination of biophysical processes, in particular drought cycles, population dynamics (population growth, density, and internal migration), urbanization, and subsequent government development policies (Deribew and Dalacho, 2019). Hence, the massive conversion of forests to agricultural land and drylands in the study area will have a considerable impact on biodiversity and ecosystem services, land degradation, and a change in the local hydrological regime. As, several studies have shown that there have been significant changes in land use and land cover in Ethiopia's highlands during the second half of the 20th century (Abate, 1994; Shiferaw, 1998; Zeleke and Dubai, 2001; Tesfaye et al., 2014). Therefore, most studies have pointed out that uneven topography, inadequate agricultural practices, and high pressure from human and animal populations were the main facilitators of soil degradation processes in the highlands.

As indicated by Agidew and Singh, (2017), LULC is caused by population pressure as well as expansion of agricultural land through unplanned and inadequate land management practices to meet the food needs of a rapidly growing population. Likewise, it is worthwhile to link food safety policies with sustainable land management policies as the two are closely related to each other.

In Ethiopia, the availability of natural resources changes and their management varies considerably from place to place. This variability is because of differences in biogeography and topography climate and, land-use/land-cover changes they accelerate, through human actions, but also produce changes that affect humans (Agarwal et al., 2002; as cited Morka, 2008).

In other ways, the dynamics of LU/LC alter the existence of different biophysical resources, including water, vegetation, soil, animal feed, and others. As previous studies reported, in Ethiopia, there has been considerable LU/LCC in a different part of the country and the expansion of cultivated land at the expense of woodland and forest land, and it was stretched into the sloppy area due to scarcity of land. Especially in the highlands of Ethiopia, agricultural practices and human settlement have a long history and recently a highland population pressure including depletion of natural resources and unsustainable practices (Miheretu et al., 2017; Morka, 2008).

Furthermore, as indicated by Netsanet (2007), our current understanding of historic land use land cover change in Ethiopia is not adequate. So, the future understanding of LULC will need to be greatly improved with systematic methods and designs addressing land-use change research. Therefore, to understand the forces of change, it will be necessary to conduct studies that explicitly reveal the variations in change characteristics.

2.4 Consequence LULC changes

LULC changes have become major issues for the world and are an important driver of global environmental change (FAO, 1999). Such large-scale land-use classes through the increase of agricultural land in a rural area, deforestation (clearance of trees), urbanization, and other natural phenomena and human activities are inducing changes in global systems and cycles. However, the main change in land use historically has been the global increase in agricultural land (Houghton, 1994).

In other ways, land-use change of vegetation cover (LULC) is influenced by global ecological processes, resulting in major environmental challenges of global significance (Sleeter BM, 2012; Klimanova O, 2018; Habte et al, 2021). As the authors also estimated that the human footprint affects 83% of the world's land surface.

As reported in Wakjira et al. (2020), the main consequences of the LULC change in the Northwest Ethiopia watershed indicated that there was; declining agricultural yield, loss of biodiversity and habitat, low and declining profitability of farmers, land and soil degradation, declining water resources, and extensive aridity and drought. Losses in soil fertility have resulted in lower agricultural yields.

Habte et al, (2021) demonstrate that there is a visible change in LULC over the past twenty years, in the central highlands of Ethiopia, having negative environmental repercussions, which would be exacerbated if the same trend were to continue. The study shows that the extension of the cultivated area increased by 12 between 1984 and 2015. Thus, as a result, they clearly showed that this change occurred to the detriment of the plant cover which decreased by 11.3% over the same period.

As indicated in Messay (2011), the overall consequence of these LU / LC conversion and modification processes is severe degradation of the natural environment. As a result, most of the area could be completely cleared and converted to plots of agricultural land within the time frame indicated. Therefore, this, added to the current frightening problems associated with global warming, certainly leads to a severe loss of soil and the deterioration of its nutrients, microclimatic change, destruction of wildlife resources, and the suffering of the human population on the plateau of central Ethiopia (Messay, 2011). Therefore, it is imperative to take all necessary measures by local government offices and other relevant bodies to prevent the existing massive destruction of vegetated land due to the increased demand for agricultural land, charcoal, firewood and, settlement areas in the district.

Our planet earth is endowed with variant natural resources that sustain life for millennia. However, LULC changes area unit the foremost necessary environmental challenges in numerous elements of the world. Globally, there had been an increase of cropland and pasture throughout the 1970–1990 and 1700–1990 periods, severally (Lambin et al., 2003; Gashaw et al, 2018).

As, Jnr, S.D., (2014) show Land degradation has negative consequences on agriculture. Unsustainable agricultural practices, in turn, promote land degradation (Olsson et al., 2005), with agriculture being the main economic activity in Ethiopia. Eventually, the effects of land degradation can be significant (UNEP, 2012; Jnr, S.D., 2014).

As, Mengistu and sausage (2007), shows that LULC changes replicate the dynamics determined at intervals through the influence of socio-economic conditions that caused impacts toward land use/management techniques and different numerous aspects of the farming systems, institutional settings, environmental policy, and others.

Generally, the historically distressing impacts of human activities on the atmosphere have recently reversed at an unexampled rate, notably. So the continued growth of ground combined with growth completely coupled to the increase of valley erosion and surface runoff potential in most a section of the high area presently experiencing each positive and negative socio-economic and environmental consequence of LULC dynamics (Mulatu et al., 2019)

2.5 Management of LULC changes

Land use is defined as how the land is utilized by people and their habitats, usually emphasizing a functional role of land for economic activities, while land use is a physical characteristic of the Earth’s surface (Watson et al., 2000; Mary et al., 2020; Regasa et al., 2021). Thus, Land Use Dynamics in Land Use (LULC) is a well-known, accelerated and substantial process, mainly induced by human activities. However, most studies have provided details of LULC over the past decades at a specific scale, thus reducing the possibility of developing adequate management strategies at the basin level for the coming years. As, Desta, (2018) shows the natural environment is made up of various valuable natural resources such as air, water, soil, land, forest, flora, and fauna which are fundamental for the survival, of all the peoples of the world. So, these resources are under intense pressure due to population growth and poor management practices. As, Desta et al., (2021), indicated soil management practices contribute significantly to improving ecosystem services, reducing soil loss, and increasing productivity. Hence, a strong reduction in soil erosion has been obtained through practices with better vegetation cover as they play the role of preventing the impact of precipitation and water erosion. As a result, the improvement in yields increases, but is mainly linked to characterized practices by high moisture and sediment retention capacity, including mechanical erosion control and agricultural conservation practices.

Otherwise, a comparison between categories of land management practices, especially on cropland, ecosystem provision, and regulation functions can be obtained by applying mechanical erosion control practices and conservative agriculture (Desta, et al., 2021).

Thus, the regulation of ecosystem functions is further improved when different categories of practices are applied in combination. Likewise, best practices are mainly associated with practices characterized by their ability to retain moisture and sediment, the presence of continuous coverage, improvement of the hydrological properties of the soil, and synergistic effects of multiple management practices. Plants and animals generally decline due to soil degradation and poor land management practices. However, land management in Ethiopia has evolved into diverse farming systems with varying levels of intensification (Wegayehu, 2006; Regasa et al., 2021). Therefore, soil and water conservation techniques have been employed by farmers, most of which derive from traditional knowledge, but adapted to current environmental and social circumstances through experiences between generations.

However, Gessesse and Bewket, (2014) LULC changes are driven by a combination of immediate changes and underlying factors such as economic, demographic, biophysical, and institutional factors. Thus, the expansion of bare land, increased surface runoff production, and soil erosion are the main environmental damages partly attributed to LULC dynamics. Hence, environmental degradation processes have negative impacts on local agricultural productivity, the availability of water resources, and the food security of communities. On the other hand, policy responses are needed for the integrated management of natural resources and the sustainability of livelihoods. As noted by Motuma (2017), land management practices can be strongly influenced by natural and socio-economic factors. the determination of land management practices which were topography and vegetation cover were the main natural factors in determining land management practices, population growth, and lack of awareness among socio-economic practices were strongly influenced by the land management practices in the territory. Hence, population growth has turned out to be the main factor. In other respects, the age, sex, and race of farmers are also identified as having a positive impact on modern agricultural inputs (Motuma, 2017). As a result, the company's level of education affects the family's decision that determines the well-being of society as land use is defined as how the land is utilized by people and their habitats, usually emphasizing a functional role of land for economic activities, while land use is a physical characteristic of the Earth’s surface (Watson et al., 2000; Mary et al., 2020; Regasa et al., 2021). Thus, Land Use Dynamics in LULC is a well-known, accelerated and substantial process, mainly induced by human activities.

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2.6 Land Use / Land Cover Dynamic and Link

According to Hudson (1995), the earth is a complex and dynamic combination of factors: geology, topography, hydrology, soils, microclimates, and communities of plants and animals that constantly interact under the influence of climate and human activities. In addition, natural resources, which provide space and raw materials for various developments and other activities, can be classified into different categories.

As indicated by Shiferaw et al., (2019), the dynamics of LULC and also the consequent changes in ecosystems, also because the services they provide are a consequence of human activities and environmental factors, such than plant species. Land use is, therefore, the term used to describe human uses of land or immediate actions that alter or convert land cover. On the other hand, vegetation cover designates types of natural vegetation cover that characterize a particular land area. Therefore, land-use change is the immediate cause of the land cover change. Thus, land use is the dynamics of land use that characterizes land use, such as the arrangements, activities, and inputs that people undertake a given type of land use to produce it, modify it or maintain it, while land use is the biophysical cover observed at the earth's surface.

In addition, like Wakjira et al. (2020), LULCC is one of the major factors influencing biophysical systems at any scale. The hydrologic cycle and environmental conditions are a variety of processes (Hordofa., 2019). Consequently, LULCC disrupts the power of natural systems to meet human needs and increase the exposure of individuals and resources to the global natural process, socio-economic and political concerns by reducing ecosystem services (Wakjira et al., 2020).

2.7 Ethiopian LULC Problems

Changes square measure achieved over the last decade (Lambin et al., 2003). The determining land use and land cover change square measure caused by population pressure however as the growth of agricultural lands through unplanned and inappropriate land management practices to satisfy the food demands of the apace growing population (Agidew, and Singh, 2017). At intervals over the past few decades, the dynamics of land use and forest coverage at intervals in the Ethiopian highlands have undergone major changes. According to, Deribew and Dalacho,(2019) show that the most drivers of the amendment were the mix of biophysical processes, particularly drought cycles, demographic dynamics (population growth, density, and internal migration), urbanization, and consecutive government development policies, since the result of the large conversion of forests to agricultural land and barren land within the study space can have way reaching impact on diverseness and system services, land degradation, and an amendment in native hydrological regime (Deribew and Dalacho, 2019).

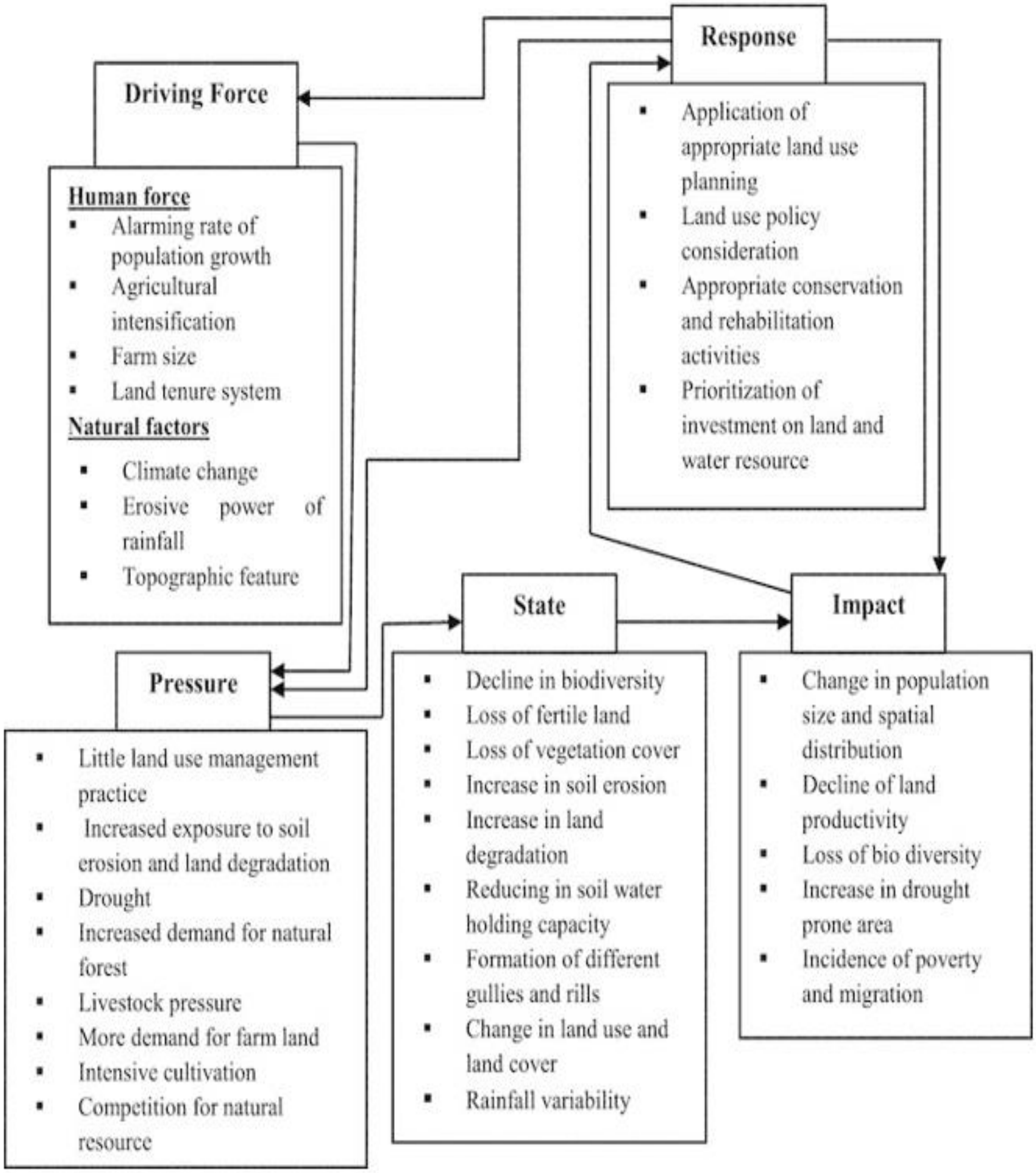
Therefore the recent growth of farmland and infrastructural development might have accelerated the speed at that land cover transformations preceded. So land degradation at intervals the look of wearing and soil nutrient decline is severely threatening agricultural production at intervals in the densely inhabited Ethiopian highlands (Abi et al., 2018). In-depth vegetation conversion and growth of agricultural areas have management on Ethiopia's large-scale geo-ecological fragmentation and land degradation (Lakew et al., 2000; Bezuayehu et al., Vivero et al. 2005; WB, 2007; cited Gessesse and Bewket, 2014). As Oumer, (2009) shows that in Ethiopia, the supply of natural resources yet as their dynamics and management varies significantly from space to space.

2.8 Conceptual framework

As Ravich and Riggan (2017), indicated the conceptual framework is a common logical direction and connection. Shaping the basic thinking, structure, plan, and practice, as well as everything about the implementation of the entire research project, so the conceptual framework comprises your thoughts on the identification of the research topic, the problem to be investigated, the questions to be asked, literature to be checked, theories to be used, methods and methods to be used, procedures, and instruments, the data analysis and interpretation of findings, recommendations and conclusions you will make (Ravitch and Riggan, 2017).

As noted by Meshesha, et al., (2016), rapid population growth required more land for cultivation, more trees for household fuelwood consumption, and more area for settlement a been responsible for a drastic change in land use/land cover change over the past 36 years in the Central highland Ethiopia watershed To control the loss of pasture and dryland areas, income opportunities from alternative sources can be provided to the inhabitants of the community. Therefore, the conservation, management, and rehabilitation of the environment require an integrated approach to community development at different levels.

In other ways, as Prasad et al., (2010) showed, the LULC changes' including deforestation have a major impact not only on the photo diversity of the region, and the speed of change, this can destroy part of the ecological balance in these regions. To understand these interactions and responses a conceptual framework has been proposed Hence to understand these interactions and feedback a conceptual framework has been proposed as follows.



Source: conceptual framework on the driving force of land cover change and associated effect adopted from FAO; 2004; Asfaw, 2021

CHAPTER: THREE

Methodology

3.1 Description of the Study Area

3.1.1 Location

The study was carried out in Girar Jarso Woreda one of the thirteen woredas of the North Shoa zone, Oromia National Regional State. The woreda lies along the highway from Addis Ababa to Bahirdar in the Northwestern direction at a distance of 112kms from Addis Ababa. It shares a border with Amhara National Regional State in the north, Yaya Gulalle woreda in the east Debre Libanos woreda in the south, and Degem woreda in the west. Astronomically the woreda the wereda extends from 90 37'-100 00``N latitudes and 380 37'-38050``E longitudes (GJWADO, 2015).

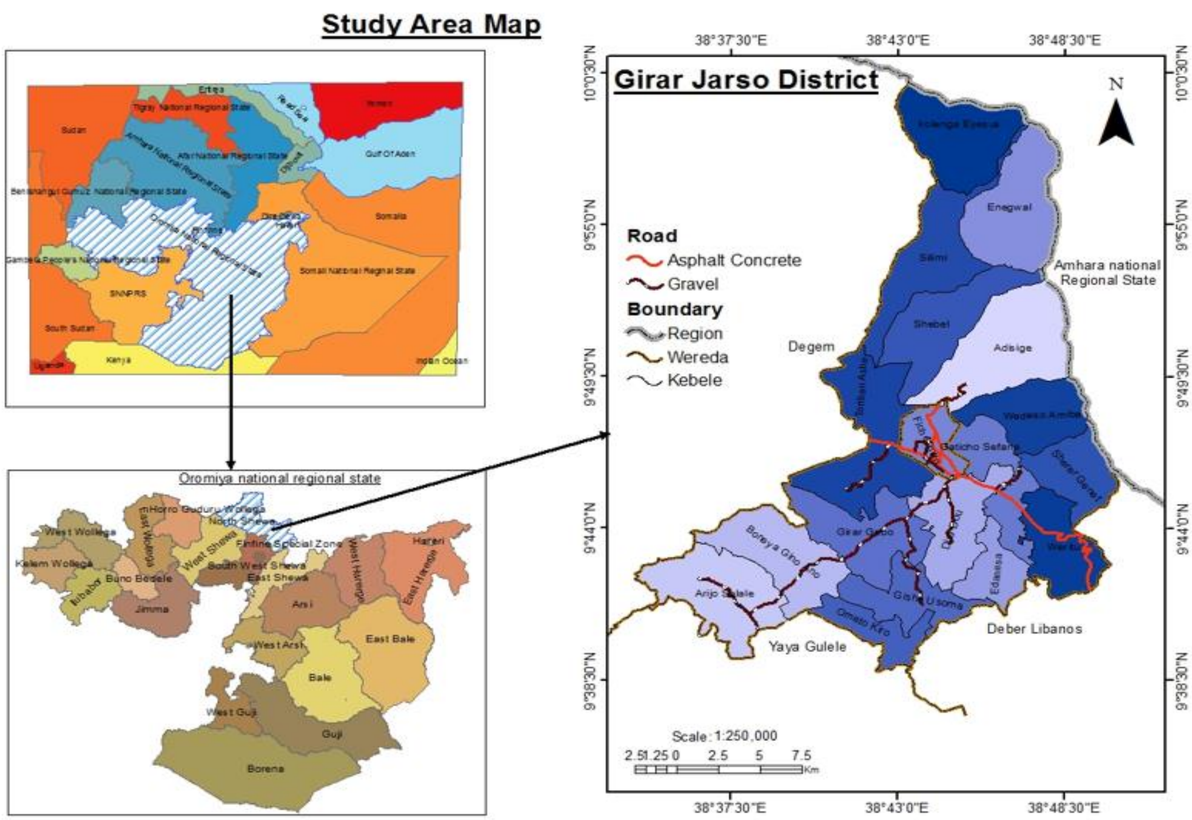


Figure 1 Location of the Study area

3.1.2 Topography, climate and vegetation

The study is characterized by mountainous, sloppy to steep sloppy, and gorges. Basic data obtained from GWFEDO, (2012) indicate that about 36 % of the land cover is plain and about 33 % is considered sloppy. The remaining 31% is classified as mountainous and gorges. The largest part of Girar Jarso woreda is part of the shoa plateaus.

The altitude of the woreda ranges from 1300m to 3419m above sea level (M.A.S.L). The lowest elevation is found in the Northern while, the highest elevation is found in the western part of the woreda. Agro ecological, the Woreda is divided into three major altitudes: the highlands (*bada*) which contain 52%, the middle-highlands (*bada dare*) with 41%, and (*gamoj*i) with 7% of the total land of the woreda‟s about 49435 hectares (Girar Jarso Woreda Office for Agricultural Development and Natural Resources 2020).

The climate is one of the elements of the physical environment that has a pronounced impact on settlement patterns, human life, soil type, flora, and fauna. According to the National Metrology Agency (2020), the mean annual temperature ranges from 150c to 180c, while the mean annual precipitation ranges between 1200-1400mm. According to the rainfall pattern of the study area, the mean annual rainfall is approximately 94.87 mm with irregular and scattered rainfall four or more times per year. According to data collected by the NMA, precipitation in the region ranges from 11.94 mm in December to 366.58 mm in July. The main rainy season, which represents the highest total precipitation of the year, takes place from June to August during the summer season, the other rainy season runs from February to April *(Belg*), and during this period the region receives a small amount of rain.

As explained by the elders of the study area, most of the land in Girar Jarso Woreda is covered with native trees such as *Juniperus Olea Abyssinia sholla*, *Hagenia forest*, *podocarpus*, adults, *Cordial Africana* and, *Coroton*. However, nowadays these three species have not been observed in study areas except in small protected areas. Thus, the vegetation cover of the study area includes scattered trees, shrubs, and eucalyptus trees. In addition, according to information obtained from the GJWAO, (2020), there is a vegetation cover of dense plantations composed mainly of eucalyptus and junipers around the surrounding farms and churches. The forest is the main source of energy and building materials for the local community and as a result of which continued, deforestation has left kindling in the area.

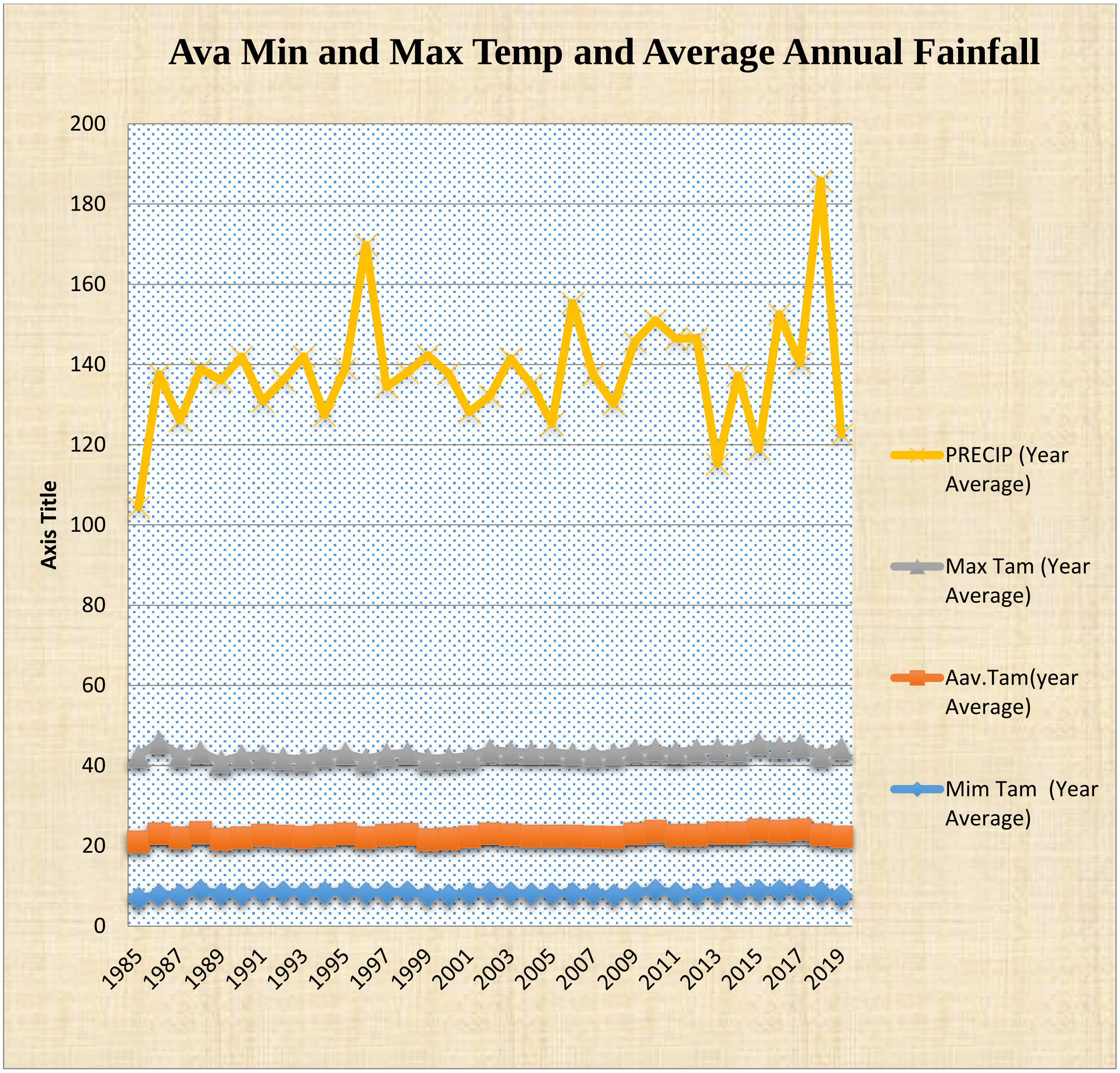


Figure 2 Rainfall distribution, Max, Min, and Average Tem.(Source: NMA,2020)

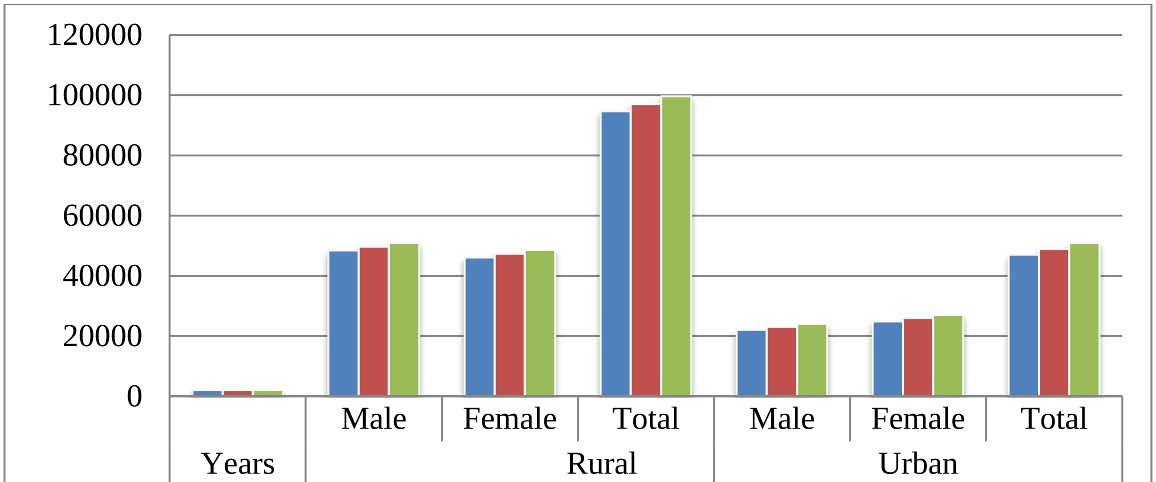
3.1.3 Landform and soil

According to the FAO report (1986) indicates, Ethiopia is based on the Precambrian crystal basement underlying most of Africa. This subsoil is dominated by various schists, gneisses, granites, and slates which are exposed in areas where geological erosion has been significant, particularly along the northern, western, and southern upland fringes of the region. and country limestones, sedimentary and, sandstones, several hundred meters thick, have been deposited on these basement foundations, suggesting that large segments of the landmass are still geologically unstable.

As, Debele et al.,(2018), the World Reference Base for Soil Resources, and are dominantly sandy clay loam in texture various contents of natural remember, to be had phosphorus, overall nitrogen, and other organic materials. Hence, the extended versions inside the pedons and physicochemical residences of the soils mean designing a land-use machine suitable to the particular wishes of every soil elegance in addition to imposing incorporated soil fertility control practices to hold soil natural remember and vital plant nutrients. Moreover, as indicated by Alias, E., (2016) Agricultural potential refers to a complex set of biophysical and agro-climatic factors that influence the comparative advantage of producing agricultural commodities in a particular place. Therefore, major soil types in the study area include vertisols 38%, nitosols (38%), cambisols 11% and others 13% (GWFEDO, 2020).

3.1.4 Population

The dynamic nature of the population in a given settlement area is the result of fertility, mortality, and migration. The demographic process is a complex phenomenon affected by social, economic, cultural, political, and psychological factors. According to May 2021 population projection, the population of Girar Jarso Woreda's other than Fitche town was close to 97,095 (Male 49,717& Female 47,378) with an average family size of 5. The average population density of the District was 157 persons per km2 (CSA, 2008). The majority of the people (75%) belong to the Oromo ethnic group and speaks Afaan Oromoo while the rest (25%) belongs to the Amhara ethnic group and speaks Amharic as indicated in graph 3. below (OEPC, 2021)



	Years	Rural Male	Rural Female	Rural Total	Urban Male	Urban Female	Urban Total
Male	2019	48,441	46,162	94,603	22,120	24,903	47,023
Femel	2020	49,717	47,378	97,095	23,046	25,945	48,991
Total	2021	51,027	48,626	99,653	24,010	27,031	51,041

Graph 1 rural and urban population projection of the study woreda

3.1.5 Economic Activities

The main economic activity of the population of the woreda is mixed farming at the subsistence level producing both crops and livestock. Farming is the main livelihood strategy of the woreda in which seasonal rainfall patterns determined the production activity. More than 90% of the population depends on subsistence farming as a livelihood strategy. In Girar Jarso woreda, belg crop production accounts14% while, *Meher* crop production accounts for about 86%. Hence, meher crop production is the major livelihood strategy that people engaged in (GJWAO,2020).

Thus, more than 90 % of the population of the woreda depends on mixed subsistence farming (farming and animal rearing) as the main livelihood strategy. In Gira Jarso, "bone (*Meher*)" crop production accounts for about 86% while "arfasa (*belg)*'' crop production accounts for 14%. (GJWAO ,2020).

The major crops grown in the district include cereals such as "*Teff*', wheat, barley, maize, and sorghum; pulses include bean, peas, lentils, and vetch and horticultural crops such as fruit, vegetables, and root crops. In addition, oilseeds such as linseeds and '*Nug'* are cultivated. Generally, wheat constitutes the largest proportion of cereals, followed by "*Teff*'" and barley. Vegetables are also grown in the backyard for household consumption. The major livestock reared in the area includes cattle (12, 5086), sheep (44,478), goat (7,888), horse (382), mule

(389), donkey (15,242), and poultry (76,284), and Sale of livestock and their products (such as milk, cheese, and butter), livestock by-products (such as cow dung), crops, and firewood are some sources of income in the study area (GJWAO, 2020).

3.1.6 Land Use Covers

According to basic data of Girar Jarso Woreda Agriculture Office, (2020), cultivated land covers the largest share, (79 %), settlements (11%) grazing land (3%), and (8%) is unusable land that is neither cultivated nor grazed land while settlements are the second-largest land use pattern that covers (11 %.) About (8%) of the Woreda settlement area and (8%) is unusable land that. This includes rough topography, mountainous and exhausted degraded land areas.

As indicated by, Girar Jarso woreda Agricultural Development and Natural Resource Office, (2020) annual report show that the average landholding is nearly 2.2 hectares. Similarly, as indicated by Ergando and Belete, (2016) the average landholding land size is estimated to be 3.2 hectares per household.

As a result, the agricultural sector is rain-fed and is characterized by low productivity due to low use of farm inputs, traditional farm practices, poor soil fertility, waterlogging, and other related problems. Consequently, Paul, and was Gĩthĩnji, (2018) additional plot, while holding total land size constant, is positively associated with land productivity. This suggests that enforcing existing subdivision restrictions, or pursuing a policy to promote consolidation of farm holdings, will not yield significant benefits and may instead have adverse effects. Our results should be read not as unconditional support for creating small farms or breaking up farms into multiple plots, but rather as a caution that where small farms do exist in a context of an excess labor supply, greater support should be directed towards the smallholder sector.

3.2 Research design

The research is based employed a qualitative research approach which helps to understand and narrate the feelings, comments, and thoughts of the respondents and to triangulate with data from key informants, focused group discussion, and observation as well as Use GPS to collect field samples of types of land use. The LULC change study can encompass observational and experimental or mixed research methods to generate the required data for the research. But this research has been carried out using the observation through exploratory, descriptive or analytical methods. To carry out an exploratory study, it needs a small-scale study of relatively short duration, which was conducted when little has known about the problem. In the case of a descriptive study, the researcher simply described the distribution of trends of LULC change of the study area. Lastly, the study has attempted to investigate the relationship between possible causes and effects of LULC change and degree of its effect on LULC changes.

3.3 Sampling methods

Past and present information was collected to identify the historical and recent LULC cover dynamics of the study area. Time-series basic data has been obtained from different organizations to supplement with Landsat images acquired from the Global Land Cover Facility (GLCF; www.glcf.org) online imagery portal. A topographic map of the study area with a scale of 1:50,000 from EMA (Ethiopian Mapping Authority) and Google Earth was employed. To substantiate imagined outputs focus Group Discussions with elder farmers and key informants with agricultural office exerts were also used.

3.4 Source of data

The most important source was the satellite image and some basic socio-economic data. A socio-economic primary data was conducted purposely from key informant's interview, FGD, and observation selected elders, who live in the study area for the last 40 years to generate information and with time horizon considered for the trend analysis using remote sensing analysis and the socioeconomic study. Additionally to triangulate the data purposively selected to identify the level change in LULC change history of observed resources, and to get an insight into various political, social, and environmental factors that influence the decision on LULC in the study area. The key informant interviews were held with household heads and woreda agricultural experts like land management officers, natural resources, and forest protection office experts. While the secondary (Ancillary) data were collected from the governmental and non-governmental organizations and published information to assess the trend LULC change status in Girar Jarso woreda from, Central Statistical Agency, Federal Geospatial agency, Agricultural office, Climate Change, and Compatible Development authority, Oromia Rural Land Use Management and National Meteorological Agency for data such as average annual temperature (1984- 2020) and average annual rainfall (1984–2020) were reviewed and used. In addition to pictorial information presented in the form of photographs, and scanned pictures, tables, graphs, and diagrams were used during the description and interpretation of the finding.

3.4.1 Data collection methods

The selected instruments of data collection for this study and their corresponding respondents are;

- Satellite Image processing; - the act of examining and interpreting images with the aid of a computer to correct the enhancement and feature extraction treated as digital image processing.
- Observation; - As indicated by Gorman, et al., (2005.) observation is a complex method of data collection that in its nature involves. Hence the research was carried out using the observation through exploratory, descriptive or analytical methods.
- Field observations and focus group discussions with farming Global positioning system (GPS) and topographical maps of scale 1:50,000 were used for ground verification
- Interview: - an in-depth interview was conducted with selected key informants to grasp rich information about the issue under investigation. The key informants were selected from the sample group and governmental officials who work on land management officers, agricultural experts, natural resources, and forest protection office experts.
- Focus Group Discussion: - to cross-check the information from other sources, a discussion session was arranged by selecting the participants purposively to triangulate or to collect detailed information from a specific group of people like community leaders, elderly group and professionals who have firsthand knowledge about the problems.

3.4.2 Data processing and analysis.

Primary and secondary data were used to achieve the specified objectives of this research study. The primary data was obtained systematically from selected key informants, natural resource management experts, and other responsible bodies by using structured interviews and field observation. The primary sources were analysed with a qualitative research approach which helps to understand and narrate the feelings ideas. For the presentation of the data, excel, descriptive statistics such as percentage, column, line, etc., were used. While the secondary data was gathered from related published and unpublished materials. The satellite image data were processed in remote sensing is dominantly treated as digital image processing with common image processing functions available in image analysis systems were categorized within pre-processing, image enhancement, image transformation, and image classification and analysis were implemented during the data processing and analysis process.

3.4.3 Basic Concept in Image data analysis

According to Shawal et al., (2014), the Image process is important for various styles of works like Land use study, numerical weather prediction, mapping, etc. The digital Image process wants digital pictures like space-based and remote sensing information. However, because the authors show that information obtained from satellites or craft i.e. remote sensing and abstraction information ought to be corrected as a result of the motion of the sensing system and therefore the craft platform will cause geometric distortion. Consequently process and pre-processing are important for such correction before image classification (Shawal et al., 2014). Therefore, the digital image process could be a technique of exploiting digital circuits or digital computers to method pictures within the kind of separate digital brightness.

As indicated by Lillesand and Kiefer, (2015). the digital image process is involved with four basic operations: image rectification and restoration, image transformation, image sweetening, and image classification. Similarly, as Lilles and Kiefer, (2000) delineated, in supervised classification, the image analyst supervises the image element categorization processes by specifying, to the pc algorithm, numerical descriptors of the numerous land cover varieties gift in a very scene.

Moreover, Wogderes,(2014), and the accuracy assessment matrix was used to judge the accuracy of the classification since classification isn't complete till its accuracy is assessed that conjointly determines the standard of the map extracted from remotely detected information. Since the investigator implies that a slip matrix or confusion matrix could be a common follow used for the assessment of classification accuracy.

Similarly, the matrix compares data obtained by reference sites thereto provided by classified pictures for several sample areas (Wogderes, 2014).

3.4.4 Application of remote sensing and GIS

As indicated by Woldearegay, (2017) remote sensing is broadly defined as the science and art of obtaining information. It helps us to understand objects, areas, or phenomena by analysing data obtained using equipment, not in contact with the object, area, or phenomenon under investigation (Reddy, 2008; Woldearegay, 2017). Thus, as the researcher shows that it is the process of acquiring information without physically contacting from distance, so it can also be defined as the practice of obtaining information about the Earth's and water surfaces using images taken from an overhead perspective, using electromagnetic radiations reflected or emitted from the Earth's surface (Campbell and Wynne, 2011), while GIS is a computer-based system that can deal with virtually any type of information about features that can be referenced by geographical. On the opposite hand, as Muzein, (2006), remote sensing is broadly defined because of the art and science of obtaining information about objects without direct physical contact. So, the recent advance in remote sensing and GIS technologies provide a powerful tool for mapping and detecting changes in LULC (Mengistu and Salami, 2007). As a result, this might not have involved anything more than selecting a strategic high point where observation with the naked eye revealed the desired information. Hence, the modern usage of the term 'Remote Sensing' has more to do with the technical ways of collecting airborne and space-borne information. Earth observation from airborne platforms features a 100 and 50 years old history although the bulk of the innovation and development has taken place within the past 30 years (Muzein, 2006). Using remote sensing and GIS technology for LULC mapping and change detection is an inexpensive method for a clear understanding of the land cover alteration processes due to land-use change and their consequences (Olokeogun et al., 2020). Eventually, mapping LULCs and change detection using remote sensing and GIS technologies have received increasing attention (Mengistu and Salami, 2007).

In other ways, as indicated by Mendoza and lutetium (2015), image analysis could be a basic tool for distinctive, and quantifying different types of pictures, as well as grayscale and color pictures, multispectral pictures for several separate spectral channels or wavebands (normally but 10), and hyperspectral pictures with a sequence of contiguous wavebands covering a particular spectral region e.g., visible and near-infrared. Therefore, the analysis is especially supported by

Landsat MISS, Landsat TM5, Landsat7, ETM+, and lookout 2A satellite pictures and fortification. The Landsat thematic clerk and lookout 2A representational process square measure accustomed verify the most chance of LULC classification.

However, the LULC knowledge was generated through satellite representational process interpretation in a geographical data system (GIS) atmosphere. Therefore Landsat pictures of the study area of the years 1984, 1996, 2008, and 2020 were obtained from the US Geographical Society (USGS) website (http://earthexplorer.usgs.gov).

The year 1984 was selected as a baseline because around 8 million Ethiopian people become the victims of the famine caused by heavy drought in all parts of Ethiopia. More than one million people were dying this year due to erratic climatic changes. Following the downfall of the Dergue regime in 1992, the Ethiopian People Democratic Front (EPRDF) government become empowered the most community forest was lost due to political changes.

In the second phase in 1996, the Ethiopian People Democratic Front (EPRDF) government become authorized the foremost community forest was lost because of political revolution changes in Ethiopia. Following privatization land policy, the majority of grazing land occupied by different cooperative producer associations was distributed among youth, land-less farmers, and the military who return from war. As a result, land coverage and utilization were modified. The government began to specialize in rural land use policy and decentralization to facilitate rural socio-economic development as a policy.

In 2008 inexperienced economic development and mass plantation program was designed therefore to succeed Millennium Development Goals while keeping gas emissions low the government of the Federal Democratic Republic of Ethiopia has conjointly initiated the Climate-Resilient inexperienced Economy (CRGE) to safeguard the country from the negative effects of temperature change and also the institution of an inexperienced economy can assist you to succeed your ambition to succeed in middle-income standing by 2025. Finally, the year 2020 represents the present or latest year of our observation. Hence the brief descriptions and analysis are summarized in Table 1 below as follows;

Table 1 Satellite image data analysis

Landsat Type	Date of acquisition	Path and Row	Resolution
L-MISS	February 1984	Path/Row 181/54	60 (M)
L1-5TM	February 1996	P168/r56	28.5 (M)
L7-ETM+	February 2008	P168/r56	30 (M)
Sentinel-2	February 2020 current	-	10 (M)

3.5 Image analysis

Digital image processing was manipulated and interpretation of digital images with the aid of a computer. Therefore this process analysis was commonly based on four image analysis processes which mean; pre-processing, enhancement, image transformation, and image classification was used for analysis.

3.5.1 Image Processing

According to writer et al., (1996) Image process may be a technique to perform some operations on a picture, to induce associate degree increased image, or to extract some helpful info from it. In alternative words, it's a sort of signal process wherever the input is a picture and therefore the output will have features/attributes related to that image. On the opposite was, the image process is among technologies (Jensen, et al., 1996). Correspondingly digital image process refers to the manipulation and interpretation of digital pictures, by a computing system, to organize a picture for show, interpretation, and to extract helpful info from the image. Therefore, the remotely perceived image knowledge area unit is sometimes not prepared to be used directly however got to endure a series of pre-processing steps. Moreover, the image process consists of processes geared toward the geometric and radiometric correction, improvement, or standardization of images to correction, improvement, or standardization of images to boost our ability to interpret qualitatively and improve our ability to interpret qualitatively and quantitatively image elements. As the result of the doable sorts of digital image manipulation area unit infinite and digital image process is essentially involved with four basic operations; image rectification and restoration, image transformation, image improvement, and image classification (Lillesand and Kiefer 2015). Therefore, during this study, the investigator was used an image process to boost the standard of the study.

3.5.2 Pre processing

Image pre-processing ways area unit meant for image improvement for the wants of the subsequent process of the image typically beholding (Stastany and Minarik, 2007). However, the most goal of pre-processing is noise suppression (usually the origin of the noise is digitizing and transmission), removal of ultimately, the distortion created by the scanner suppresses or emphasizes different attributes that area unit vital for post-processing, segmentation, and edge detection. As Alemu et al., (2015) indicate each geometric rectification and image sweetening was conducted geometric correction that converts the picture element position of the image by correcting the optical pure mathematics and compensation distortion caused by the movement of the imaging platform and therefore the form of the piece of land.

Accordingly Remote detected knowledge was before analysis properly sorting of the remote sensing knowledge, it's vital to correct the error throughout scanning, transmission, and recording of the information. Pre-processing is to enhance the standard of the image so that we can analyze it during a higher method. By pre-processing, we will/we area unit able to suppress unwanted distortions and enhance some options that are necessary for the actual application.

Similarly, the raw satellite image is filled with errors and cannot be directly utilized for options identification, and any application desires some correction before the most knowledge analysis and extraction of knowledge. Therefore, Pre-processing involves 2 major processes: geometric correction and radiometric correction or haze correction. Remote sensing imageries area unit inherently subjected to geometric distortions.

So, these distortions are also because of the attitude of the device optics, the motion of the scanning system, the motion of the platform (the platform altitude, attitude, and velocity), the piece of land relief, or the curvature and rotation of the world (Lillesand and Kiefer, 2015).

The aim of pre-processing is to correct the distorted knowledge to additional accurately represent the initial scene. This sometimes includes the initial process of raw image data to correct for geometric distortions, calibrate the data radiometrically, and eliminate noise present in the data. Based on these a classification scheme was developed for the study area. Accordingly, five classes were identified namely cultivated land, grassland; settlement, vegetation, and wetland were indicated in Table 2 below.

Table 2 Classification scheme used to classify LULC categories in study Woreda

Land-cover types	Description
Cultivated land	The land that encompasses areas allotted for crops production (mainly seasonal crops with scattered trees inside).
Grassland	Grasslands are areas where the vegetation is dominated by grasses and herbs with nil or little proportion of shrubs and trees.
Settlement	Permanent residential and invested areas of varied patterns and scale occupied by backyards, compounds and individual huts.
Vegetation (bushes and shrub etc).	Refers to those areas covered with tree, shrub, bushes, and some grasses that dominate the foot slopes and riverine vegetation between less dense shrub/bush lands are mixed with grasses;
Wetland	Represents most plants areas with frequent flooding event during the rainy season.

3.5.3 Image enhancement

Image enhancement was the process of making an image more interpretable for a particular application and, used to increase the details of the image by assigning the image maximum and minimum brightness values to maximum-minimum display values (Wang et al., 1983). Thus remotely sensed data is more interpretable easier to the human eye and it is done on pixel values, by increasing the visual discrimination between features in a scene and assists the human analyst.

3.5. 4 Image transformation

According to Richards, (2013), Image transformations generally involve the manipulation of multiple bands of knowledge, whether or not from Multispectral pictures taken at totally different times or 2 or additional pictures of constant space (i.e., multi-temporal image data).In either case, image conversion creates "new" pictures from 2 or additional sources, It highlights fascinating options or attributes higher than the initial input image. but Image transformation involves processes that area unit similar in construct to those processes in image sweetening, however in contrast to image sweetening these processes that area unit similar in construct to those processes in image sweetening, however in contrast to image sweetening, these processes area unit ordinarily applied on multichannel (band) pictures (Richards, 2013). Consequently, Image knowledge is commonly reworked in either the spectral or special domains for functions of data extraction, compression, or image filtering. Operations like smoothing, edge detection, or radiometric or geometric sweetening might not be potential within the original image however area unit is simple on the reworked knowledge.

3.5.5 Image classifications

According to, Lillesand and Kiefer and Kiefer, (2015), show that the attainable sorts of digital image manipulation area unit infinite. Therefore digital Image process is basically involved with four basic operations: image rectification and restoration, image transformation, image improvement, and image classification. Thus, image classification is that the method of distribution categories to the pixels in pictures. So, there are unit 2 broad styles of classification procedures, supervised classification and unsupervised classification. Satellite image of 1984, 1996, and sand 2008 was classified victimization supervised classification. Whereas the machine-driven technique was wont to cluster coefficient values to derive a needed variety of land categories and their associated spectral signatures. The land cover of 2020 was classified through supervised ways looking forward to the previous specification of coaching areas (scene), within which major land cover varieties were delimited manually as a key for electronically classifying the image. Therefore, the goal of image classification ways is to mechanically classify all pixels in a picture in step with LULC classes or topics. Usually, multispectral knowledge is employed for classification, however it's truly "existing spectral samples" The knowledge of every peel is the digital basis for classification" (Lillesand et al., 2004). Similarly, before performing arts image classification and analysis for thematic land use and canopy mapping, one should choose or develop an organization that meets the wants of the matter to be resolved. However as Parkis and Klemas, (2011) expressed a possible organization should meet a minimum of the subsequent criteria, i.e. it should be:

- Exhaustive, i.e. all doable land covers or conditions should be assigned to a class;

- Mutually exclusive, i.e. any land cover should be alienable to at least one and only 1 class;
- Hierarchical, i.e. begin at a general level and divide every category into subclasses at consecutive lower level;
- Flexible, i.e. permit the assembly of the many completely different specialty maps (e.g. information layers of a GIS) and be able to answer dynamic desires.

Hence, the foremost appropriate and preferred classification technique chosen to perform the classification of LULC mapping of the analysis (study) space was supervised classification. During this classification procedure, the analyst defines the clusters throughout the coaching method once intensive field survey by taking communication system points. It suggests that the image analyst supervises the element categorization method by specifying, to the pc algorithmic program, the varied land over sort's gift in a very scene. To do this,

> "Representative sample sites of identified cover sort, referred to as coaching areas, were wont to compile a numeric interpretation key describing the spectral properties of every object style of interest. Then digitally compare every element within the information set with every class throughout the interpretation method, and marked with the name of the class most almost like it" (Lillesand et al. 2004).

Therefore during this style of classification (supervised classification), there have been 3 basic steps concerned within the procedure. These at the coaching stage, the classification stage, and therefore the output stage. The primary stage, that is that the coaching stage, is that the stage wherever the analysts identifies representative coaching areas and numerically describe the spectral attributes of every land cover style of interest within the scene. The second stage, that is that the classification stage, is that the stage wherever every element within the image dataset is classed in keeping with its nearest land cover class. This stage is that the most tedious, exhaustive, flexible, and time taking stage. The third and therefore the end within the supervised image classification is that the output stage. Therefore, this can be the stage wherever the results were given. The results were given in 3 forms: thematic maps, tables of full scene/record or elect records or sub scene, and digital information files compatible to inclusion in a very GIS atmosphere.

3.6 Post Classification Analysis

Most of the applications performed in the post-classification analysis are to produce smooth land use and land cover data. Classified data from satellite images often manifest sharp edges (known as "salt-and-pepper appearance" (Lillesand et al., 2004). Owing to the inherent spectral variability encountered during classification on a pixel-by-pixel basis. One means of classification smoothing involves the application of a majority filter in Arc GIS software. The majority filter applies a moving window of 3x3 pixel filters, 5x5 pixel filters, or 7x7 pixel filters. Mostly, a 5x5 pixel majority filter moving window is passed through the classified data set and the majority class within the window is determined. Thus, the majority class in the window takes precedence over the small or minority classes in the window. The majority filter can be applied to classified data more than once to get it smoothed.

The other way of smoothing the classified data is through boundary cleaning. Thus Boundary cleans smoothest the boundary between classes by expanding and/or shrinking it. It gives the option or opportunity to determine the priority by which cells can expand to their neighbors either based on their values or size (area). Besides, other applications such as neighborhood analysis, clump, sieve and recode have been used subsequently to produce a smoothed and clean output of land use and land cover from a classified satellite image.

3.7 Change detection

Change detection is the procedure of distinguishing variations within the state of associate degree object or development by perceptive it at completely different times. Essentially, it involves the power to quantify temporal effects victimization multi-temporal knowledge sets. Several ways for detection changes are developed and utilized in numerous applications, for example, there are a unit post-classification comparison, image differencing, image parcelling, image regression, principal element analysis (Ayele, 2011).

As indicated by, Al-do ski et al., (2013), showed that detection and analysing LULC changes by victimization remote sensing satellites is done through a method ordinarily known as ‘change detection. Whereas the post-classification comparison technique has been verified to be the foremost in style approach in amendment detection analysis as a result of their area unit many benefits to the current technique: it minimizes device, region, and environmental variations and it provides a whole matrix of land cover amendment once victimization multiple images.

3.7.1 Rate of LULC changes

As indicated by Miheretu and Yimer, (2018) determine the rate of land use /land cover changes quantification of the rate of change has been applied the following equation was performed for computing the rate change calculated using the formula.

$$\boxed{\text{Percentage LULC Change} = \frac{(\text{Area final year} - \text{Area initial year})}{\text{Area initial year}} \times 100}$$

Where, x= area final year

y= area initial years

$$\boxed{\textbf{Annual rate of change= \% Change Observed / Rate of Time Intervals}}$$

3.8 Accuracy assessment

As Foody and weight unit, (2002), show the confusion matrix lies at method premise of the many accuracy assessments and is usually used hook line and sinker its utility. So the confusion matrix is employed to supply a site-specific assessment of the correspondence between the image classification and ground conditions. Thus, the confusion matrix could, as an example, be accustomed to summarizing the character of the category the allocation of classifications is the basis for several quantitative measures of classification accuracy. However, there are several issues with accuracy assessment. Additionally, LULC maps production at any scale, improvement, and use of advanced classification processes like pre-field and subpixel, classification procedures victimization knowledge domain method, and incorporation of auxiliary knowledge into classification procedures; such knowledge includes, Digital Elevation Model (DEM), road, soil, land use and census knowledge (Rwanga et al., 2017).

Moreover, the classification theme soil, grassland, settlement, vegetation's and land, are the main LULC categories for the study periods that the classified pictures were not inheritable, throughout the winter season once all crops were harvested (dry season), to assure similar inquiry.

In other ways, as Congalton and R.G., (2001) State validation or accuracy assessment is associated with the nursing integral element of most mapping comes incorporating remotely detected knowledge. Thus different abstraction info might not be therefore strictly evaluated, however a minimum of needs meta-data that documents, however, the data was generated. Accordingly, accuracy assessment or validation could be a key element of any project using abstraction knowledge. This assessment is very important for many reasons, including:

- The requirement to understand however well you're doing and to be told from your mistakes;
- The power to quantitatively compare methods; and
- The power to use the information ensuing from your abstraction data analysis in some decision-making method.

The visual scrutiny of your map derived from abstract knowledge ought to be the primary step in any assessment. Therefore, as, indicated by. Rwanga, et al., (2017), Remote sensing is every one of the tools that are incredibly vital for the assembly of land use and land cover maps through a method known as image classification. Therefore the foremost common thanks to assessing the accuracy of a classified map are to form a group of random points from ground truth knowledge and compare that to the classified in a very confusing matrix. World Health Organization sleep in the study space for 1984, 1996, 2008, and field observation and Google Earth image used for the 2020 study amount. The accuracy assessment of this project calculated as the follows formulas;

Users Accuracy$\frac{\text{Number of Correctly Classified Pixels in each catogory}}{\text{Total number of classified pixels in that category (The Row Total)}} * 100$

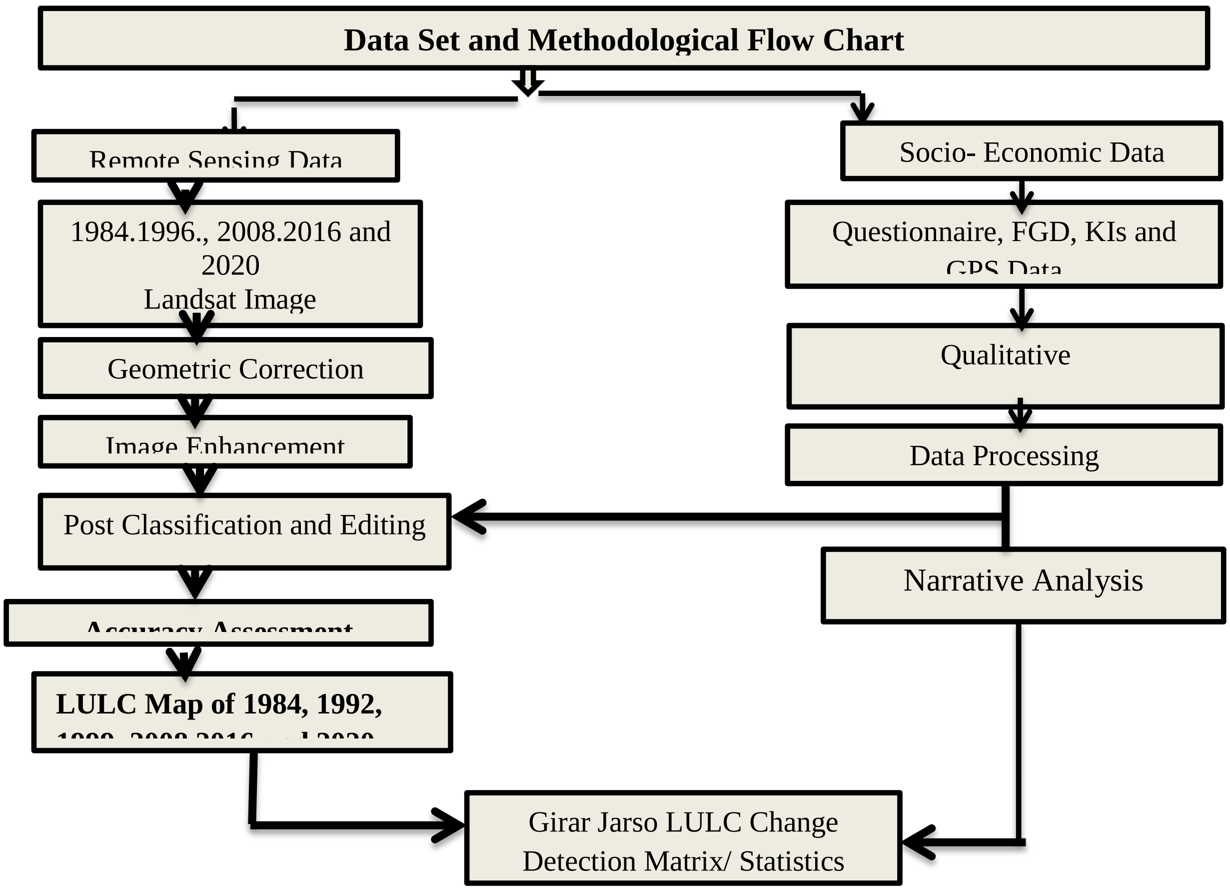
Producer Accuracy =$\frac{\text{Number of Correctly Classified Pixels in each catogory}}{\text{Total number of classified pixels in that category (The Column Total)}} * 100$

Kappa Coefficient (T) =$\frac{(\text{TS}*\text{TCS})-\sum(\text{Column Total}*\text{Row Total})}{\text{TS}^2-\sum(\text{Column Total}*\text{Row Total})} * 100$

Over Accuracy= $\frac{Total\ Number\ of\ Correctly\ Classified\ pixels\ (Diagonal)}{Total\ Number\ of\ Reference\ Pixels} * 100$

The ways for land use and land cover dynamics analysis to investigate LULC change analysis using GIS and remote sensing techniques analyzing multi-temporal remotely perceived pictures of six data of Landsat satellite imageries. a mixture of steps and procedures were developed to interpret, analyze, map, and quantify the on the market, determination of relationships between variables, and identification of important variables of data set and methodological flow chart indicated below as follows;

General methodological flow chart



Flow chart of research methods of the study

CHAPTER FOUR
Results and discussion

4. 1 Overall LULC changes (1984 to 2020)

Four sets of remotely sensed images namely Landsat MISS (1984), Landsat TM (1996), ETM+ (2008), and Sentinel-2A (2020) are used in this study to classify land use land cover categories into different informational classes. The informational classes categorized from the different four major land-cover types were identified in Landsat images include Cultivated land, Grassland, Settlement, Vegetation (bushes and shrub, small tree) and, Wetland classified based on the fundamental elements of image interpretation and sample training created during image classifications. Twenty training samples were gathered from each land sat class of the images and the maximum likelihood algorithm of the supervised classification technique was used to generate land use land cover maps in ERDAS Imagine 2015 software and finally the GCP data was used in the GIS environment using ArcGIS 10. 8 software to assess whether the point data agreed with classified satellite images. The classification hierarchy used in this study is derived from field observation, document analysis of the district of agricultural office, and land use land cover classification of the past study.

4.2 LULC Changes analysis (1984 to 2020)

The study analysis shows land-use change over the past 36 years the distributions of land use land cover categories in the study area are well presented in Table 3and in Figure 3 of different periods of the study. The result indicated that cultivated land, grassland, settlement, vegetation (bushes and shrubs, small trees), and wetland showed a fluctuating trend during the study period. Thus, research indicated cultivated land and settlements have increased from time to time.

As a result, indicated that from 1984 -2020, cultivated and vegetation land occupied 68 % to 84%, and 5% to 7% of the total landmass of the woreda respectively. In other ways, grassland, Vegetation (bushes and shrub, small tree), and wetland showed the biggest decline from 1224ha (3%) to 381ha (0.76%), 11785 ha (23%) to 4421ha (8.83%) and 199ha (0.3%) to 104 ha (0.2%) respectively.

As indicated by Gebre and Andualem, (2018) the LULC changes were identified as farmland expansion, fuelwood extraction, and wildfire; being the former a major cause. Consequently, as result demonstrated that there are significant changes in land use and land cover allow making an informed decision which will allow better land use management and environmental conservation interventions. Therefore, the government should limit further expansion of extensive farmland and implement rehabilitation practices of degraded land. Eventually, to ensure the results of this study additional research is required that covers a wide area of the study Woreda. similarly, As indicated by Zeleke Kebebew, (2005) vegetation cover is decreasing attributed to an increase in cropland with the accelerated rate of change, the development of mechanized state farms between 1972 and 1986, and agro-industrial development since1991at accelerated rate of change with its related infrastructures but the collapse of state farm in the valley. Thus, the change is directly related to socio-economic activities, fire, and poor environmental management and is inseparably connected. Therefore, there was a significant loss of vegetation, grassland, and LU/LC map of the study period are shown in table 3 and 4 Maps LULC changes of the study area for the year 1984-2020 below.

Table 3 Land use land cover changes in four periods of from 1984 - 2020

LULC	1984		1996		2008		2020	
	Area (Ha)	%	Area (Ha)	%	Area (Ha)	%	Area (Ha)	%
Cultivated land	33978	68	35646	71	38960.5	78	41857.2	84
Grass land	1487	3	1224	2.45	857	2	381	0.78
Settlement	2609.3	5	2701	5.4	3026	6	3295	7
Vegetation	11785.1	24	10322	21	7082	14	4421.4	9
Wetland	200	0.4	165.4	0.33	133.3	0.3	104	0.21

Source: Satellite Image Data Analysis

Land use/ Land Cover Map of the study area between in (1984-2020)

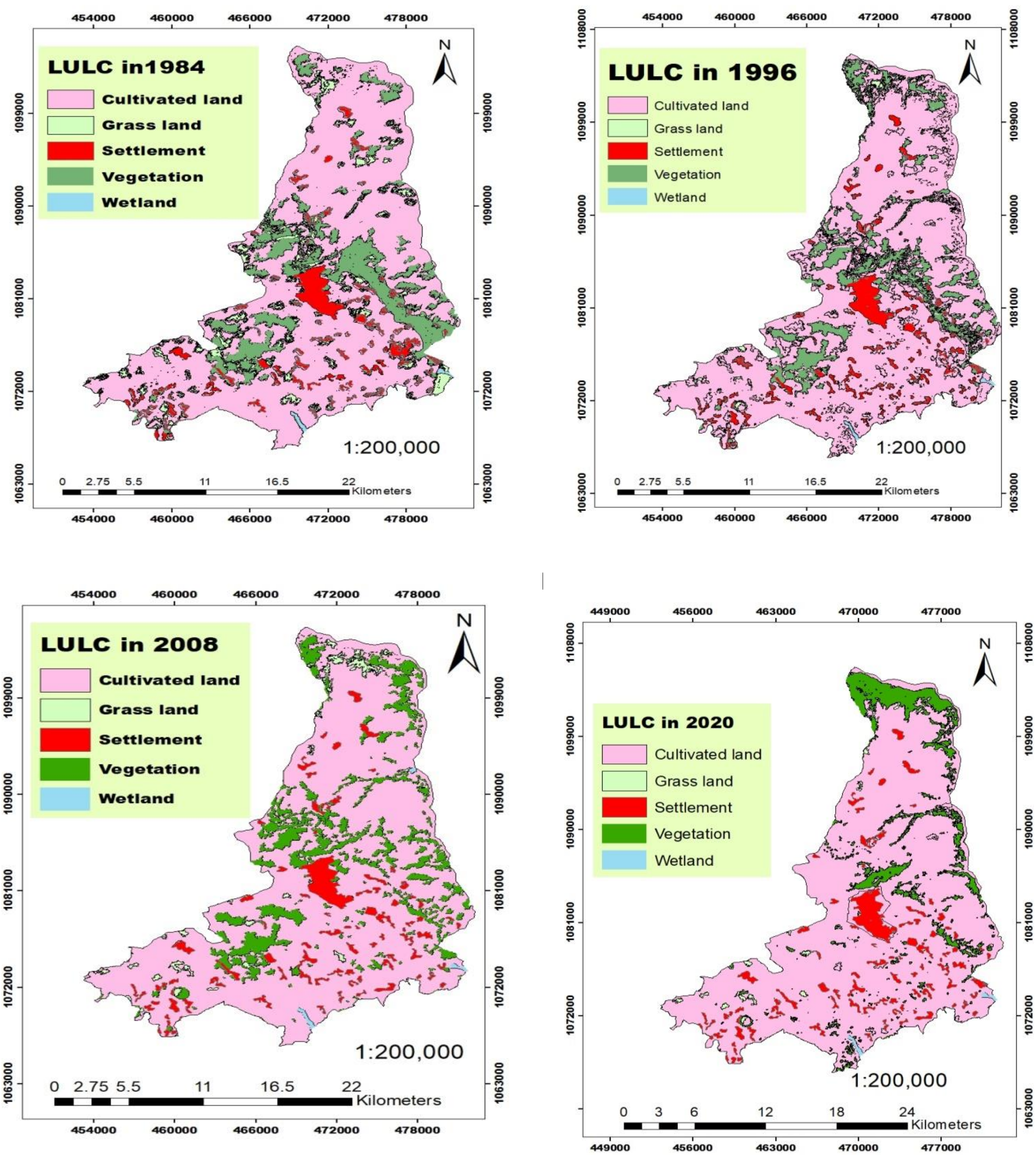


Figure 3 Maps LULC changes of the study area for year 1984-2020

4.3 Land Use /Land Cover over the study period

4.3.1. LULC in 1984

To determine and classify LULC of the study area by using supervised classification; prior knowledge about the area is important. During field observation, five major LULC classes were identified which were cultivated land, grassland settlement, vegetation, and wetland (Figure 4). Based on the supervised image classification of 1984 Landsat, the dominant LULC classes were cultivating and vegetation land as indicated in figure 4 below.

LULC in 1984

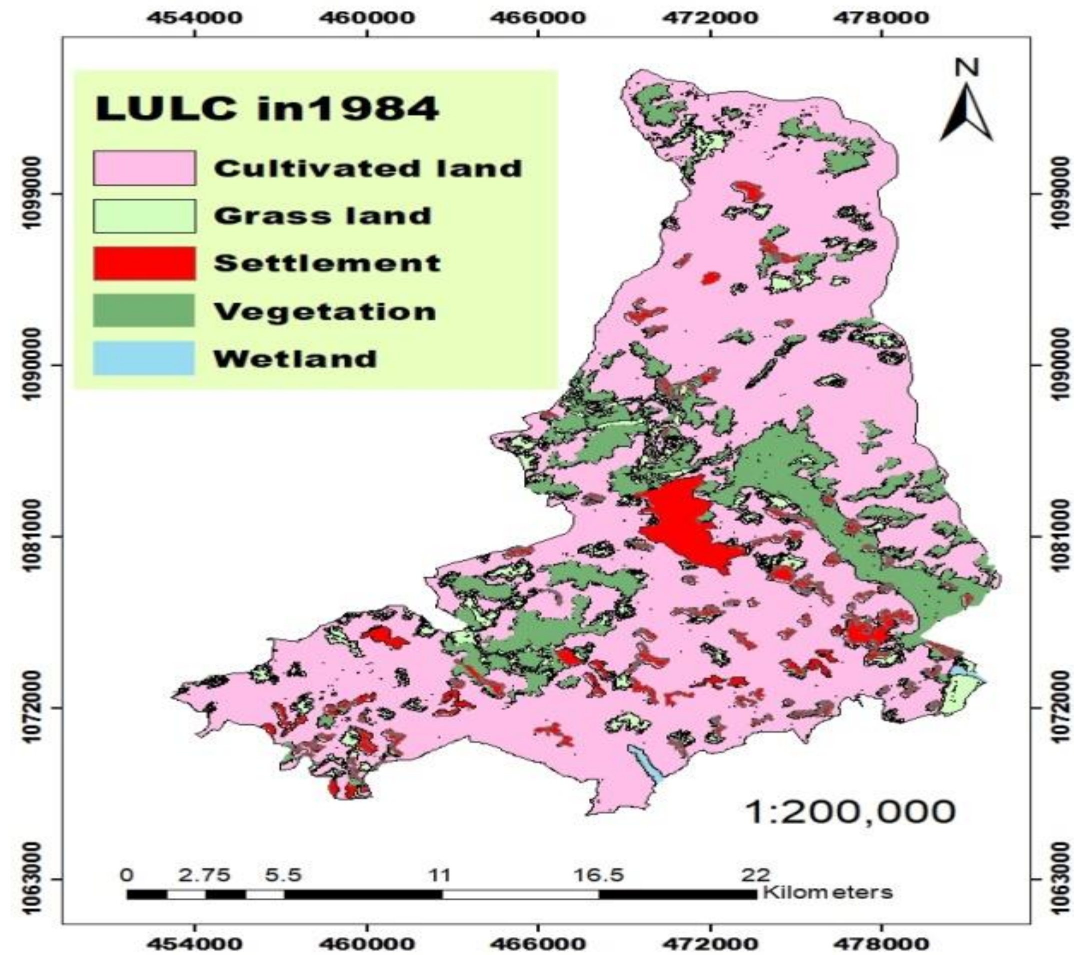


Figure 4 Land use land cover of 1984

Table 4 LULC proportion of the study area of 1984

LULC Class	Year (Period) 1984	
	Area (ha)	%
Cultivated land	33977.53	67.88
Grass land	1487.00	3.00
Settlement	2609.27	5.21
Vegetation	11785.10	23.54
Wetland	199.65	0.40
Grand Total	50058.55	100

As indicated in Table 4 above during the first period of assessment the largest portion of land classification distribution cultivated land. Thus, the majority of LULC in 1984 based on supervised image classification cultivated land during this period 33977.53ha (67.88%) and Vegetation, 11785.10 (23.54%) respectively. Therefore, as a result, show that 91.54% of the total landmass was revealed on cultivated land and Vegetation (bushes and shrubs, small trees) in the study Woreda. likewise, the result was similar to Tadese, (2017) shows that in 2016 cultivated land had the largest areal Coverage (93.06%) was the share of other LULC classes in Ameya Woreda.

In other ways as the result indicated by Miheretu and Yimer, (2018) LULC changes and possibilities for their optimal use are essential for the selection, planning, and implementation of land use schemes to meet the increasing demands for basic human needs and welfare. Hence, there is an urgent need to design and implement appropriate land management options, coupled with population control and designation of protected areas to preserve natural resources in the Gelana sub-watershed of the Northern highlands of Ethiopia.

4.3.2. LULC Classification for 1996

In 1996, five major LULC classes were identified. Figure 5 presents the map of supervised classification of Landsat image of 1996. Again in this period, cultivated land cover the highest percentage of the woreda followed by vegetation.

LULC in 1996

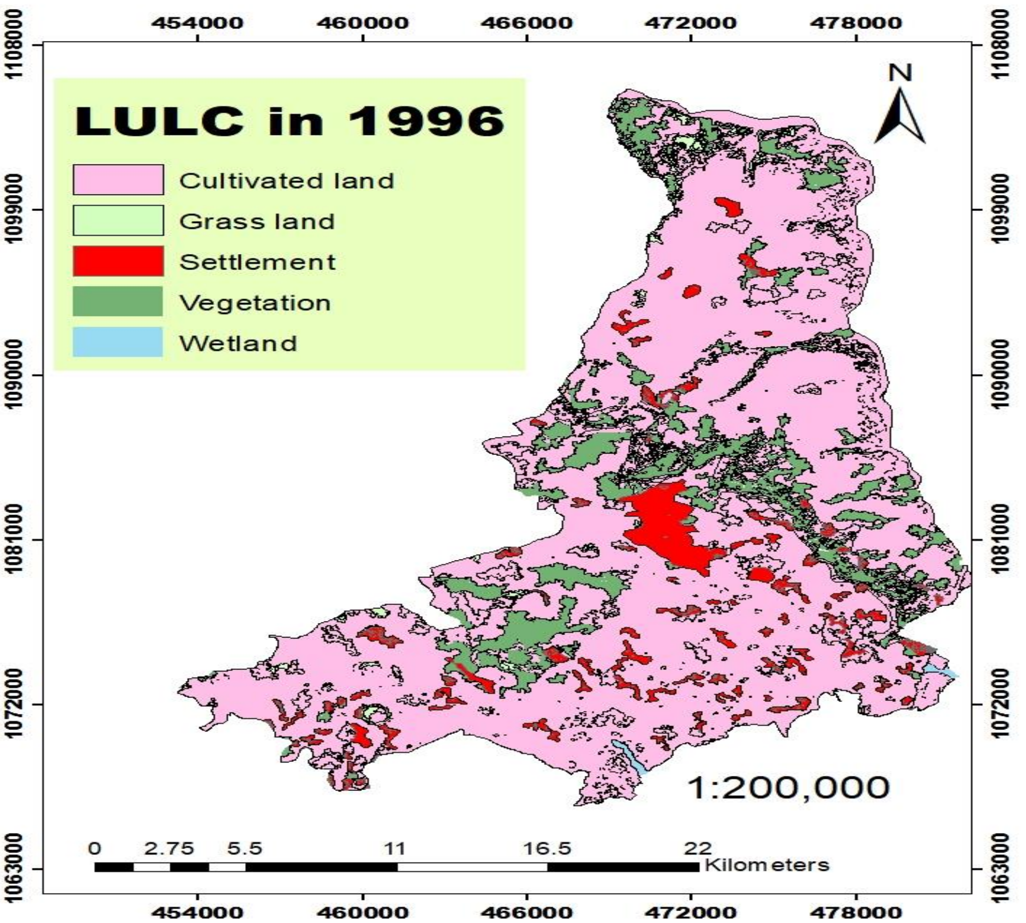


Figure 5 land use land cover of 1996

Table 5 shows the total distribution of each LULC in 1996 based on supervised image classification. As indicated in Table 5 below five major LULC types (cultivated land, grassland, Settlement, vegetation, and wetland) were identified in the study area. Cultivated land has a large proportion that was 35646 ha (71.21%), vegetation Woreda accounts for 10322 ha (20.62%), followed by settlement accounts 2702 ha (5.40%), and grass and wetland 1224.12 ha (2.45%) and 165.38 ha (0.33%) respectively. Similar research indicated by Alemayehu et al., (2016) reported that During the Derge regime, the resettlement policy and villagization policy, which is called “*Sefera"* contributed to the expansion of settlements and agriculture. The other main policy that contributed to the agricultural expansion in the study area during the Derge regime was "Land to Tiller" where privatization of communal lands was carried out. National and regional policies on land use and economic development such as infrastructural development (such as roads and schools, etc.), attaining food self-sufficiency through investment in agriculture are the other factors contributing to LULC change (Alemayehu et al., 2016). A result of lack of proper land use plans is also the policy-related driver of forest and grassland cover change this indicated in table 5 below.

Table 5 LULC classification classes 1996

LULC Class	Year (Period) 1996	
	Area (ha)	%
Cultivated land	35646.04	71.21
Grass land	1224.12	2.45
Settlement	2701.43	5.40
Vegetation	10321. 98	20.62
Wetland	165.38	0.33

4.3.3. LULC classification of 2008

The LULC analysis of 2008 (Figure 6) shows that the majority of the study area was under cultivated land accounting for 38,960.5 ha (78.0%) as revealed in Table 6 below. The LULC classification of 2008 indicated in Table 6 below shows vegetation accounted for 7082 ha (14%), settlement accounted for 3026 ha (6%), whereas, the vegetation cover apparent on 7082 ha(14%) severally. Similarly, in line with, Deribew and Dalacho, (2019) show Agricultural land, forest land, and barren land were the three dynamic LULC varieties dominating gains and losses among themselves and suggesting these changes might be driven by a mixture of biophysical, socio-economic, and policy factors. Thus agricultural land and forest land showed comparably equally magnitude of web modification through time. So the amount of play had conjointly seen a speedy modification in settlement notably settled areas that showed a positive increase. So supported this info tilth, settlements, and vegetation cover showed increment because of growth and mass plantation campaign announced by the government.

LULC in 2008

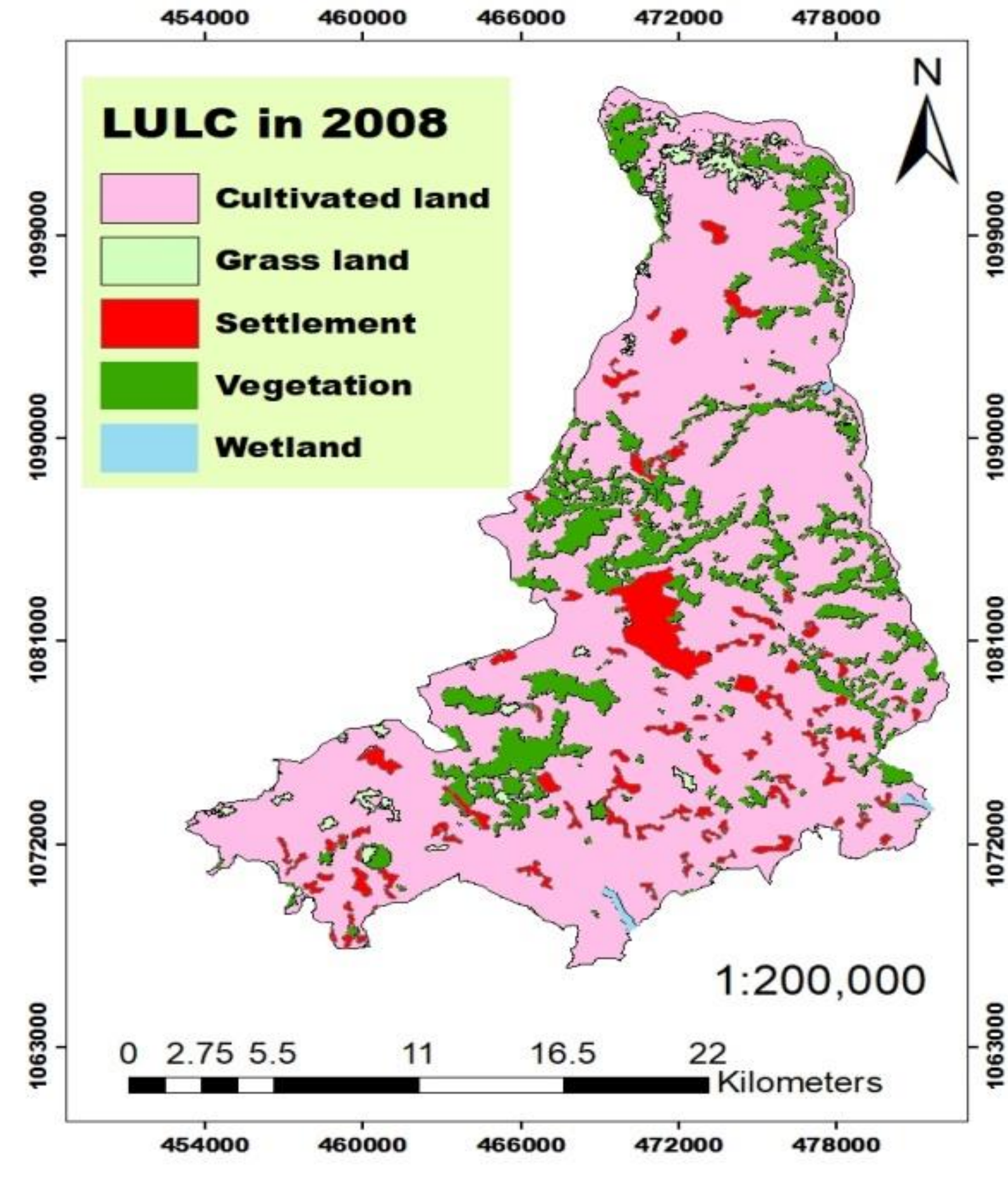


Figure 6 Land use land cover of 2008

In other ways, as a similar study indicated by Bufebo and Elias, (2021) increase in population has implications for natural resources as a result of they have to be compelled to find themselves food, and so the demand for settlement and fuelwood increase in response to growing population desires. In other ways, in which, the shortage of farmland stirred by increase forced the native people to clear forests on steep slopes, which aggravated erosion issues and soil fertility decline in the study area. Consequently, agricultural productivity that determines rural gain levels and wealth is ill with land-use modification. Thus, modification brings land-use modification brings tremendous impacts on agricultural productivity, as indicated in Table 6 as follows.

Table 6 LULC classes of 2008

	Year (Period) 2008	
	Area (ha)	%
Cultivated land	38960.5	78
Grass land	857	2
Settlement	3026	6
Vegetation	7082	14
Wetland	133.3	0.3
Grand Total	50058.55	100

4.3.4. LULC classification of 2020

In 2020, cultivated land and vegetation cover were accounted for 93% of the overall area coverage of the woreda (Figure 7). On the other hand, during the entire study periods starting from 1984 to 2020, the smallest portion of the land in the study area was covered with grassland and wetland as indicated in (Table 9) grassland accounted for 381 ha (0.78%), and wetland 104 ha (0.21%) of the total area of Girar Jarso Woreda in the years 2020 respectively.

A similar study result indicated, by Wubie, et al., (2016) Population pressure, demand for fuelwood and construction material, agricultural expansion policy, and the insecurity of the mandate in possession were the main driving forces behind the change of use/land cover. Therefore, environmental and local livelihoods implications such as lake water and its aquatic resources and soil degradation, biodiversity loss, and forest cover decline have resulted from the changes.changes.

LULC in 2020

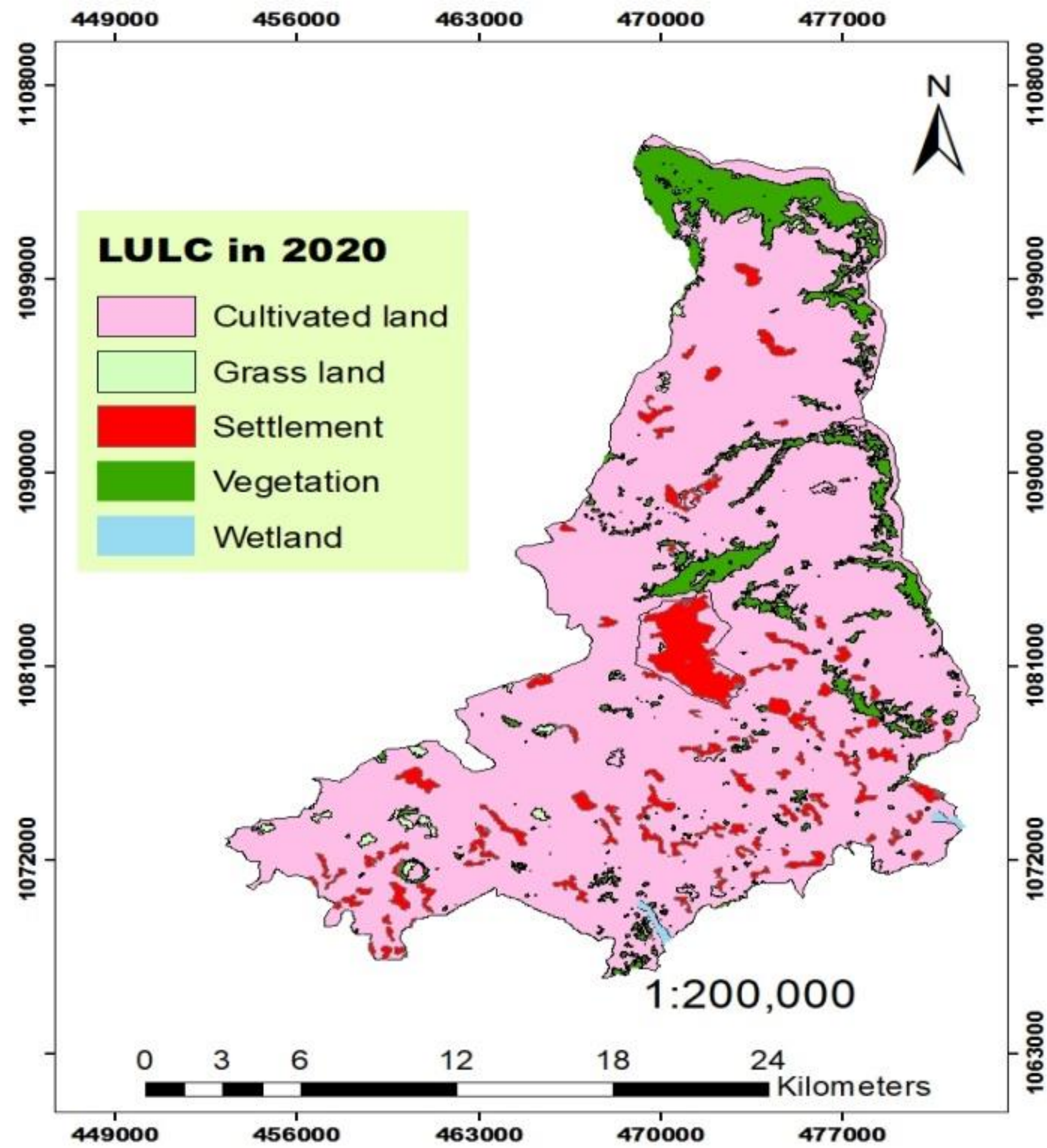


Figure 7 Land use land cover of 2020

On the other hand, the results of the study showed that cultivated land increased from 68% in 1984 to 84 % and settlements lands from 5% in 1984 to 7% in 2020. But, vegetation land was decreased from 24% in 1984 to 9% in 2020. This kind of alteration could be at the expense of grasslands, scrublands, and forest lands. So, the main driving forces are population growth, agricultural land expansion, and low rainfall, which in turn aggravated the food security problems. Hence land degradation, rural-urban migration, farmland fragmentation, climate change, crop yield reduction, and soil erosion are also identified as major underlay cause implications of LULC in Girar Jarso woreda.

A different study shows that LULC detection analysis revealed that the increase of settlement covers observed in the study area took place under cultivated lands. The result was similar to (Birhan Asmame and Assefa Abegaz 2017; Gasha, A., 2019), reported that increased rural settlement land due to increasing population pressure in Gelana sub-watershed of North of highlands of Ethiopia. Therefore, a result indicated in table 7 below cultivated land changed to settlement due to population pressures on farmlands in the study woreda.

Table 7 LULC classes of 2020

LULC Classes	Year (Period) 2020	
	Area (Ha)	%
Cultivated land	41857.2	84
Grass land	381	0.78
Settlement	3295	7
Vegetation	4421.4	9
Wetland	104	0.21

4.4. LULC change detection Analysis (1984 to 2020)

As LULC analysis indicated cultivated land covers 68% of the total landmass of the woreda in 1984 while in 2020 it occupied 84% of the total area of the woreda (Table 3). The cultivated land has increased from time to time and, it occupied 78% and 84% of the total landmass of the woreda in 2008 and 2020, respectively.

A similar settlement also showed a large increment with the 36 years from 1984 to 2020, which means settlement accounts for 5% in 1984 and increased to 7% in 2020 from the total landmass of the study area as indicated in table 3 above.

The LULC change analysis between 1984 and 2020 indicated that grassland, vegetation, and wetlands dramatically decreased. Grassland decreased from 1487 hectares in 1984 to 1224 hectares in 1996 and further decreased to 381 in 2020. Similarly, vegetation was reduced in size from 11785.1 ha to 10322 ha between 1984 and 1996 and natural vegetation further decreased to 4421.4 ha in 2020. However, as reported from the discussion and interview with focus groups and key informants the home garden agroforestry increased the vegetation coverage over time. Accordingly wetland also decreased from 200 ha (0.4%) to 104ha (0.21%) 1984 and 2020 respectively. thus as stated by focus group discussion and key informants the high reduction of vegetation(bushes and shrub, small tree) between 1984 and 2020 followed the revelation change of the Durg regime. Therefore, period of 1996 illegal settlements from different parts of the country participating was involved vegetation deforestation the new government was not experienced in change protecting the natural resources of the study area.so LULC change between 1984 and 2020 dramatically change to bare land and loss of soil fertility as indicated in graph 4 below.

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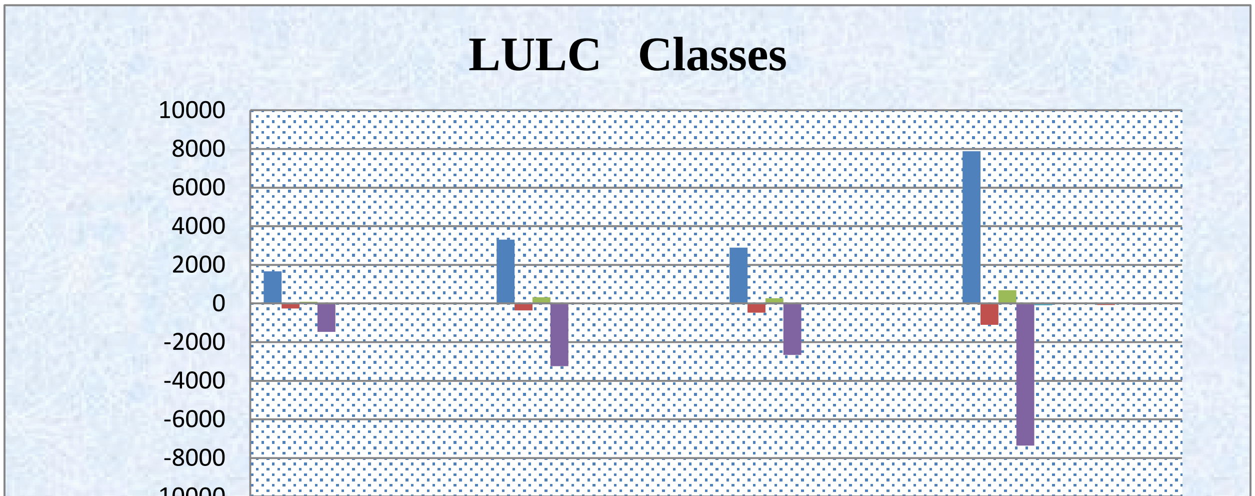
Accordingly wetland also decreased from 200 ha (0.4%) to 104ha (0.21%) 1984 and 2020 respectively. thus as stated by focus group discussion and key informants the high reduction of vegetation (bushes and shrub, small tree) between 1984 and 2020 followed the revelation change of the Durg regime. Therefore, period 1996 illegal settlements from different parts of the country participating were involved vegetation deforestation the new government was not experienced in change protecting the natural resources of the study area.so LULC change between 1984 and 2020 dramatically change to bare land and loss of soil fertility as indicated in graph 4 below.

Land-use/land-cover distribution and changes during the period 1984 to 2020



	1984-1996 Area (Ha)	%	1996-2008 Area (Ha)	%	2008-2020 Area(Ha)	%	1984-2020 Area (Ha)	%
Cultivated land	1668	4.9	3314.5	9.75	2896.7	8.52	7879.2	23.18
Grass land	-263	-18	-367	-24.6	-476	-32	-1106	-74.3
Settlements	91.7	3.5	325	12.45	269	10.3	685.1	26.25
Vegetation	-1463.1	-12.4	-3240	-27.5	-2660.6	-22.56	-7363.7	-62.48
Wetland	-34.6	-17.3	-32.1	-16.05	-29.3	-14.65	-96	-48

Graph 2 the trend of LULC change in the study area.

4.4.1 Land Use and Land Covers Change Rate between periods (1984-2020)

The LULC detection result shows that from 1984 between 1996, cultivated land and settlement increased by 1668 ha and 92 ha. However, grassland, vegetation, and wetland declined by 263, 1463, and 35 hectares, respectively. As the information obtained from the key informant interview cultivated land and settlements were increased in this period due to high population pressures on farmland, vegetation (bushes and shrub, small tree), and grassland in the study Woreda.

Therefore, an increase in cultivated and settlement areas caused a substantial reduction in the area of vegetation and grazing land in the study area as indicated in table 8 below.

In other ways, the poor land management practice system also has an impact on the LULC change rate within the study Woreda. As indicated by Girar Jarso Woreda's agricultural office, the LULC management implementations practice was not exercised (limited). In other ways as indicated by Lambin et al., (2001), the common understanding of the causes of land use and land cover change is dominated by simplifications which, in turn, underlie many environmental development policies. Therefore, this article also follows some of the major myths about the forces driving land cover change and Offers alternative pathways for change that is better supported by evidence from case studies.

Hence, the large conversion of vegetation and grasslands to agricultural land and settlements within the study area will need a profound impact on biodiversity and ecosystem services, soil degradation, and changes in the local hydrological condition indicated in table 8 below.

Table 8 LULC Between (1984- 2020) rate of change

	Area (Ha)	**%**	**Area (Ha)**	**%**	**Area(Ha)**	**%**	**Area (Ha)**	**%**
	1984-1996		**1996-2008**		**2008-2020**		**1984-2020**	
Cultivated land	1668	4.9	3314.5	9.75	2896.7	8.52	7879.2	23.18
Grass land	-263	-18	-367	-24.6	-476	-32	-1106	-74.3
Settlements	91.7	3.5	325	12.45	269	10.3	685.1	26.25
Vegetation	-1463	-12.4	-3240	-27.5	-2661.	-22.56	-7364	-62.48
Wetland	-34.6	-17.3	-32.1	-16.05	-29.3	-14.65	-96	-48

Source:-Satellite GIS analysis result

According to table 8 from 1996 to 2008 similar to the first period cultivated land increased by 3314.5 hectares and settlement increased by 325 hectares respectively. This implies farmland has been extensively increased at the expense of grazing land, vegetation (bushes and shrub, small tree) lands. This is due to increased demand because of population growth, additional farmland is required to full fill food demand. As a result of an extensive expansion of cultivated land (23.18%), have negatively contributed to the decrease of grassland, vegetation (bushes, and shrub, small tree), and wetland, that were affect that; -24.6, -27.5, and -16.05 % respectively in the last 36 years. Due to the ever-increasing of cultivated land farmers were exerting pressure on the forest, bushes/shrubs, grazing, and wetland resulting in further accelerated erosion and degradation.

According, to the Change detection analysis formula, was conducted using post classification image comparison technique. Consequently, changes in land use/ cover between 1984-1996, 1996-2008, 2008-2020, and 1984-2020 were compared using the post-classification result indicated in table 9 below. As indicated in the table grassland, vegetation cover and wetland has been declining since year 1984 to 2020 sequentially; 3%, 24%, 0.4%, for 1984; 2.45%, 21%, 0.33% for 1996; 2. %, 14%, 0.26% for 2020; and 0.78%, 9%, 0.21% for 2020 grassland, vegetation and wetland diminished respectively. Thus grassland, vegetation, and wetland cover types in the study area were highly converted throughout the study period. On other ways, from1984-2020 change in present grassland, vegetation, and wetland decline at an alarming rate; in order to-2.22,-15,-0.19 respectively. While, from 1984-2020 grassland, vegetation, and wetland shrunk at annual rates of -0.061, -0.416, and- 0.005 with corresponding change whereas, with the same fashion cultivated land and settlement areas highly expanded at an annual rate of 0.44 and 0.05 changes respectively. As indicated, table are showing an area distribution of land cover and land use classes and also provide information about what proportion of each cover and use types changed into other cover classes in the forthcoming time reflection. The area of %, change of %, and rate change in% per year are indicated in table 9 below.

Table 9 Land use/ land covers class and change rate (1984-2020)

LULCS	**Area in%**				**Change in %**				**Rate of Change in %/Year**			
	1984	1996	2008	2020	1984 to 1996	1996 to 2008	2008 to 2020	1984 to 2020	1984 to 1996	1996 to 2008	2008 to 2020	1984 to 2020
Cultivated land	68	71	78	84	3	3.8	5	16	0.375	0.42	1.25	0.44
Grass land	3	2.45	2	0.78	-0.6	-0.1	-0.62	-2.22	-0.068	-0.011	-0.155	-0.061
Settlement	5	5.4	6.04	7	0.4	0.29	0.96	2	0.05	0.0322	0.24	0.05
Vegetation	24	21	14	9	-3	-4	-4	-15	-0.375	-0.444	-0.25	-0.416
Wetland	0.4	0.33	0.26	0.21	-0.1	-0.02	-0.001	-0.19	-0.009	-0.002	-0.0003	-0.005

Source:-Satellite GIS analysis result

4.4.2 Accuracy assessment of 1984 to 2020 images analysis

The accuracy is alive of what number ground truth pixels were classified properly. Remote sensing is extraordinarily necessary for the assembly of Land Use / Land cover maps which can be done through some way called image classification (Rwanga et al., 2017). As the result of the accuracy, the assessment provides North American countries with an associate overall accuracy of the map supported a median of the accuracies for every category within the map. Once the classified image is integrated into a GIS, accuracy assessment ought to be processed because it limits the classification results of remotely perceived imagination information.

Based on post-classification from 1984 to 2020 the land was a lot enlarged to the land that was coated by vegetation (bushes and shrub, small tree), grassland, and wetland. In alternative ways that, the settlement conjointly equally enlarged to vegetation land, grassland, and wetland.

In keeping with an attention cluster, discussion and key informant of the study area as they targeted in their discussion points advice that enormous cover water skim was dry in last 36 years follows forest gradation and expansions of farmlands as growth from time to time in study Woreda. This showed was there is a pointy decrease within the land during this amount which fits agricultural land and settlements.

The accuracy assessment during this project was created persecution the initial pictures and elders UN agency board the study area for 1984, 1996, 2008 and, field observation and Google Earth image used for the 2020 study amount. Hence, LULC maps from remotely perceived imageries might contain some errors; accuracy assessment was used to seek out those errors later on to confirm the dependableness of created LULC maps. Therefore, the classified maps were assessed associated compared with reference information and ground truth victimization miscalculation matrix and show the overall results of the tabular error matrix. The overall accuracy for four LULC classification reference years; 1984, 1996, 2008, and 2020 indicated in (table 10) the study was 89%, 88%,90.57%, and 91% for the several years, whereas, kappa coefficients or statics of 0.8458, 0.8382, 0.8709 and 0.8796 respectively.

This implies classification with an associate overall accuracy of the reference years evident between the intervals of 12, 12, 12, and 36 and kappa coefficients statistics during the study period the minimum and maximum lies between 88 and 91% respectively. As a result, the worth indicated a sensible accuracy agreement in keeping with the accuracy classification normal standards. Therefore, the kappa coefficients statistics price bigger than 0.80 (80%) represents a powerful agreement and a worth between 0.60 and 0.80 represents a considerable agreement (Landis and Koch, 1977; as cited Tulu, 2017). Moreover, as Rwanga and Ndambuki,(2017) rumored the theoretical confusion matrix (error matrix) of a LULC classification classification.

Table 10 accuracy assessment LULC map of 1984 to 2020

1984		**Ground truth**						
Classified image	**LULC types**	Cultivated land	Grass land	Settlement	Vegetation	Wetland	User accuracy	Kappa Coefficient
	Cultivated land	18	1	0	2	0	21	**84.58%**
	Grass land	1	6	0	1	0	8	
	Settlement	0	0	11	1	0	12	
	Vegetation	1	0	0	18	0	19	
	Wetland	0	0	0	0	2	2	
	Total (Producer)	20	7	11	22	2	62	
	Overall accuracy					**89%**		
1996		**Ground truth**						
Classified image	**LULC types**	Cultivated land	Grass land	Settlement	Vegetation	Wetland	User accuracy	Kappa Coefficient
	Cultivated land	20	1	0	1	0	22	**83.82%**
	Grass land	1	11	0	1	0	13	
	Settlement	0	1	8	1	0	10	
	Vegetation	1	0	1	18	0	20	
	Wetland	0	0	0	0	2	2	
	Total (Producer)	22	13	9	21	2	67	
	Overall accuracy					**88%**		
2008		**Ground truth**						
Classified image	**LULC types**	Cultivated land	Grass land	Settlement	Vegetation	Wetland	User accuracy	Kappa Coefficient
	Cultivated land	15	1	1	0	0	17	**87.09%**
	Grass land	0	10	0	1	0	11	
	Settlement	0	0	7	1	0	8	
	Vegetation	1	0	0	13	0	14	
	Wetland	0	0	0	0	3	3	
	Total (Producer)	16	11	8	15	3	53	
	Overall accuracy						**90.57%**	
2020		**Ground truth**						
Classif	**LULC types**	Cultivated land	Grass land	Settlement	Vegetation	Wetland	User accurac	Kappa Coefficient

							y	
	Cultivated land	14	0	1	1	0	16	
	Grass land	0	5	0	1	0	6	
	Settlement	1	0	14	0	0	15	
	Vegetation	0	1	0	16	0	17	**87.96%**
	Wetland	0	0	0	0	2	2	
	Total (Producer)	15	6	15	18	2	56	
	Overall accuracy						**91%**	

4.5 The major driving force of LULC change analysis

The LULC was caused by different causative factors which may lead to permanent environmental problems and natural resource degradation. Looking at the driving forces of LULC change is very crucial in addressing the constraints. Subsequently, change in land use and land cover is the reflection of the socio-economic condition of the surrounding community. So, LULC change is the outcome of numerous driving forces that command certain environmental, social, and economic conditions. Likewise, the driving forces can be influenced by social outlooks and practices like local culture, economic and financial elements. Hence, the state of the environment as the quality of the earth, the topography, the availability of water, the current land policy, and development plans. Human actions and natural processes are responsible factors for LULC change in the study Woreda. As a result, LULC change was always caused by multiple interacting factors with the mix of driving forces of land-use change varying in time and space according to specific human-environment conditions (Martin, J.R., 2017).

However, LULC change was observed numerous of worldwide, there's different rationally in the country specifically within the study area. These were is indicate that the foremost important driving forces for the depletion of rural land use managements practice components include ground expansion; mitigation through applying modern agricultural practice supported productivities and production with implementation of rural LULC changes policy and control the expansions of cultivating farmland. These factors come mainly from human-induced activities (Harden 2014), although natural factors such as eruptions, earthquakes, landslides, and climatic events can also contribute to substantial changes on the planet Earth. Therefore, many conditions were identified as important points before discussing the results of the underlying causes of the change in LULC to link the result to the underlying facts were discussed with the FGDS and key informants. How, respondents answered that population growth, informal settlements, land scarcity, extraction of firewood, expansion of new farmland, lack of additional job opportunity, poor soil fertility, soil erosion, environmental degradation, and poor production and productivity were the main cause driving factors of LULC change identified in the study area.

In other ways, as indicated by Ewunetu, et al., (2021) they are also consistent with root causes that include population growth, land tenure, common property rights, persistent poverty, weak enforcement of rules, low levels of extension services, a lack of public awareness, and poor infrastructure. Thus, the drivers for LULC should be controlled, and sustainable resources use is required. Similarly, focus group discussions were conducted with elders where the causes of LULC changes in Girar Jarso woreda are; population pressure, expansion of agricultural land, demand for fuelwood and construction materials, and absence of natural resource policy enforcement.

4.5. 1 Population pressure

An increasing rate of population growth is among the major causes of land degradation in Ethiopia. This is because the increasing population leads to dense population and inappropriate farming practices combined with intensive rain and rugged topography intensified land degradation problems in the country. The high population growth made steep fragile areas be included in cultivation, thus accelerating the rate of soil erosion (Birhanu and Meseret, 2013).

As the population size increased from time to time the demand for agricultural land was increased. Because the majority of Woreda's population are earning their living through agriculture.

> "According to the key informants for last 36 years ago, there was enough cultivated land because the population number at that time was not many compared with the present time (Personal interview, 30 March 7:40 PM 2021)." nevertheless, nowadays due to rapid population growth and immigrants from different parts of the county to these Woreda, there is the scarcity of farming land and grasslands" (Girar Jarso Woreda Agricultural Experts).

Population pressure disturbs the traditional systems of land use in a given area and this negatively affects the local population and their environment. Hence, it additionally will increase the demand for biomass as a supply of fuelwood increases. it affects, deforestation and loss of soil fertility.

In other ways, as FGD population growth was the main indication for land scarcity leading to non-availability of off-farm activities was the cause's factor. On the other hand, the related issue which respondents responded that land productivity was declining from time to time in their localities. Thus, regarding the underlying causes of LULC change, a majority of the respondents replied that the cause was population growth and land tenure insecurity right factors identified in the study area. Furthermore, the Oromia Plan and Economic Development Commission population projection (2013), indicating the total population is approximately estimated at around 146,086 people live in Girar Jarso Woreda. Hence, this showed that there was a high population growth rate from time to time. Therefore, as the population increased demand for land for agriculture and construction has also significantly increased.

Figure 8 FGD with elders in Girar Jarso Woreda (photo by Author)

4.5.2 Expansion of Farm Land

According to, Hailu et al. (2015) show that since the start of the last century, the population of the Federal Democratic Republic of Ethiopia has exaggerated drastically with massive effects on the natural vegetation and diverseness. However, the initial land cover patterns in the Federal Democratic Republic of Ethiopia haven't been exactly mapped, which hinders the identification of the biophysical and socio-economic factors that contributed to the present landscape patterns.

Thus, on the result from the amendment detection matrix of LULC and then the enlargement of farmland of very cheap and concretion at intervals the plot of land and vegetation was determined as a result of the foremost issue for the depletion of land use /land cover amendment elements. Supported the amendment detection matrix of LULC122.24 pointed distance plot of land and 54.69 ha vegetation amendment elements have modified to land between 1984 and 2020 i.e. an amount as indicated table 15 around 40 years in the study area.

Figure 9 Expansion of farm land in Girar Jarso woreda (photo by Author)

> "According to focus group discussion of the study expansion of agricultural land, one altogether the foremost causes of LULC change within the study area is principally caused by ascension, lack of job opportunity in the non-agricultural sector, lack of up to date agricultural practices, rural land us policy implications problem, loss of soil fertility, lack of rural finance, lack of irrigation farm, absence of crop rotation thanks to the short size of farmland, land slid lack and lack awareness among to area people (interview, 30 March 7:40 PM 2021)."

Therefore, as the results of LULC change analysis indicated, the expansions of the farm have also occurred within the inner part of grassland and vegetation indicating the misuse of rural land management practices. Therefore, just in case, expansion of agricultural practices woreda negatively affects the natural environment in some ways like land conversion (vegetation land to through deforestation (See Figure: 4.3) grassland to cultivated land and wetland to cultivated land). Consequently, these significant problems caused deforestation, eroding, and climatic change decreases the degree of water, soil infertility, extinction of untamed animals, and natural forest.

Moreover, the effects of land use/land cover change in study Woreda led to deforestation of natural resources for agricultural expansion, construction, and source of energy (firewood and charcoal). In response to high demand for agricultural lands; woodlands, grazing lands, protected areas, and mountainous areas of the woreda were converted to agricultural lands. This implies as there was swift LULC change over time.

When the overall LULC change of the woreda is remarked, there is the intense expansion of agricultural lands and residential areas. In contrast, the coverage of forests, woodland, grassland, and wetland is decreasing at an alarming rate. Population growth is also accompanied by mismanagement of resources that are aggravating land degradation. Reasonably, sloppy areas are not recommended for agriculture and residence. Practically such land uses are being used for unintended purposes.

4.5.3 The Demand for Fuel Wood and Construction Materials

The use of wood charcoal as a source of heat and cooking food has accounted for thousands of years (Jones, B., 2015). Even in the current renewable and alternative energy potential, the demand and use of charcoal have remained in extreme increase due to its relatively cheap price than kerosene, relatively low smoke, labor-intensive and time-consuming than collecting fuelwood and its content of energy twice the wood it was made of. It is also being used as a backup for other sources of energy (Katie M. Preston, 2012). Thus, the dependency of the world population on the use of charcoal for their day to day life activities has a significant impact on the environment, economic health, and even the survival of human beings by disturbing the balance of nature through the emission of greenhouse gases (carbon dioxide and methane) released in the process of charcoal production and use. The use of charcoal as a source of energy is more prevalent in developing countries as there is low access to modern electrification (Katie M. Preston, 2012). Consequently, many people in the Woreda use firewood and charcoal as a source of income they sell it out to their neighbors in the rural areas and for urban dwellers. Moreover, the demand for fuelwood and construction materials was the cumulative effect of this is leading to further demand land to fulfill the demand for food of survival food. Meanwhile, it intense loss of quality of soil, lower fertility, and lower productivity followed by a vicious circle of poverty. Therefore to alleviate these problems it needs to the reduction of population growth and strengthen land management policy.

4.5.4 Absence of natural resource policy enforcement

As indicated by Gessesse and Bewket, (2014), Changes in LULC are driven by a combination of immediate and underlying factors such as economic, demographic, biophysical, and institutional factors. Besides these, bare land expansion, increased surface runoff production, and soil erosion are major environmental damages partly attributed to LULC dynamics in the study woreda. Therefore, environmental degradation processes have adverse impacts on local agricultural productivity, water resource availability, and the food security of communities.

Accordingly, the lack of an effective land-use policy and poor natural resource management was intensified as the main cause of land degradation and climatic changes. Hence, this leads to high environmental degradation, deforestation, poor agricultural production and productivity, loss of plants and animal species, shortage of water and animal feed in study woreda. While the local community in the study area is faced with a host of social, economic, and institutional challenges which need to be properly addressed in seeking solutions to the problems of different underlying causes of land use/ land cover changes. Therefore, policy responses are needed for integrated natural resource management and livelihood sustainability in the study area.

4.6 Conversion matrix for the year 1984 - 2020

According to, Al-Saady et al., (2015) show that different remote sensing and GIS techniques were applied, such as digital image processing using supervised classification and image indices. Hence, supervised classification using a maximum likelihood algorithm was only applied on the Landsat 8 OLI data to classify the LULC map. Thus, the classified image was modified with the help of image indices and visual interpretation to produce a more accurate map.

Therefore, to analyse and extract information from these LULC change matrices, the following points should be taken into consideration: first, the land cover and land use-value are presented in square hectares. The second one is each column gives the cover and use type in the recent years and the thirds of each row values indicate the cover and use types for the previous years. Finally, in the change matrix, the value above and below the diagonal lines represent a change in LCLU. So, in contrast, the value along the diagonal line represents where no change has occurred as indicated in table 11 below.

Based on these, the LULC change matrix had been generated based on 1984, 1996, 2008, and 2020 satellite image interpretations and presented in tables 11, 12, and 13. These tables are showing an area distribution of land cover and land use classes and also provide information about what proportion of each cover and use types changed into other cover classes in the forthcoming time reflection.

Table 11 LULC changes matrix for the year 1884- 1996

LU/ LC Classes		**1996** Cultivated land	Grass land	Settlement	Vegetation	Wetland	**Grand Total**
1984	Cultivated land	**2825.19**	361.30	118.89	1013.22	41.73	4360.33
	Grass land	26235.48	**944.35**	706.93	5690.34	67.62	33644.71
	Settlement	1309.65	74.50	**1565.09**	306.49	8.57	3264.30
	Vegetation	3598.28	81.12	125.19	**4851.00**	37.54	8693.14
	Wetland	12.72	0.00	0.00	28.74	**54.61**	96.07
	Grand Total	33981.31	1461.27	2516.11	11889.80	210.06	50058.55

Source: Land use/cover classification maps of 1984 and 1996

As a result, the LULC matrix analysis was presented under table 11 above the diagonal lines representing a change in land cover and use. In the study period between 1984 and 1996, the change in the LULC was enlarged attributed to the expansion of the cultivated land area.

This class has expanded at the disbursement of grassland (26235.48 ha), Settlement (1309.65ha), Vegetation (3598.28ha), and wetland (12.72ha). There was also a significant change of grassland and vegetation to cultivated land in this period 361.30 ha and 81.12 ha respectively. Therefore there is a sharp decrease in grassland and vegetation cover in this period which goes to cultivated land and settlements as indicated in table 12 below.

Table 12 LULC changes conversion for the year 1996-2020

LU/ LC Classes		**2020** Cultivated land	Grass land	Settlement	Vegetation	Wetland	**Grand Total**
1996	Cultivated land	**3962.28**	0.00	0.01	431.34	0.00	4393.64

	Grass land	30967.69	**391.21**	0.07	2306.02	0.00	33664.99
	Settlement	0.11	0.00	**3259.78**	0.00	0.00	3259.89
	Vegetation	6950.30	0.01	0.03	**1685.63**	0.00	8635.96
	Wetland	0.01	0.00	0.00	0.00	**104.06**	104.07
	Grand Total	41880.37	391.22	3259.89	4423.00	104.07	50058.55

Source: Land use/cover classification maps of 1996 and 2020

According to the above Table 12 above conversion matrix for the year 1996-2020, the change in the land use/ land cover in the study area was by increase attributed to the expansion of grassland (30967.69 ha) and vegetation (6950.30 ha). In other ways, the LULC a remained unchanged and value along the diagonal indicated in table 12 no change was observed during the study periods.

Table 13 LULC changes conversion matrix for the year 1984-2020

LU/ LC Classes		**2020**					
		Cultivated land	Grass land	Settlement	Vegetation	Wetland	**Grand Total**
1984	Cultivated land	**29998.60**	122.24	1297.09	2493.46	12.73	33924.12
	Grass land	1056.50	**205.98**	71.61	393.82	0.00	1727.90
	Settlement	980.71	2.15	**1560.73**	3.52	0.00	2547.11
	Vegetation	9748.41	54.69	298.05	**1529.38**	28.72	11659.25
	Wetland	138.22	0.00	6.47	2.46	**53.01**	200.17
	Grand Total	41922.45	385.06	3233.95	4422.63	94.46	50058.55

Source: Land use/cover classification maps of 1984 and 2020

According to table 13 conversion matrixes for the year 1984 - 2020, the change in the use/ land cover in the study area was by enlarging attributed to the expansion of the cultivated land area. This class has expanded at the expense of grassland (1056.50 ha), settlement (980.71 ha), vegetation (9748.41ha), and wetland (138.22 ha). There was also a significant change of cultivated land to grassland and vegetation in this period in 122.24 ha and 54.69 ha respectively. Therefore, cultivated showed an increment in this period which mainly attributed to the change of grass and vegetation to cultivated land.

CHAPTER FIVE

5. Conclusion and Recommendations

5.1 Conclusion

Local LULC is a fundamental agent of global climate change at all scales and was a significant force that impact biodiversity, water and radiation budgets, and trace gas emissions. At local and regional scales, LULC change can have reflective impacts on aquatic systems to understand of LULC change is of fundamental importance to lead to sustainable development and to define natural resource management strategies. To contribute to the country's development by identifying the major problems of LULC changes was conducted on dynamics of land use/ land cover change analysis using GIS and Remote sensing techniques which occurred within the period ranges 1984 - 2020 G.C in Girar Jarso Woreda.

The LULC change during 36 years was evaluated from four Landsat satellite images the extent and trend of LULC changes were shown. To understand the possible causes of LULC of the area and address issues that enhance LULC, in addition, biophysical and socio-economic situations of the area were assessed through secondary data collection.

As, the general objective of this research aims to dynamic land use/ land cover change, focusing on the trend, the rate, extent, and distribution of various land use and cover changes. Hence, the major change that happened on LU/LC analyses and posts classification techniques for LU/LC change detection was supported with interviews and focus group discussion. Based on these, the LULC pattern of change observed on the five classes of land use land cover has shown different trends and magnitude in four different periods. So, from, 1984 to 1996, 1996 to 2008, 2008 to 2020, and from 1984 to 2020 comparisons had been made to understand the land use land cover change.

Accordingly, Settlement land was expanded and cultivation land was increased throughout the four periods with different patterns, trends, and magnitude. Grassland, vegetation (bushes and shrubs, small trees), and wetland were alarmingly decreased throughout the four consecutive periods.

As, a result of the study indicated that topography, vegetation cover, population growth purpose, expansion of farmland, demand for fuelwood and construction materials increase, absence of natural resource policy enforcement of land use, and lack of awareness shown as main factors that indicated that cultivated land has increased from time to time and, it occupied 79% and 84% of the total landmass of the woreda in 2008 and 2020.

A similar settlement also showed a large increment with the 36 years from 1984 to 2020, which means settlement accounts for 5% in 1984 and increased to 7% in 2020. On the other ways, a result of the LULC change analysis between 1984 and 2020 indicated that grassland, vegetation (bushes and shrub, small tree), and wetlands dramatically decreased.

Subsequently, change in LULC is the reflection of the socio-economic condition of the surrounding community. Likewise, LULC change is the outcome of numerous driving forces that command certain environmental, social, and economic conditions. Similarly, the driving forces can be influenced by social outlooks and practices like local culture, economic and financial elements. As result of the study revealed that observed LULC is caused by population pressure and the expansion of agricultural land. Therefore, birth control methods and Environmental education emphasizing the economic and environmental role of the LULC change correlating its long term promising survival importance to those communities and with a green economy policy of Government should be planned and implemented based on common consensus with the community.

Generally, LULC in Girar Jarso Woreda was mostly accelerated by, Population growth disturbs the traditional systems of land use in a given area and this negatively affects the local population and their environment. Hence, it additionally will increase the demand for biomass as a supply of fuelwood, Therefore, resulted in deforestation and loss of soil fertility which can affect human, plants, and animal life.

5.2 Recommendation

The determined LULC square measure was caused by population pressure and also the growth of agricultural land. As a result, there are not enough land management plans and measures to fulfill the food wants of the speedily growing population. Therefore, its value linking food security policies with property land management policies implemented as a result of they are closely connected. It conjointly recommends the decentralization of responsibilities and money resources to farmers and native governments to improve their food security. This decentralization will promote full access to data regarding agricultural resources, land management, and food security services. Therefore, to rehabilitate the degraded part of LULC changes comfort this human influence and for future land management practices on a property basis, the subsequent recommendations forwarded:

1. Environmental education emphasizes economic development on behalf of the accelerated role of the LULC modification correlating its future promising survival importance to those communities.
2. Improve Forest resources development, protection, and use strategies needed to counteract the deteriorating shrub/bushes and avoid further extinction of important shrub/tree species and migration of associated wild animals.
3. Developing sustainable land management strategies and Improvement the management of the soil resources for sustainable agriculture use.
4. The surrounding community should be trained and provided with the study based on other livelihood alternatives which are environmentally sound economically productive and sustainable activities like in green foot legacy to reduce anthropogenic pressure of the area.
5. The surrounding community should be provided with alternative efficient energy sources and services such as Bio-gas, solar energy, and efficient energy stoves to reduce heavy dependency on biomass fuels.

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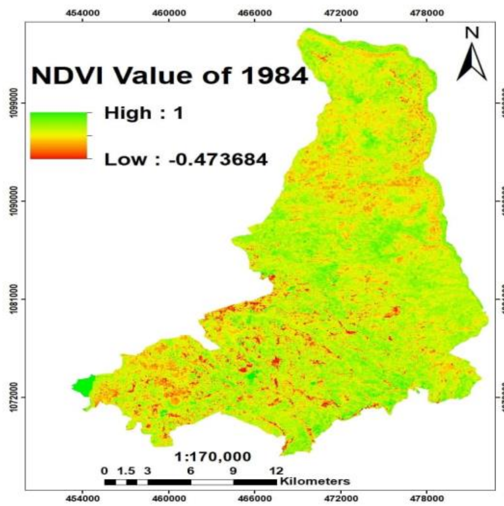
Appendix

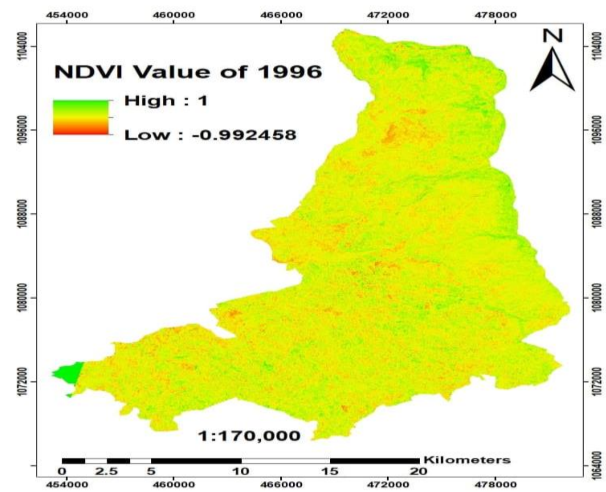
Annex: 1

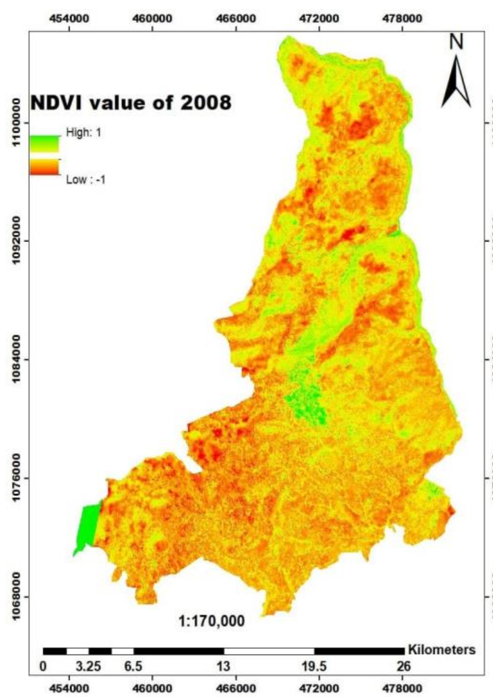
Normalized Difference Vegetation Index (NDVI) calculated by formula

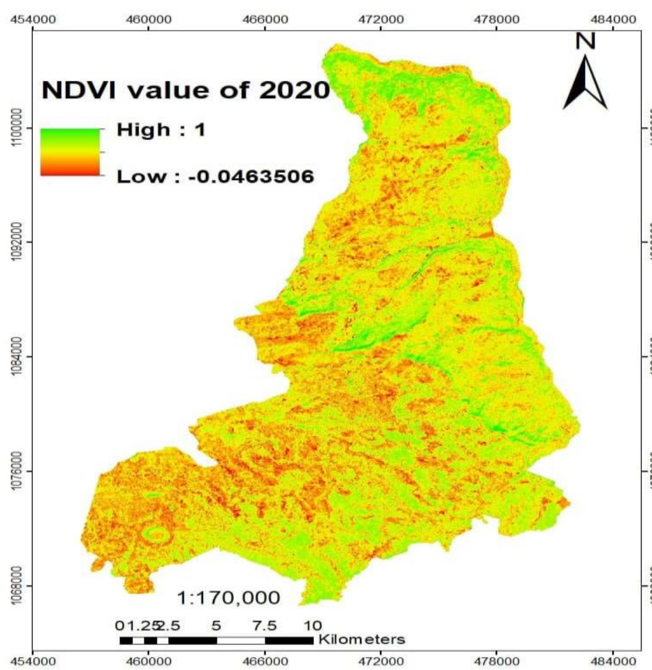
$$NDVI=\frac{Pnir-Pred}{Pnir+Pred}$$

to show the vegetation cover of the study during the last four decades .



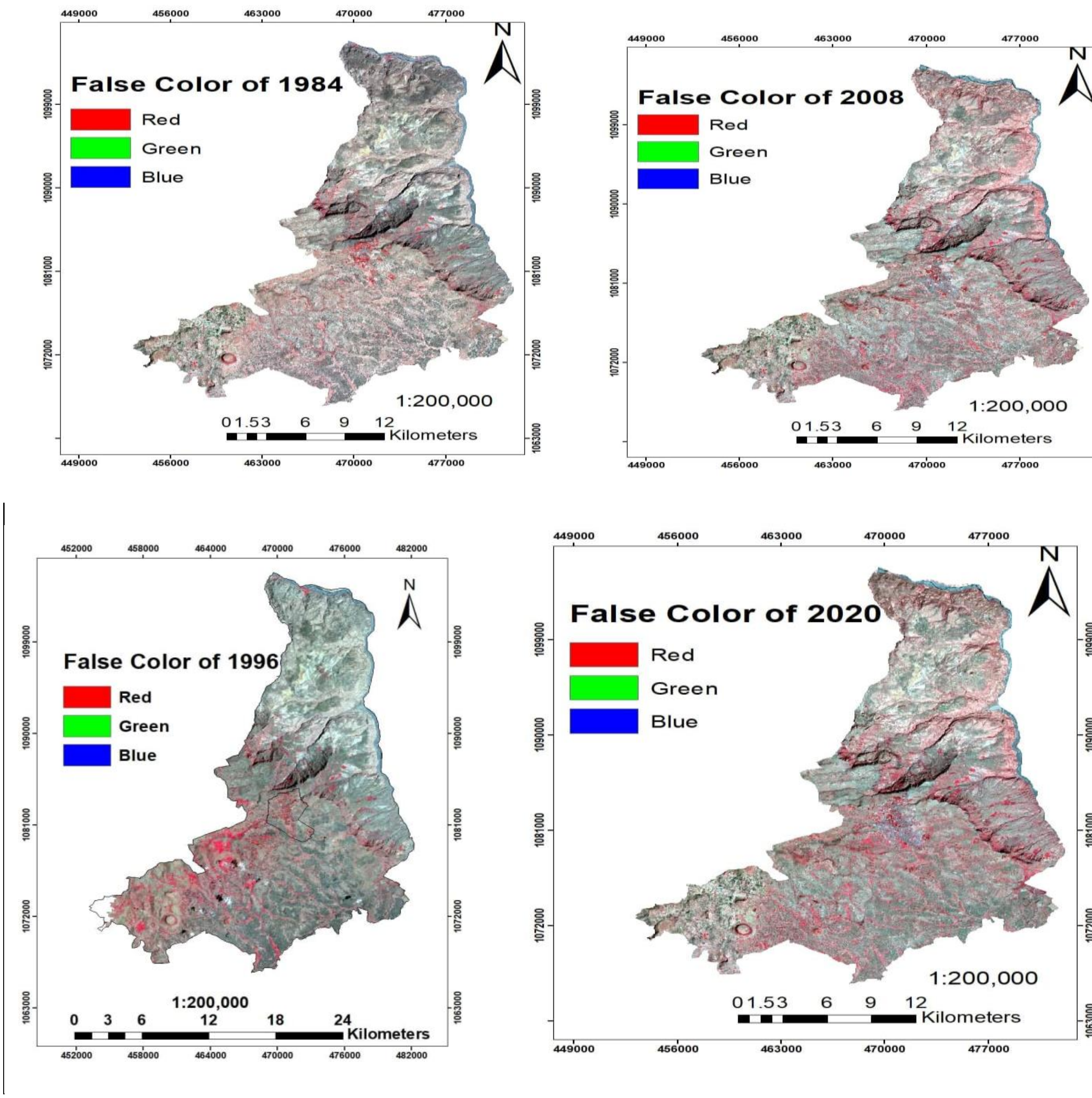






Annex: 2.

False color color composite of Landsat image (Raster)



Annex: 3

Year	TMPMIN (Year	TMPMAX (Year	PRECIP (Year
1985	6.95	21.30	62.15
1986	7.78	22.74	91.82
1987	7.81	20.55	83.49
1988	8.86	20.09	95.45
1989	7.98	19.39	95.08
1990	7.90	20.35	99.61
1991	8.44	19.89	88.36
1992	8.47	19.43	94.22
1993	8.31	19.38	100.49
1994	8.35	20.00	84.87
1995	8.65	20.03	96.07
1996	8.20	19.48	128.28
1997	8.39	20.16	91.63
1998	8.57	20.17	94.93
1999	7.68	20.08	100.69
2000	7.79	20.13	95.83
2001	8.15	20.08	85.74
2002	8.42	20.81	88.36
2003	8.31	20.65	98.05
2004	8.07	20.70	91.94
2005	8.03	20.81	81.88
2006	8.13	20.48	112.44
2007	8.03	20.36	94.88
2008	7.81	20.79	87.21
2009	8.35	20.88	101.79
2010	8.98	20.39	106.96
2011	8.19	20.68	103.13
2012	7.98	21.26	102.65
2013	8.50	20.85	71.15
2014	8.65	20.58	93.38
2015	8.84	21.45	73.48
2016	8.84	20.86	107.98
2017	9.02	21.02	95.35
2018	8.58	19.86	143.16
2019	7.55	21.95	28.90

Source: NMA, 2019

Annex: 4

YEAR	LAT	LON	PARAMETER	ANN
1983	9.83331	38.75001	PRECTOT	1535.31
1984	9.83331	38.75001	PRECTOT	985.89
1985	9.83331	38.75001	PRECTOT	1349.05
1986	9.83331	38.75001	PRECTOT	1355.25
1987	9.83331	38.75001	PRECTOT	1491.99
1988	9.83331	38.75001	PRECTOT	1215.96
1989	9.83331	38.75001	PRECTOT	1210.16
1990	9.83331	38.75001	PRECTOT	1076.74
1991	9.83331	38.75001	PRECTOT	1064.15
1992	9.83331	38.75001	PRECTOT	1022.09
1993	9.83331	38.75001	PRECTOT	1271.42
1994	9.83331	38.75001	PRECTOT	1073.73
1995	9.83331	38.75001	PRECTOT	1050.77
1996	9.83331	38.75001	PRECTOT	1405.63
1997	9.83331	38.75001	PRECTOT	977.88
1998	9.83331	38.75001	PRECTOT	1274.55
1999	9.83331	38.75001	PRECTOT	1126.98
2000	9.83331	38.75001	PRECTOT	720.27
2001	9.83331	38.75001	PRECTOT	723.98
2002	9.83331	38.75001	PRECTOT	581.57
2003	9.83331	38.75001	PRECTOT	610.4
2004	9.83331	38.75001	PRECTOT	561.15
2005	9.83331	38.75001	PRECTOT	738.33
2006	9.83331	38.75001	PRECTOT	1207.88
2007	9.83331	38.75001	PRECTOT	1063.91
2008	9.83331	38.75001	PRECTOT	1007.8
2009	9.83331	38.75001	PRECTOT	895.91
2010	9.83331	38.75001	PRECTOT	1333.83
2011	9.83331	38.75001	PRECTOT	722.33
2012	9.83331	38.75001	PRECTOT	1094.57
2013	9.83331	38.75001	PRECTOT	1345.26
2014	9.83331	38.75001	PRECTOT	1092.9

2015	9.83331	38.75001	PRECTOT	818.97
2016	9.83331	38.75001	PRECTOT	1140.24
2017	9.83331	38.75001	PRECTOT	1149.17
2018	9.83331	38.75001	PRECTOT	2.58
2019	9.83331	38.75001	PRECTOT	3.24

Source: NMA, 2019

Annex: 5

w folder (2) > 1984, 1999,1999,2008,2016 and 2020 satalitte images

Name	Date modified	Type	Size
New Folder	5/22/2021 11:03 PM	File folder	
._LC08_L1TP_168053_20161209_20170317_...	3/29/2021 4:48 PM	WinRAR archive	4 KB
._LC08_L1TP_168053_20201118_20210315_...	3/29/2021 4:50 PM	WinRAR archive	4 KB
._LE07_L1TP_168053_20081211_20161223_...	3/29/2021 4:46 PM	WinRAR archive	4 KB
._LT05_L1TP_168053_19840421_20170220_...	3/29/2021 4:49 PM	WinRAR archive	4 KB
._LT05_L1TP_168053_19841030_20170220_...	3/29/2021 4:50 PM	WinRAR archive	4 KB
._LT05_L1TP_168053_19921121_20190906_...	3/29/2021 4:51 PM	WinRAR archive	4 KB
LC08_L1TP_168053_20161209_20170317_0...	3/22/2021 6:02 PM	WinRAR archive	946,922 KB
LC08_L1TP_168053_20201118_20210315_0...	3/23/2021 2:14 PM	WinRAR archive	954,399 KB
LE07_L1TP_168053_20081211_20161223_0...	3/22/2021 6:13 PM	WinRAR archive	239,187 KB
LT05_L1TP_168053_19840421_20170220_01...	3/22/2021 5:04 PM	WinRAR archive	168,874 KB
LT05_L1TP_168053_19841030_20170220_01...	3/22/2021 5:06 PM	WinRAR archive	175,375 KB
LT05_L1TP_168053_19921121_20190906_01...	3/22/2021 5:03 PM	WinRAR archive	158,023 KB

Focus Group Discussion Check List (for your response you can use the attached paper)

1. Age of the respondent: Sex: ----------Marital status--------------level of education------------?
2. Role of expert in the office…………………………………..
3. Is there any investment on land improvement measures? Yes/no
4. If yes, what type of improvement measures exist? ---------------------------------
5. Can you mention the consequences of land cover changes from one type to another?
6. How local people's occupation of land changed over the past 40 years, because of population increment?
7. Do you believe that human activities have prompt impact on land use/cover change? If your answer is "Yes", explain it in detail?
8. How do you evaluate the trends distributions of rain fed in your woreda's in last 40 years?
9. What do you observe the states of climatic changes in your area? Explain your observation?
10. What do you say the population pressers on LULC change in your area?
11. What is its implication in environmental degradations?

Key Informant Interviews (KII) (for your response you can use the attached paper)

1. Age of the respondent: Sex: ----------Marital status----------------
2. What is your level of education? -------------------------
3. Role of expert in the office…………………………………..
4. How is the land history and distribution system of in your woreda?
5. 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 40 years?
6. What are the major cause's changes of one land use to other land use type? Explain brief the major causes

7. What are the driving forces of LULC changes in your area?
8. How do you explain impact of the deforestation of the area in line with benefits the community is deriving from the area?
9. Do you think that Environmental protection sector help you the rural population to conserve their own natural resources?

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At every step of this retrench the Addis Ababa University anti- plagiarism policy, (2019) was strictly considered. Based on this policy my advisor checked this unrikaned and resulted **0 % similarity.**