

**ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES**



**The impact of Fincha Sugar Factory Plantation Expansion on forest covers
change and wildlife specifically on large mammals**

**A Thesis presented to the School of Graduate Studies of Addis Ababa
University in partial Fulfillment of the Requirements for the MSc in Biology**

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August, 2017
Addis Ababa, Ethiopia

Acknowledgement

First and for most I would like to extend my heartfelt thanks and appreciation to my advisor Dr. Habte Jebessa for his pertinent and unreserved remarks throughout the thesis.

My special credit and appreciation goes to my wife W/ro Medanit Begna Bedada, my brother Ato Habib Musa Ali, Ato Habtamu Tesfaye Gera, Habtamu Deressa, Endalkachew Deressa, Mintamir Deressa and Fasika Deressa for their financial, moral and material support. It is also my pleasure to express my deepest gratitude to Ahimed Amdihun for his invaluable source of information, about Fincha Valley throughout the research. I am indebted to Finchaa sugar Factory and staff members for providing data and valuable assistance during the field survey.

I am indebted to Finchaa sugar Factory and staff members for providing data and valuable assistance during the field survey.

Finally, I would like to express my sincere feeling to my friends specially Yohanis Birara and Adugna Tolessa for their unreserved support in various aspects of the research work.

Abstract

Large scale agriculture uses agricultural machinery to mechanize the practices of agriculture. It is one of the leading causes for the loss of forest and wildlife in many countries including our country, Ethiopia. Information on forest cover change that occurred from 1972 to 2000 in Fincha valley was compared with the present time using GIS and remote sensing method. Key informants, focal group's discussion and observation methods were used. Because of the limited resources only some environmental parameters were selected. These parameters are forest cover change, wildlife, and climate. The Shannon diversity index (H') and rate of land use land cover change analysis were used to detect the spatial change of forest cover and wildlife in the study area. The highest and lowest plant diversity was seen at Neshe and east bank ($H'= 1.57$ and 0.95) respectively. The highest and lowest large mammals diversity was seen at Neshe and east bank ($H'= 8.47$ and 1.25) respectively. The result from rate of land use land cover change analysis indicated that agricultural land, built area and degraded land are increasing. However, the forest cover and wetland are declining. This is mainly due to the plantation expansion of Fincha sugar factory agricultural land and expansion of built area's made in the area. As over twenty years rain fall, and temperature data indicated, no abrupt inclining or declining trend is observed that could tell the possible impacts of the project. This study was address relevant issues on the impact of large scale agriculture on forest and wildlife and provides recommendation which may contribute to the sustainability of natural forests and conservation of the wildlife habitat in the study area. Generally, despite the significance of the Fincha plantation expansion project, it has negative impact on forest coverage and wildlife habitat. This is evident from vegetation cover distraction, and migration and losses of large mammals. If the current condition continues the problems may out weight the benefits of the plantation expansion irrigation project. Thus in the project site and adjoining areas urgent environmental conservation is necessary. This helps to sustain the existing and revitalize the fading resources.

Key Words: Large Scale Agriculture, Land use, land Cover, Loss of wild life, Environmental impact.

Table of contents

Contents	Page
Acknowledgement	i
Abstract	ii
Table of contents	iii
List of Tables	vi
List of Figures	vii
List of Plate	viii
List of Appendices	ix
Acronyms	x
CHAPTER ONE	1
1. INTRODUCTION	1
1.1 Background of the study	1
1.2 Statement of the problem	2
1.3 Objectives of the Study	3
1.3.1 General objectives	3
1.3.2 Specific Objectives	3
1.4 Significance of the Study	3
CHAPTER TWO	4
2. LITERATURE REVIEW	4
2.1 Concept of Large Scale Agriculture	4
2.2. Effects of large scale agriculture when compared with traditional Farming	5
2.2.1. Deforestation	5
2.2.2. Monoculture	7
2.2.3. Concept of wildlife	8
2.3. Use of remote sensing and GIS land use land cover mapping	9
2.4. Land-Cover Dynamics	10
CHAPTER THREE	12

3. STUDY AREA.....	12
3.1 Location of the study area	12
3.2 Topography	14
3.3 Vegetation cover and wild life of the study area.....	15
3.3.1 Vegetation cover.....	15
3.3.2 Wildlife of study area	18
3.4 The Climatic Conditions of study area.....	18
3.4.1. Rain fall	19
3.4.2. Temperature.....	20
3.5. Socio economic and demographic features.....	21
3.6. Water resources of the study area	22
3.7. Land use land cover changes.....	22
CHAPTER FOUR.....	26
4. MATERIALS AND METHOD	26
4.1. Materials.....	26
4.2. Methods.....	26
4.2.1. Preliminary survey	22
4.2.2 Site selection and Sampling Design	27
4.2.3 Data Collection Methods.....	27
4.2.4. Type and source of Data Collection	31
4.3. Data Analysis and Interpretation.....	31
CHAPTER FIVE	33
5. RESULT AND DISCUSSION	33
5.1. Response rate of respondents	33
5.2. Demographic data of the respondents	33
5.3. Forest coverage in the Fincha Valley (in the study area) before 1974.....	36
5.4 The present status of forest covers in the study area.....	37
5.4.1 Diversity of some of large mammals at the study area.....	38
5.5 The cause for the loss of forest and wildlife	38
5.6 Effects of forest cover change.....	39
5.7 Cause of deforestation.....	40
5.7.1 Problem of pure drinking water in the study area	42

5.8 Humans wild conflict in the study area.....	42
5.8.1 Diversity of some of large mammals at the study area.....	44
5.8.2 Problems faced by wild animals during their migration due to loss of habitat	45
5.8.3. New settlement in Neshe Plantation expansion Farm	46
5.9. Land Use / Land Cover Changes.....	46
5.10. Effect of monoculture to study area.....	47
CHAPTER SIX.....	53
6. CONCLUSION AND RECOMMENDATION	53
6.1 Conclusions	53
6.2 Recommendation.....	56
References.....	57
Appendices.....	64

List of Tables

	<i>No.</i>
Table 1 Type and source of data collection	31
Table 2 Sex, Age, Level of education, marital status, Family size, duration in the area	35
Table 3 Ranking the percent of forest coverage before 1974	36
Table 4 Diversity of some plant speceis	38
Table 5 The first cause for the loss of forest and wildlife in the Fincha Valley	39
Table 6 The immediate effects of forest cover change	39
Table 7 Cause of deforestation	40
Table 8 Other factors influencing the forest cover of the area	41
Table 9 The responsible bodies for the loss of forest and wildlife in the study area	41
Table 10 Humans and large mammal conflict	43
Table 11 Diversity of some mammals specious	44
Table 12 Problems faced by wild animals during their migration due to loss of habitat	45
Table 13 Effects of vegetation cover change in the study area.....	46
Table 14 Statistics of land use / land cover of the study area from 1972 to 2000	47

List of Figures

Figure 1 Map of Fincha Sugar Factory area.	12
Figure 2 Location of the study area..	13
Figure 3 The vertical cross-section of Finchaa valley.	14
Figure 4 The Long years Average Monthly rain fall Data.....	19
Figure 5 Shows an alarm rate increment Population size of Fincha Valley	22
Figure 6 Industrial Waste Water Treatment Plant near the Factory.	23
Figure 7 Photo of Household head during interview	28
Figure 8 Photo of Key-informants during interview.....	29
Figure 9 Untreated water from Agul river used for drinking purpose	42
Figure 10 Supervised Land use/ land cover Map of 1972 image.	49
Figure 11 Graph of 1972 LULC of the study area (Fincha Valley).....	49
Figure 12 Supervised Land use/ land cover Map of 2000 image.	50
Figure 13 Graph of 2000 LULC of the study area.....	51
Figure 14 Image differencing results of the 1972 and 2000 Images.....	53

List of Plate

Page

Plate 1 Large scale Sugar cane farms (monoculture) at (Fincha district).....	9
Plate 2 Photo that shows Study area at two different seasons	15
Plate 3 Forest Fire in Finchaa Valley.....	16
Plate 4 A photograph of fire escaped from cane field and fire vegetation	16
Plate 5 Field observation of farm land area at Fincha valley	31

List of Appendices

Appendix 1	Some samples of photo taken during field study	64
Appendix 2	Wildlife species identified inside EB, WB, and Neshe Village in the study area.	700
Appendix 3	Monthly average rainfall data from 1979 - 2014	71
Appendix 4	Monthly average temperature data from 1990 - 2014.....	72

Acronyms

CSA	Central Statistics Authority
DA	Development agent
EB	East Bank
FAO	Food and Agriculture Organization of the United Nations
FSF	Fincha Sugar Factory
FV	Fincha Valley
FVSF	Fincha Valley State Farm
GIS	Geographic Information System
GPS	Global Positioning System
ILO	International Labor Organization
LSA	Large Scale Agriculture
LULC	Land use land cover
NV	Neshe Village
PCA	Principal Component analysis
UNDP	United Nations Development Program
WB	West Bank

CHAPTER ONE

1. INTRODUCTION

1.1 Background of the study

Agriculture is the science of cultivating the soil, harvesting crops, and raising livestock and as the science or art, it is the production of plants and animals that is useful to man and in varying degrees the preparation of such products for man's use and their disposal (Rubenstein, 2003). Agriculture is the systematic raising of useful plants and livestock's under the management of human being (Rlmando, 2004). All forms of farming have major impacts on forest and wildlife. When the new land is brought into cultivation habitats are destroyed. This leads to the loss of native species of plant and some species of animals Barraclough and Grimier (2000).

Large scale agriculture is the process of using agricultural machineries to mechanize the work of agriculture, greatly increasing farm worker productivity. Now a day, powered machinery replaced many jobs formerly carried out by manual labors or by draft animals such as oxen, horses and mules. Mechanization involves the use of an intermediate device between the power source and the work. Large scale agriculture includes the use of tractors, trucks, combiners, harvesters, and other vehicles large scale agriculture (mechanized farming) has the following advantages: increase yield, increase independence, increases the accuses of variety of crop, decreases the cost of crops and poverty reduction (Ahimed Amdihun, 2002).

Even though large scale agriculture increases the yield production, it has a great impact on forest, wildlife, soil, and the climate (environment). LSA leads to Intensive monoculture that depletes soil and leaves and is again vulnerable to erosion. It affects the distribution and abundance of wildlife in the area because large scale agriculture is associated with practices such as deforestation and monoculture. The demand for agriculture as well as technological change in agriculture significantly impacts the mode and rate of transformation of forested area, which leads to the loss of wildlife habitat and the loss of animals from the area. In present time Ethiopia, forests are being destroyed at an alarming rate and the area covered by forest is only less than 2.4 percent compared to the estimated 40 percent before one hundred years initial coverage (Kahsay Berhe, 2004).

Despite the fact that, there are long lists of activities that affect forest and wildlife, in this study area. A great deal of emphasis is given to the impact of large scale agricultural on forest and wildlife in Western Ethiopia, Fincha sugar Factory. Specifically, East bank, West bank and Neshe villages. This area is selected for the reason that there was a dense forest with a variety of mammal species before the establishment of the former Fincha State Farm and the present Fincha sugar factory. This becomes deforesting and losing its plant and animal species from time to time.

1.2 Statement of the problem

Large scale agriculture has its own negative impact on forest coverage and habitat of wildlife. Study area represents one of the areas at which natural forest change and loss of some wildlife has been take place. Hence, Large scale agriculture due to Fincha Sugar factory plantation expansion affects both the forest and the wildlife of the Fincha Valley particularly East bank, West bank and Neshe villages. As a result large areas which was under dense forest cover was exposed to deforestation, which leads to environmental degradation and serious threat to wildlife, losses of the vegetation cover, regional and global climatic change and other significant problems were raised in Fincha sugar factory particularly in East bank, West bank and Neshe villages. The main concern of this research work is, thus, to assess the impact of plantation expansion through irrigation on forest coverage and wildlife habitat. And there by reach at weighting conclusions and suggest feasible recommendations useful for sustainable development.

1.3 Objectives of the Study

1.3.1 General objectives

The general objective of the study was to evaluate the impact of large scale agriculture on forest cover change and loss of wild life habitat at East bank, West Bank, and Neshe Village.

1.3.2 Specific Objectives

- ✓ To assess the extent to which large scale agriculture affected forest and wildlife in the East Bank, West bank and Neshe kebeles.
- ✓ To identify the current problems associated with the new settlement in the study area.
- ✓ To evaluate the effect of deforestation on wild life.
- ✓ To identify the contribution of monoculture to the study area.

1.4 Significance of the Study

The study is believed to have a special contribution in identifying the key problems of the plantation expansion through irrigation of Fincha sugar factory on forest cover change and wild life. It addresses them in more scientific ways. Fincha sugar factory in particular, is the main beneficiary in using the findings of the paper as an input meeting its development goals and expansion plans. On the other hand the paper can give a yellow light for the factory to take justifiable action towards the degrading environment. The concerned bodies can use the result in their efforts to identify, monitor and prevent the negative impacts of plantation expansion through irrigation project on forest cover change and wild life of the irrigation schemes in the world.

In this study communities knowledge, attitude and practices about deforestation of an area for large scale agriculture are explored. The result of this study is used as an input for the researchers to conduct further research on the same issue. It also helps the policy makers to take the result of the research to review their policy and strategies.

CHAPTER TWO

2. LITERATURE REVIEW

2.1 Concept of Large Scale Agriculture

Agriculture is the cultivation of plants, fungi, other life forms and breeding animals for food, fiber, bio-fuel, medicine and other products used to sustain and enhance human life ILO, (1999). Large scale agriculture is the practice of using large areas of land to produce one crop variety such as maize, rice, sorghum or other cereals. This brings a reduction in biodiversity for several reasons some of which are: the area domination by just one species, reduction of number of niches and increases vulnerability of crop. Large scale agriculture uses agricultural machinery to mechanize the work of agriculture greatly increasing farm worker productivity. In modern times powered machinery has replaced many jobs formerly carried out by manual labor or by working animals such as oxen, horses and mules (Reid and John, 2011).

Agricultural mechanization involves the use of an intermediate device between the power source and the work. Large scale agriculture uses tractors, combine harvesters, air planes and others for different purpose.

In traditional farming crops were rotated so that in a field one year a cereal would be grown, in another year root crops or legumes can be grown and sometimes one or more years fallows. Crop rotation would be carried out with different time in different field so that all crops were always available; hence it uses to provide different habitats for different organisms. However, large scale agriculture aimed at farming for few crop varieties year after year, keeping pests with herbicides and pesticides, it cause local extinction of species. Modern agricultural methods and technologies brought spectacular increases in food product, but not without high environmental costs (Tillman et al., 2002). Efforts to increase food production through large scale agriculture negatively affect the capacity of ecosystem to support food production and to provide their essential services. Large scale agriculture brings ecosystems simplification and loss of biodiversity (Bengtsson et al., 2005). Habitat modification through agriculture affects more than 80% of the globally threatened mammals, birds and plants, with serious implications for ecosystem services and human well-being (Bridge and Jenkins, 2002).

Globally, one of the major pressures on forest and wildlife is the transformation of natural habitats to agriculture, especially through forest clearance (Jenkins, 2003). As Kahsay Berhe stated (2004), in Ethiopia, the annual loss of natural forest cover mainly for agriculture has been estimated at 150,000 to 200,000 hectares per-year.

2.2. Effect of large-scale agriculture and their impact on forest and wildlife

Natural forests are used for various ecological and economic purposes. They could maintain local climate, regulate hydrologic cycle, used as wild life habitats, reduce runoff and soil erosion (UNEP, 2014). Forests provide us the oxygen we need to live and absorb carbon dioxide during photosynthesis. Therefore, they maintain the concentration of toxic gas in the atmosphere. They provide a wealth of natural medicine. Forests also play an important role in protecting soil erosion. Tree roots protect against washout and help to keep water in the soil and also reduce global warming by uptake of carbon dioxide. In addition forests used for fuel, for cooking food, house and road construction, timber, house furniture and some are used as traditional medicines. Forests are homes for wildlife. Demand for agricultural land, timber and other forest products as well as technological change in agriculture significantly impacts the mode and rate of change of forest areas.

A long time back in history some parts of northern Ethiopia, which are today suffering from conditions caused by land degradation were covered with forests. At present however, forests are being destroyed at an alarming rate and the area covered by forest at present is only less than 2.4 percent compared to the estimated 40 percent before one hundred years initial coverage (Kahsay Berhe,2004).

2.2.1. Deforestation

Deforestation is the removal of a forest or stand of trees where the land is converted to a non-forest use. Deforestation not only affects the climatic condition of the world, but also poses a big threat to the plants and animals that live within the forest (FAO, 2011).

When the act of deforestation occurs it entails cutting down massive amounts of trees and vegetation. Many animals, big or small are herbivores and when their food supply gets taken away they are forced to move elsewhere. Some of them are able to find different food sources and make do with what they have; however, others die and in some cases become extinct

altogether. Deforestation is the conversion of forest to an alternative permanent non-forested land use such as agriculture, grazing and urban development (Barrowclough and Grimier, 2000).

Deforestation also affects wind flows, water vapor flows and absorption of solar energy, thus clearly influencing local and global climate (Chomitz et al., 2007). Deforestation on lowland plains moves cloud formation and rainfall to higher elevation (Lawton et al., 2001). According to Rube, (2005), in 1990's the majority of deforestation was caused by industrial factors, including extractive industries, large scale cattle ranching and extensive agriculture. Globally, one of the major pressures on biodiversity is the transformation of natural habitats to agriculture, especially through forest clearance (Jenkins, (2003). Tropical deforestation is caused by multiple factors, but agricultural expansion is the most significant one, which is coupled with wood extraction and infrastructure expansion (Sherbinin, 2002).

Deforestation is the change of forests to use the land for other purposes or to leave it as unused wasteland (FAO, 2012). It is one of the widest spread and important changes that people have made to the surface of the earth. Over a period of 5000 years the cumulative loss of forest land in worldwide is estimated at about 1.8 billion hectares, that is, an average net loss of 36,000 hectares per year (Williams, 2002). Population growth and the burgeoning demand for food and fuel have accelerated the pace of forest clearance and the average annual net loss of forest has reached about 5.2 million hectares in the past ten years (FAO, 2010b). As stated by FAO (2012), the expansion of agricultural production accounted for most forest clearing but economic development and the related, often unsustainable use of forests for raw material and fuel were another contributing factors.

Deforestation in Ethiopia is a major issue, because it is one of the main causes of the prevailing land degradation and loss of forest and wildlife. It is due to humans clearing forests for their personal needs such as fuel, hunting, agriculture and sometimes for religious reasons. Deforestation is the process of removing the forest ecosystem by cutting the trees and changing the shape of the land to suit different uses (Scoff, 2003).

Gessesse Dessie, (2007), indicated that the rate of deforestation in Ethiopia between 1972 and 2000 is 80 percent. In Ethiopia, the proximate change of land cover change, particularly natural forest destruction are agricultural expansion both through shifting cultivation and the spread of

sedentary agriculture, the demand for increasing amounts of construction material, fuel wood and charcoal (Kahsay Berhe, 2004).

Deforestation disrupts the global water cycle (Bruijnzeel, 2004). With the removal of part of the forest; the area cannot hold water in a drier climate. Filtering and treating water is expensive. Forests can reduce the cost of doing so either actively by filtering runoff or passively by substituting for housing or farms that generate runoff (Dudley and Stolton, 2003). Deforestation can also result into watersheds that are no longer able to sustain and regulate water flows from rivers and streams.

2.2.2. Monoculture

Monoculture is cultivation of land cultivated with a single crop using methods that imply a high use of inputs such as agro toxic chemicals and machinery (Rose Grant et al., 2001). Monoculture is planting of genetically similar or uniform crop varieties over large tracts of land, sometimes without rotation to other crops in space or time (Kimberly, 2002). Monoculture crops and plantations have a host of social and environmental problems associated with their cultivation. Evidence indicates that extreme dependence on monoculture farming and agro-industrial inputs such as capital-intensive technology, pesticides and fertilizers have negatively impacted the environment and the rural society (Miguel and Alfieri, 2010). Monoculture include crops such as food based agriculture and trees (plantation). The social impacts of large scale monocultures are often disastrous for communities who continue to grow local foods using sustainable practices. Small scale farmers often cultivate local species which not only contain important minerals for the soils and for human health, but also have adapted to the local environment over many years. When small scale farmers are confronted with industrial large scale monocultures in their area, they are faced with water and other resources shortage, contamination from pesticide spraying and from genetically modified crops (Miguel and Alfieri, 2010). The take over-off land by monocultures also causes rural depopulation, destroying local community life and local economies.

Monoculture plantations usually provide only temporary labor, for which workers are often hired from outside the region. Land grabbing and forced evictions of local populations are strongly linked to expansion of monocultures. In the monoculture system locally and naturally occurring plants and animals are merely seen as pests that have to be destroyed. Monocultures are

particularly susceptible to diseases, which can spread far more quickly over a large area covered by a single crop than in a biodiversity ecosystem. In order to fight these weeds, pests and disease outbreaks, cultivators will apply more herbicides and pesticides to keep the plants growing, therefore, these chemicals can affect the local community (Alfieri and Nicholls, 2004).

Native species have adapted to the local environment over thousands of years and have developed a relationship with other plants and animal species which allow them to survive cooperatively. But, non-native plants often require high amounts of water, energy or minerals to survive. Then, this causes a great impact on other plants and animals living in the area, and on the water and soil resources. It has been demonstrated that increasing crop genetic diversity can play an important role in pest management and in controlling crop disease as well as enhance pollination services and soil processes (Barberi, 2002). Generally, monocultures are not forests and they do not stand long enough to lock – in carbon in the soil, moreover, they inhibit soil carbon up take by frequent tilling and pesticide use.



Plate 1. Large scale sugar cane farm at east bank (A) and west bank (B)

(Photo by: Jajabe Dheressa, 2017)

2.2.3. Concept of Wildlife

Ethiopia is a large and ecologically diverse country with unique environmental conditions. However, the natural vegetation of the country has been destroyed by humans, natural catastrophe and converted into agricultural and pastoral land. Moreover, its vegetation has been deforested for various purposes (Demeke Datiko and Afework Bekele, 2011). As a result wild animal resources of the country are now largely restricted to a few protected areas (Tewodros

Kumsa and Afework Bekele, 2008). At present due to humans' activity the number of wildlife is decreasing. Humans have cleared forests, drained swamps, dammed streams and polluted the environment. Therefore, these activities destroyed the habitat of wildlife. Over hunting also reduces the larger mammal population in an area. Destruction of wildlife habitats lead to loss of wildlife locally as well as globally. Loss of wildlife is also associated with serious destruction of natural food chains and extinction of species. Human induced wildlife mortality affects the population viability and has broader environmental impacts on ecosystem equilibrium and biodiversity preservation (Conover, 2002).

The most general reasons that lead to destruction of wildlife are: over hunting (exploitation), habitat destruction and fragmentation, impact of introduced species and Chains of extinction (Diamond, 1989). As stated by (Aggarwal, 1995), the cause for extinction of wildlife includes: deforestation, land degradation, alteration of habitat, overgrazing by livestock and environmental pollution. Wildlife requires some of the following basic habitat components including: food, water, air, cover and space. The amount and distribution of these will influence the type of wildlife that can survive in a given area. Wildlife needs cover for many life functions such as nesting, escaping from predators, seeking shelter, feeding and breeding. An underground borrow, a cavity in a tree or even plants along a road might provide cover for a den or nest size and ever green plants provide nest sizes for birds in spring and thermal cover for wildlife. Generally, type of habitat and its specific feature determines the wildlife species in an area.

2.3. Use of Remote Sensing and GIS for Land Use Land Cover mapping

A remote sensing system using electromagnetic radiation has four components: a source, interactions with the Earth's surface, interaction with the atmosphere and a sensor. The amount and characteristics of radiation emitted or reflected from the Earth's surface is based upon the characteristics of the objects on the Earth's surface. So that, different objects on the earth interact with radiation at distinct way and knowledge of this interaction is fundamental issue on classifying satellite images. Therefore, it is possible to distinguish and classify based on the reflectance variation of Earth surface objects.

The classification of a satellite image can be achieved by supervised or unsupervised procedures. A procedure relies on the prior specification of training areas by the analyst, in which major land cover types are delimited manually as a key for electronically classifying the image. It needs the knowledge of study area in advance. In contrast, no such visual interpretation is involved in an unsupervised method. Unsupervised procedure uses automated methods to cluster reflectance values in order to derive a required number of land classes and their associated spectral signatures (Tudor et al., 1998; as cited in Netsanet Deneke, 2007). Remote sensing and GIS are being increasingly used in combination for spatial analysis. GIS data bases are used to improve the extraction of relevant information from remote sensing imagery, whereas remote sensing data provide periodic pictures of geometric and thematic characteristics of terrain objects, improving our ability to detect changes and update GIS data bases (Janssen, 1993; cited in Netsanet Deneke, 2007). Both remote sensing (RS) and geographic information systems (GIS) have been widely applied and recognized as powerful and effective tools in detecting the spatiotemporal dynamics of land use and land cover (LULC). Remote Sensing can provide researchers with valuable multi-temporal data for monitoring land-use patterns and process and GIS techniques make possible the analysis and mapping of these patterns (Birhanu. Mokonnen. 2005).

2.4 Land-Cover Dynamics

Land use is the term that is used to describe human uses of land, or immediate actions modifying or converting land cover (Sherbinin, 2002; cited in Netsanet Demeke, 2007). On the other hand, land cover refers to the natural vegetative cover types that characterize a particular land area. Therefore, land use change is the proximate cause of land-cover change. Hence, land use defined in this way establishes a direct link between land cover and the actions of people in their environment. Land use typically causes distinctive patterns of land cover. That is why all remote sensing techniques primarily deliver images of land cover and not of land use. The fact that human beings are the major contributors to land cover changes and are the ones experiencing the consequences of these changes. It will be of paramount importance to understand the interaction between humans and the terrestrial environment. This need becomes more imperative as changes in land use become more rapid affecting the livelihoods of societies. Land cover has gone under continuous change for many years. This change has occurred through the use of fire for game hunting and clearance of patches of land for agriculture and livestock production, since the advent of plant and animal domestication. Plantation expansion of agricultural lands, increment

of population number, technological development, and Settlement are the most significant historical change in land cover. Ultimately, the change in forest cover affects biodiversity, nutrient and hydrological cycles as well as climate. There are also Institutional factors such as policies on land use and economic development, transportation, or subsidies for land-based activities, lack of adequate governance structures, land tenure and property rights issues. Issues of open access resources and squatting by landless farmers are the major driving causes of cover change.

CHAPTER THREE

3. STUDY AREA

3.1 Location of the study area

Finchaa sugar factory is located in western part of Ethiopia, at 353 Km from Addis Ababa in Oromia regional state Horro Guduru Wollega. Geographically the study area is situated within $9^{\circ}30'23''$ to $10^{\circ}01'05''$ North and from $37^{\circ}30'30''$ to $38^{\circ}51'59''$ East at 1350-1600 meters above sea level. The area is enclosed with in four Woredas; Jarde Jardega, Abay Chomen, Guduru and Hababo Guduru.

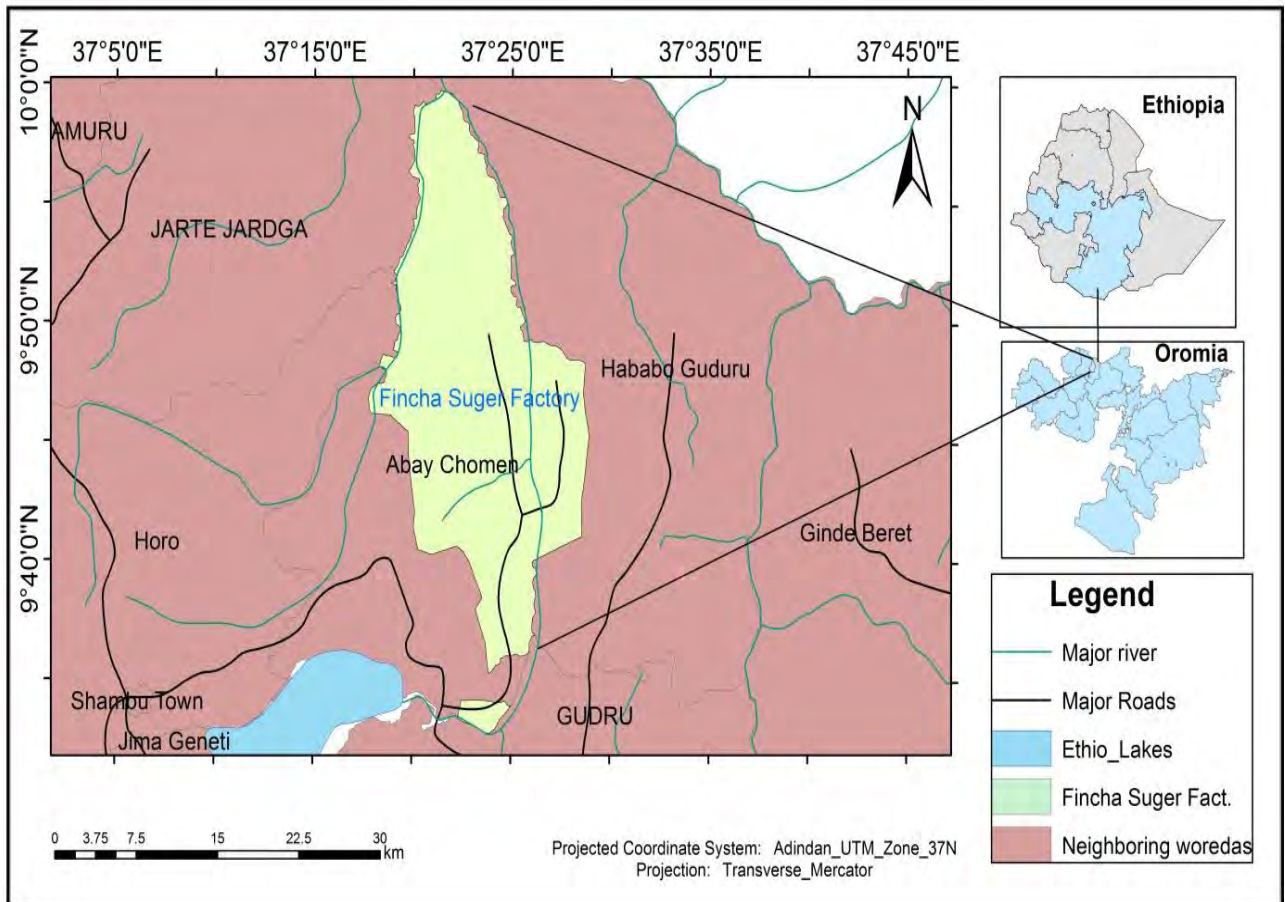


Figure 1. Map of Finchaa Sugar Factory area (Source: Ethio-GIS 2015)

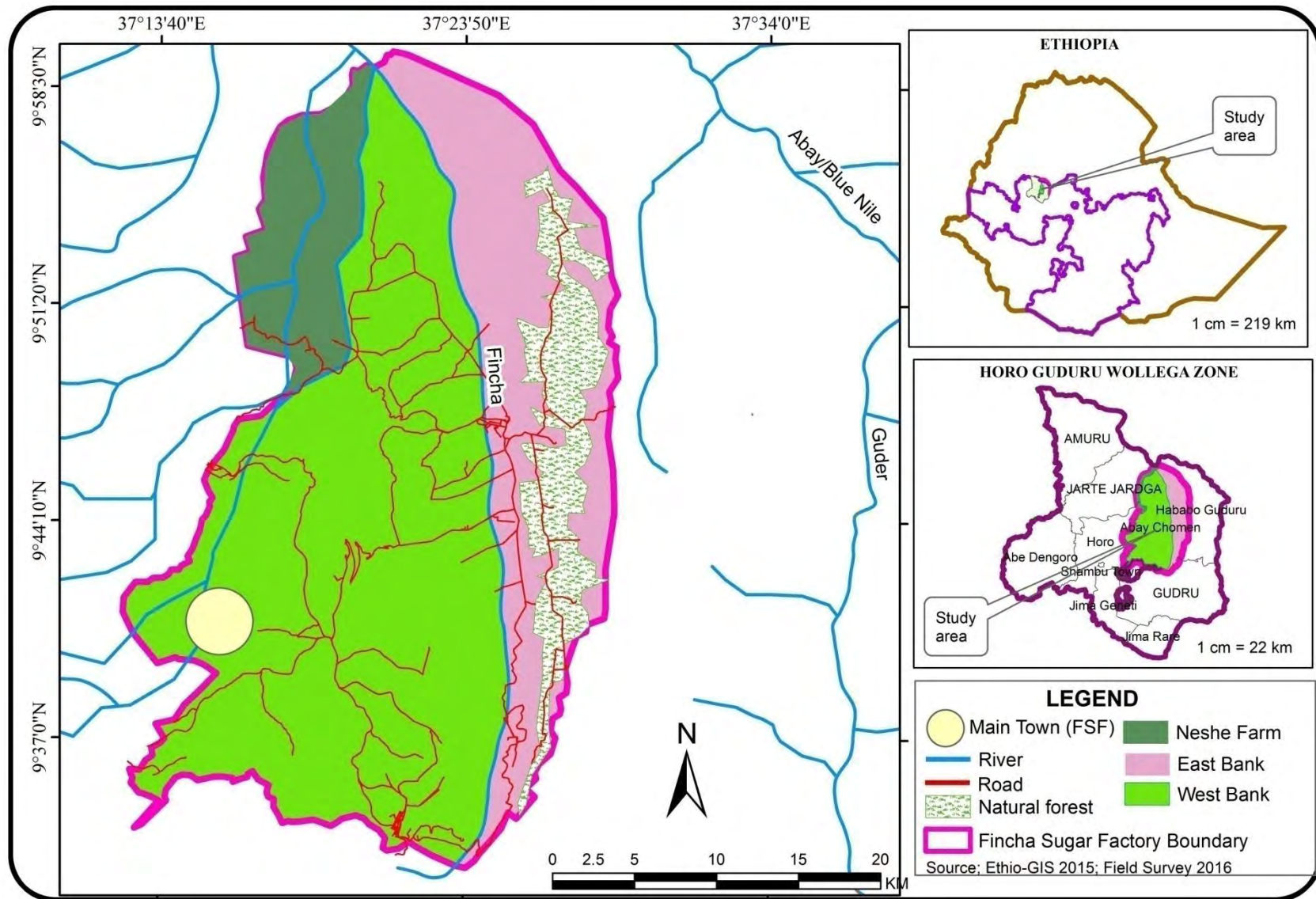


Figure 2. Location of the study area (Source: Ethio-GIS 2015)

3.2 Topography

One of the prominent aspects of Fincha valley is the landscape. The topography greatly varies from low land (<1000m) to high land(>2000m).The lowest area in the study area is about 902 meter above sea level and the highest being 2448.5 meters. This big elevation difference within short distance contributes a lot for soil erosion and micro climate anomalies. It has again an enormous role in controlling factor on the surface and sub-surface hydrological conditions. Fincha valley is low lying area surrounded by elevated and precipitous escarpments. The valley is surrounded by these escarpments in the eastern, southern and western sides. These features have their own role to play in slope change and some other related analysis. The average elevation in the valley floor is about 1,550 meter. In the surrounding elevated areas the average elevation is about 1800 meter. The valley in the project site is about 12 kilometer wide and extends for about 37 kilometers. It has a “U” shaped profile. This mainly creates fertile ground for soil erosion and makes road construction problem (Ahimed Amdihun, 2006).

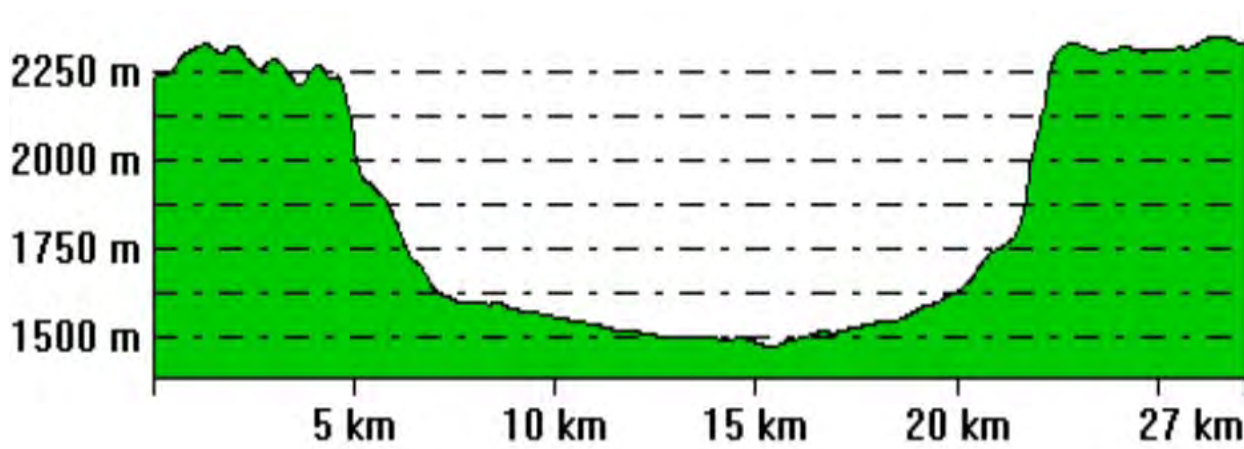


Figure 3. The vertical cross-section of Fincha valley (Source: Ahmed Amdihun, 2005)

3.3 Vegetation cover and wildlife of the study area

3.3.1 Vegetation cover

Fincha valley has been home for variety of flora and fauna. There are different kinds of trees and grass species which totally covered the top escarpments to the valley floor. The feasibility study carried out by Shawinigan Company (1981) stated that vegetation is more dense, varied and growth is more vigorous, canopy is up to 80 percent during the wet season (Appendix 1d). On the other hand, during the dry season, majority of the vegetation's are fire out.



(a)

(b)

Plate 2. Vegetation covers of FSF during wet (A) and dry (B) seasons

(Photo by: Jejebe Dheressa)

The major species are *comburtum*, *isoberlinia* and *acacia*. The tall grass species completely dominates the ground flora, *Hyparrahenia rufa*, which grows to the height of 2.5 m. Bamboo is found in patches throughout the area. Fire is the most pressing problem in Fincha valley. Now days the frequent sugar cane burning for cause of harvesting gives good opportunities for the fire to escape from the cane fields and expand to the forest boundary. The factory assigns few numbers of guards during cane burning to control the fire. But sometimes there are incidents where the fire escapes to the forest. Even after burning, there is little or sometimes no attention given to extinguish the fire. This mainly aggravates the problem of forest fire (Zelege Kebebew, 2005).



Plate 3. Forest Fire in Fincha Valley (Photograph by: Jajabe Dheressa, 2017)



Plate 4. Photograph of fire escaped from cane field and fire vegetation (Source: FSF Public and State office, 2017)

The factory cleared vegetation to construct infrastructures and irrigation. The factory lit fire to cane fields (hoping) to increase sucrose content and to accelerate harvesting process. But sometimes such fire escaped from cane field and fire vegetation. This is one obstacle to the forestry program in the valley. For instance in 1995/96 a total of 13.5 hectares of eucalyptus plantation was burnt due to such fire (Zelege Kebebew, 2005).

The second top problem of vegetation resource in Fincha Valley area is deforestation. Deforestation has long history in the area (Appendix 1F). Especially the coming of the state farm in 1975 brought about a paradigm shift in the history of the valley. The State farm was aimed at producing food and commercial crops. The project comes with mechanized farming equipment's which were used to carry out large scale land (vegetation) clearing and preparation. Large scale vegetation clearing has taken place and in the meantime farm lands, roads, settlement camps and other construction activities chiefly in the east bank of Fincha River were carried out. In 1991 the State farm devolves the project to Fincha sugar factory. This incident opened up the second history of vegetation clearance in Fincha Valley (Zelege Kebebew, 2005).

Fincha sugar factory consider the East bank, West bank and Neshe as more suitable and currently 195.196 km² (19,519.6 hectare) of land is irrigated. The factory abandoned the eastern bank until the recent years. Currently, however, vegetation clearing and land preparation is going on. This decision was mainly based on land suitability. As per the recommendation of the companies that handled the feasibility studies the forestry department of Fincha Sugar Factory was established. The first line objective is to reclaim the vegetation that has been removed for cane plantation and construction purposes. The department is currently taking actions to carry out the afforestation and reforestation. However, the amount planted and the vegetation removed is incomparable (eye witness and Key informants).

Head of forestry department, explained that about 1700 hector of land is currently under forest cover. In the future the unit has the plan to cover 3,000 hector of land with Eucalyptus tree. According to the head department, eucalyptus is preferred because of its availability and fast growth. Critics stated that domination of a single species do have its own negative repercussion on the existing ecosystem. The conservation of natural vegetation helps to balance the natural systems. This in turn avoids the distraction of environmental components on one hand and promises sustainable use of resources on the other (personal communication).

3.3.2 Wildlife of study area

Fincha valley was a Sanctuary for varied wild animals. There were large number of wild animals like carnivores, browsers, grazers and other small animals. The natural vegetation in the area was dense and with full canopy during the wet season. As eye witnesses confirmed there were large number of wild animals residing in the area. The tall savanna grass mixed with trees which has occupied most of the valley floor creates favorable conditions for grazers, browsers and carnivores. Reptiles are also found in the river courses. In the earlier years of the farm a variety of animals were seen on the road to Fincha town specially Lion, Greater kudu, Water back, and Fox, were very common. Regrettably Monkeys, spotted hyena, Grey duiker and some other few animals are the only animals that can be seen on the road now days. Three reasons were given for the devastation of this resource. These are the large scale deforestation, expansion of plantation project and increased number of population in the area. The animals were believed to migrate down to the Abay River. Still the far down stream area and within 100 meter of the gallery forests of Fincha and Neshe Rivers can serve as home for the remaining wild animals. If proper value is given for wild life conservation the present condition is not that much discouraging to rehabilitate this resource (Ahimed Amdihun, 2006)

3.4 The Climatic Conditions of study area

The altitude of the project site ranges from 902 meter to 2448.5 meter. This substantial variation made the area to experience different weather conditions with in short distance. For instance, the weather conditions of Fincha valley and Shambo (60 km away) is not the same. In terms of elevation based classification the project site is grouped under “Woina Dega” to “Kolla”. The topography plays a pivotal role in controlling the micro climate of the area. The valley is warmer day time and cold during the night. Generally speaking the valley floor is hot weather conditions than the surrounding high lands. The tropical setting, more specifically the equatorial location, of the area also contributes for the existence of distinct wet and dry seasons. The south westerly and north easterly trade winds provide “Kiremt” and “Belg” rain respectively (Ahimed Amdihun, 2006).

The climate of Fincha valley and the surrounding high lands ranges from temperate to semi-arid climate. The Rain fall and temperature are the most decisive components of the climate. There is a distinct wet and dry season but there is no uniform distribution of rain falls throughout the year. June, July and August are the wettest months. On the other hand January, February and March constitute the driest months (See Appendix 3 and 4). The human interference has been taking place for about 30 years in the

project area. There is a change in the natural ecosystem and the alteration has repercussion on the environmental components which in turn can affect the micro climate of the area. But it is hardly possible to distinguish slight anomalies by using the ordinary temperature and rain fall data from the existing meteorological station (Appendix 3 and 4).

3.4.1. Rain fall

Fincha valley area is found in the wettest part of the country. Relatively speaking there is high rain fall throughout the year except for few months. The rain fall mostly comes in showers. The average rain fall of Fincha valley area is about 1300mm per year. The highest rain fall a maximum is received in the summer season (Appendix 3).

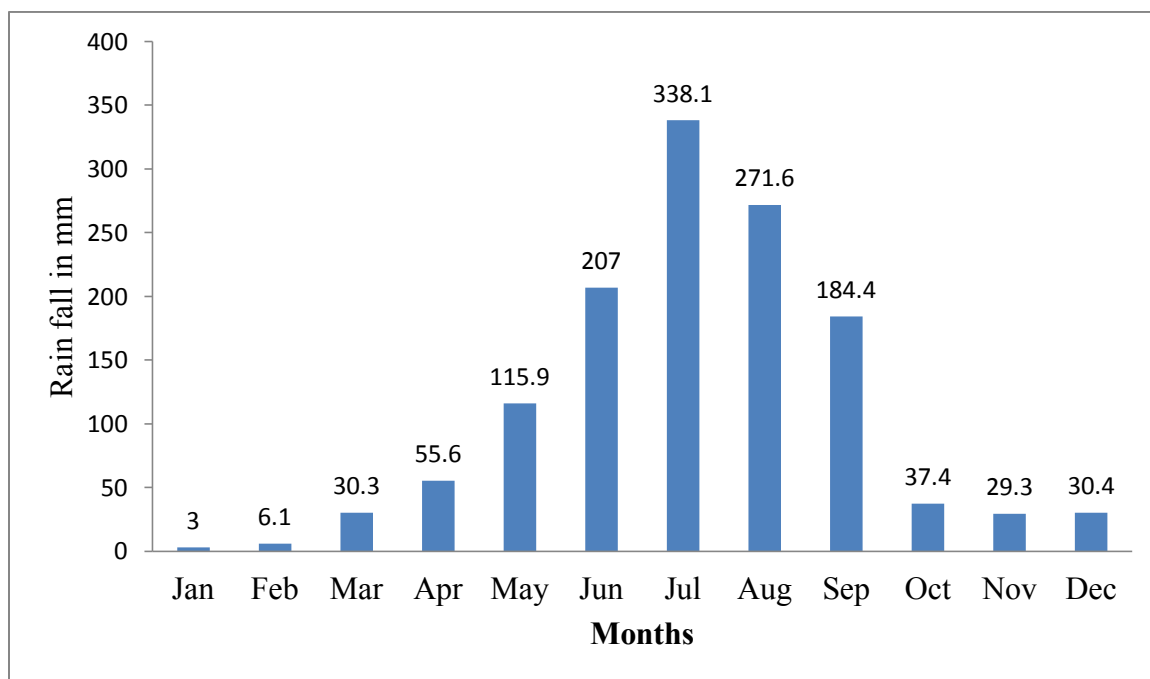


Figure 4. The Long years Average Monthly rain fall Data

(Source: FSF Meteorological station, 2008)

As it is evident from the figure the average monthly rain fall varies from season to season. Almost 80 percent of the rain fall is recorded with in four months. The months of December, January and February account for not more that 5 percent of the rain fall and constitutes the dry season.

This rain fall pattern helps the rain fed agriculture. Conversely it may give good opportunity for high rate of erosion during the rainy season. To see the impact of human interference on climate long year data is required. This task is very difficult if the level of human interference is very small like the irrigation

project. The available climatic data shows no significant and meaningful change after the launching of the irrigation scheme in the area. Figure 4. Illustrates considerable fluctuations on the average annual rain fall for twenty two years. At the end of 1980s and beginning of 1990s highest rain fall was recorded. But it is difficult to identify any sequential pattern over time and give explanation on the markedly fluctuating years.

3.4.2. Temperature

Fincha valley is hot compared to the surrounding elevated areas. The temperature varies from 14°C early in the morning to 36°C early hours in the afternoon. The average temperature is about 26°C. The topographic effect of the valley is noticeable from high diurnal range of temperature. (See appendix 4). The valley is usually very hot day time and cold night time. Normally the highest temperature is recorded in spring which is before the start of the rainy season.

There is slight fluctuation of the annual average temperature (See appendix 2b). Still depending on this data it is difficult to see any pattern and apparent change after the irrigation project. Rather informally it could be possible to tell the daily weather in relation to the former years. In this respect the inhabitants claim that the area is getting hotter compared to the former years. Thus from the twenty two years average temperature data it is hardly possible to tell any declining or inclining pattern. This could be due to the sluggish response of climatic parameters to small scale disturbances.

3.5 Socio economic and Demographic features

The total population of Fincha district (Fincha Sugar State farm) is about 56,700 out of the total populations 34,768 male and 21,932 females (CSA, 2007). The people under the study area basically depend on seasonal agriculture like Maize, Corn, oil crops during the Dergue regime (1975 – 1991). But know, more than 60% of the total population of the area lower grade employers of Fincha sugar Factory state farm. Because of their low income, they are forced to destruct the forest cover around their villages for Agriculture. Some of the youth are engaged in trade, craft work, woodwork which can clear natural forest from study area too. The major crops grown in the study area includes sugar cane, oil crops, maize, mango, avocado and tomato. The major livestock's raised in the area includes cattle's, goats, and hens. However, the production is not satisfactory because the local people use primitive methods of production, and the pressure exerted down from governmental bodies toward the people. (Source: Eye wetness during survey, community leaders and local elders).

Some families are engaged in trade and crafts work. The communities'' come together and help each other during house building, harvesting, trashing and farming. In the low land area where there are no oxen some families'' use hoe to plow small amount of land and cultivated crops and garden root crops. The crops were cultivated using rain and some streams for irrigation. Fincha woreda was organized into eighteen rural and twourban kebeles. In the study area there are also many traditional social organizations like Dabo, Edir, Eukub and others. Dabo is applied during crop harvesting and production, house construction and generally when the household head cannot accomplish the work by him/herself .Both „Edir'' and „Eukub'' are used to strengthen more social relationship among local societies and to save money that will be used during some sermonizes like wedding, burial and to help one another at accident. (Source: Eye wetness during survey, community leaders and local elders).

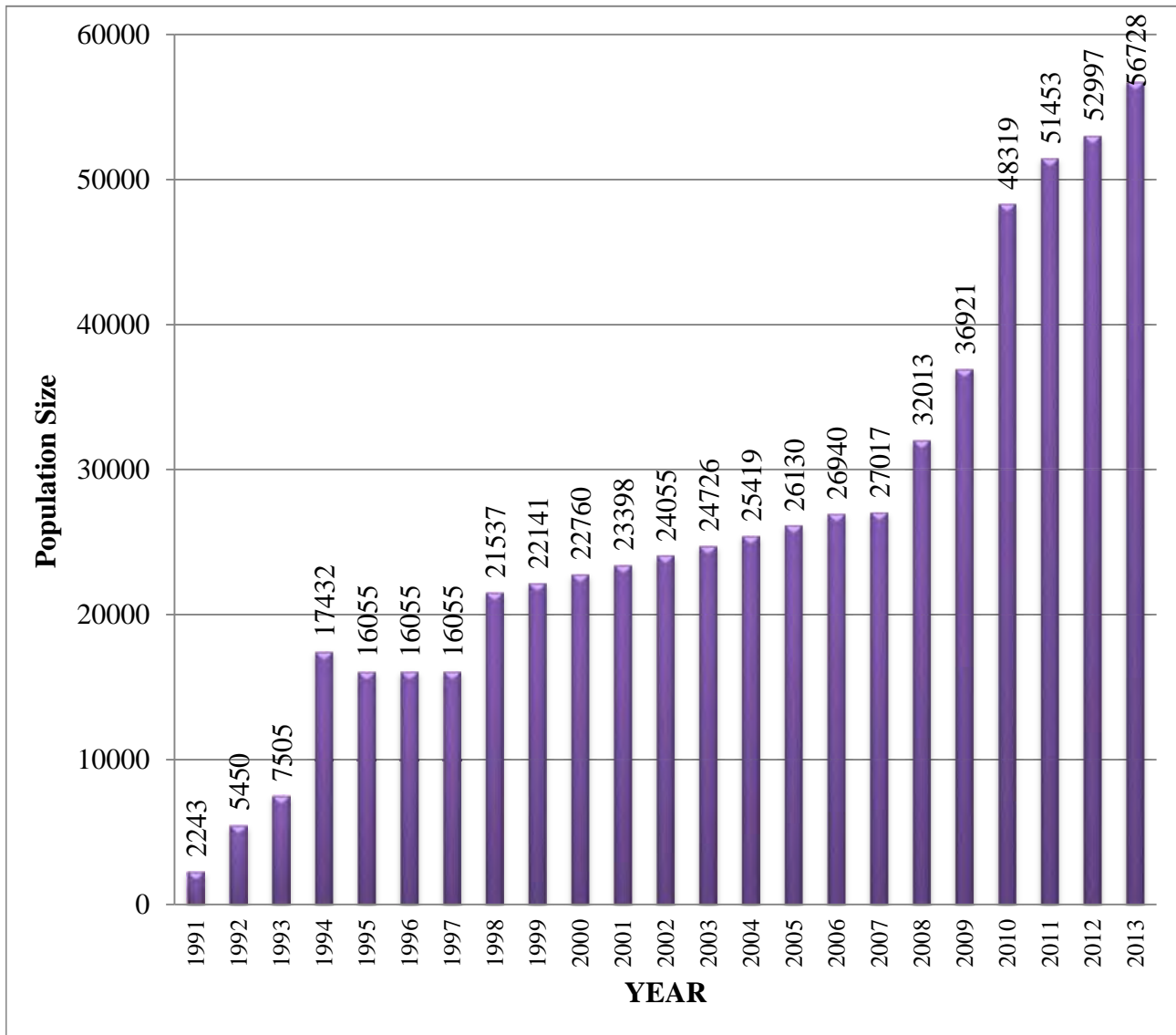


Figure 5. Shows increment in Population size of Fincha Valley

3.6 Water resources of the study area

In most cases toxic wastes from different sources are dumped to the surface and subsurface water. In the study area the Fincha and Amerti-Nashe rivers form the main drainage system. They both join the Abay River in the far down stream area. The irrigation field and the Fincha sugar factory lie within the networks of Fincha river system. They both rely on this river to meet their water requirement. The factory uses a rock filtration treatment method. However some of the instruments of the treatment are nonfunctional. The waste water coming from the factory over flows due to these broken parts and two stream-sized crude waste water flows to Fincha River. These direct leakages together with the agro-chemicals from irrigation fields indisputably alter the physico-chemical properties of the water (Ahimed Amdihun 2005).



Figure 6. Industrial waste water treatment plants near the factory. (Source Ahimed Amdihun 2005)

This phenomenon affects the living organisms in water in particular and the environment in general. Again Fincha River as one of the tributaries of Abay River crosses the boundaries of Sudan and Egypt. Any water quality problem in this place arise dispute with these countries. Thus strict water quality control works should be carried out in and around the industrial and agricultural sites.

3.7. Land Use / Land Cover Changes

Fincha valley area have transformed from primary to secondary and tertiary economic activities; from traditional agriculture to industrial and commercial activities. There is land use land cover change in the area since 1975. There is remarkable land use and land cover change in Finchaa valley area. These changes were mainly due to agricultural and industrial developments and their expansion. Agricultural lands increased and the vegetation cover is decreasing. These changes have a negative implication on land and other biodiversity"s (Zelege Kebebew, 2005).

In the pre-1975 years there were no considerable land use classes in Fincha valley area. Most of the areas were under the natural vegetation cover. From 1975-1991 the state farm used to produce some food and commercial crops on about 3,500 hectors of land in the valley floor (Ahimed Amdihun, 2005). This incident attracted few people to the area to get jobs in the farm but still the number was not that much substantial. During this period there were no significant land use classes except for the state farm and few fragmented private holdings outside the valley. With the beginning of the sugar project in 1991 extensive land has been cleared and irrigated. Currently (2016) the irrigated land and domestic farm land together are over 24,619.6 hectors and the built up areas occupy approximately 5700 hectors of land in the valley. (Source: FSF Harvesting and Land management Department & Public Relation Office).

The dominant land use classes are irrigation agriculture; Rain fed agriculture, built up areas, roads, lakes, and others. The land cover of the study area can be categorized in to two classes. These are the natural and artificial land covers. The human made features in the area composed of towns, roads, drainage canals, ponds, agricultural and irrigated fields, and artificial lakes. Only a few artificial structures are observed near Fincha dam in the MSS image of 1972 following the construction of the dam. (See figure 10) In these years approximately more than 95 percent of the area was under natural environment. Land cover changes of 1972 to 2000 for East bank, West bank, and Neshe kebeles were presented in Table 14. In addition, the statistics of land use/ land cover were computed and Change in land use / land cover in general and land cover in particular would have either direct or indirect impacts on the extent and conditions of wildlife as a whole.

The changes could be transformation of land cover to land use or vice versa. However, it is very difficult to generalize whenever there is change in land use/land cover, the change could be eventually followed by land deforestation, the formation of that deforestation/avoided of forest which may had been replaced by large scale agriculture, settlement and bare land which together lead to the loss of forest and wildlife from an area.

CHAPTER FOUR

4. MATERIALS AND METHOD

4.1. Materials

In this study Computer, ArcGIS 10.2, Earth Resource Data Analysis System (ERDAS) IMAGINE 2010, Global Positioning System (GPS), Digital Camera, Other software like Microsoft Word, Satellite images of different years were used.

4.2. Methods

To produce valuable data and conclusions, selection of appropriate research method is a key issue at the outset. So, both quantitative and qualitative research methods were used for this study.

Data for this study was collected from December, 2016 to April, 2017. The first data collection program was aimed at observing the areas affected by large scale agriculture and recording the observable impact caused by Fincha sugar factory farm expansion. Second collecting data about the location, demography, socio-economy and climate of the study area in depth. Third using checklist questions gathering information"s from Focal group discussion and key informants interviews. Fourth distributing the questionnaires to each sample households and collecting them.

The study design selected for this research was descriptive survey method. Descriptive research can only describe a set of observations or the data collected, Jackson, (2009). Therefore, using this research design participants answered questions administered through interviews or semi-structured questionnaires. Descriptive survey research enabled to examine the existing situations and problems of the study area, particularly the impact of Large Scale Agriculture on forest and wildlife specifically large mammals.

4.2.1. Preliminary Survey

This section deals with the different activities postulated in order to attain the stated objectives of this study. Methods and techniques used to study LULC of the East bank, west bank and Neshe villages included. Basic information about demography, topography, climate, soil type, water source, of the study area was gathered from Fincha district Agriculture Sector, water source office and also households interview, key informants and focal group discussion were conducted on a pre-set checklist questionnaires with the purposely selected informant groups of the three kebeles (East bank, West bank

and Neshe kebeles,) in which the study area was situated. Using German Global Positioning System (GPS) ground trothing record was carried by the researcher.

4.2.2. Site selection and Sampling Design

The study area was purposely selected because it is an area where the impact of large scale agriculture on forest and wildlife, especially, large mammals is viable. Out of eight villages (seven rural and one main town) found in Fincha Sugar state farm three of them namely, East bank, west bank, and Neshe are purposely selected. From each village 75 households was randomly selected. Using simple random sampling techniques from the total of population of 2513. Allocation of the number of sample households to each village is proportional to the number of household"s heads living in each selected villages; accordingly 20 households from east bank, 32households from west bank, 23households from Neshe were selected for this study. In addition to this a total of 9 people from the three villages who are elders lived in the area for more than fifty year, educated person related to agriculture, officers, who know more about the establishment and impacts of Fincha state farm on the study area are selected for focal group discussion and also a total of nine key informants interview were selected.

4.3. Data Collection Methods

Pilot survey was conducted in the selected kebeles. During the pilot survey 10 households were randomly selected and interviewed .The main purpose of the pilot survey was to evaluate the questionnaire whether it was suitable or not in the study area.

Four types of data collection methods were used to conduct this study. These are: In-depth interview (household interview), Focus group Discussion, key informant interview, observation, Shannon Wiener diversity index (**H'**) and rate of LULC. Secondary data from internet and written documents were also used to collect information about the Impact of Large Scale Agriculture on Forest and Wildlife. And about the Demographic, Socio- Economic and Climatic features of the study area data were collected from these secondary data.

4.3.1. In-Depth (households) Interview

In-depth interview is one of the qualitative research methods which service the researcher to conduct extensive individual"s interview with small number of respondents to explore their ideas or perspective Turner, (2010). In-Depth interview is applied to explore in-depth information pertaining participants" life experience, attitude and view point of a particular problem. Therefore, in this study in-depth interview

was used as one of the tools to explore detail insight and relevant data on the people’s knowledge, attitude and perception in line with the impact of large scale agriculture on forest and wildlife in Fincha valley, where the study area was found. The selection of interviewees was conducted based on purposive sampling techniques.

The samples selected were rich in the information required by taking three purposively selected sample kebeles. In-depth interview was conducted depending on the detail data needed and conditions of the study area.



Figure 7. Photo of Household head during interview (photo by: Jajabe Dheressa, 2017)

To get detail information from the local community priority was given to the elders and for those who have a good experience and information about the Fincha state farm which was established during the Dergue regime. Accordingly, a total of fifteen (15) interviewees were selected.

4.3.2. Key Informant Interview

To strengthen the information collected using questionnaire and to have a detailed insight about the impact of Large Scale Agriculture on forest and wildlife in the study area key informant interview was also used as one of the data collecting tools. Key informant interviewees were selected from Fincha district, three villages namely: East bank, West bank and Neshe villages.

The participants were selected purposively based on their Age, experience, and involvement in different activities and practices in the Fincha state farm during the Dergue Socialist Regime. Therefore, about nine key informants were selected and interviewed.



Figure 8. Photo of Key-informants during interview (Photo by: Jajabe Dheressa, 2017)

4.3.3. Focus group Discussion

Focus group discussion is one of the major qualitative research tools to examine people thought and feelings. It is mostly conducted by inciting “ten to twelve” participants to explore information on specific issues (Flick, 2007). The researcher was act as a dedicator or facilitator and the participants were explained and gave justification for their idea on the issue. The information was flowed from the people involved in the discussion to the moderator who was posed leading questions. Focal group discussion was employed by selecting sample of people from the study kebeles. The samples were purposively selected based on their previous experiences about the problem. Both men and women were included in the selection.

Three focal group discussion was conducted in the study area (one for each kebele), where the focal group discussion consists of eight to ten members. The members of the focal group discussion were purposively selected from community leaders, elders, agriculture experts, water resource sector, health sector and respected farmers who were known to have a good knowledge about the problem.

4.4.4. Observation

Observation is one of the data collecting tools that were used in this study. It is important in the research to see directly the sources of the problem in the selected area. Therefore, the researcher was made a field observation in three villages to look for the impact of large scale agricultural on forest and wildlife in the Fincha sugar factory state farm.



(a)

(b)



(c)

Plate 5. Harvested land of Sugar cane plantation (photo by: Jajabe Dheressa, 2017)

Sugar cane cultivated large scale agricultural farm land East bank (a), and West bank (b)

4.5. Type and source of Data Collection

The appropriate data types gathered from their respective sources to conduct the study on land cover change of the area were:

Table 1 Data types and their sources

No	Type of data	Source
1	<p>Satellite imageries and their acquisitions date:</p> <ul style="list-style-type: none"> • Thematic mapper (TM) date of acquisition 22/11/1972 and 30m resolution • Enhanced Thematic Mapper (ETM+) date of acquisition 26/11/2000 and 30m resolution 	- Ethio-GIS 2015 and Ahimed Amdihun (2005)
2	Demography data	- Fincha District, and central statistical agency (CSA)
3	<p>GPS (Global Position System) ground truth /ground verification</p> <p>Information as to conservation and support practices</p>	- FSF - Woreda's Rural and Agriculture Sector

4.6. Data Analysis and Interpretation

The collected data from different sources was organized in to meaningful facts and made detail explanation. The frequency, cumulative frequency and percent of the relevant data were analyzed. Quantitative and qualitative data collected from different sources using (households; key informants, focal group discussion, observation, Shannon Wiener diversity index (H'), rate of change LULC, GPS, GIS and digital camera) were organized in to meaningful facts and detail explanation were made. Then the analyzed data were presented in the form of percentage, tables, charts, graphs, and textual description and photos to examine the extent to which Large scale agriculture caused loss of forest in the study area.

Shannon-Weiner (H') diversity index.

Species diversity in different land use and land cover areas was determined by calculating the Shannon-Weiner (H') diversity index (Shannon and Wiener, 1949). Shannon – wiener diversity index is calculated as:

$$H' = -\sum P_i \ln P_i$$

Where:

H' ----- Shannon – Wiener diversity index

i-----number of individual

P_i----- ratio of each individual to total pop.

ln -----Natural logarithm

Rate of land use land cover changes

The areal extent of land use / land cover summarized to detect the nature of major changes occurred between 1972 and 2000. The rate of change was calculated for each land use land cover using the following formula (Ahimed Amdihun, 2002):

$$\text{Rate of change (Hectare (ha)/year)} = \frac{X - Y}{Z}$$

Where:

X = Recent area of land use/ cover in hectare (ha).

Y = Previous area of land use/ cover in hectare (ha).

Z = interval between X and Y in years

CHAPTER FIVE

5. RESULTS AND DISCUSSION

This section describes the results obtained through demographic characteristics, data processing and analysis techniques, that is, it deals with the results obtained from survey as well as the analysis of the remotely sensed data of post classification comparison of land use and land cover changes between 1972 and 2000.

5.1. Response rate of respondents

Out of the total 75 households respondents that have been interviewed during the survey all of them (100%) were answered the questionnaires. In addition to this nine key-informants and nine focal groups were answered and discussed on the interview questions. This implies that the proposed sample size was exactly participated on the study which helped the researcher to find out the real problems caused by large scale agriculture on forest and wildlife (Ahimed Amdihun, 2006).

5.2. Demographic data of the respondents

Based on the sample, the household's survey results show that the average family size of the study area is 4-5 persons per household head ranging from 1 to 14 (Table 2). This implies that there is a high rate of population growth in the study area. As a result the demand of household head and his or her family's to use firewood and the land become increase, this indicates that population growth has an impact on forest and wildlife.

Out of the 75 household heads who participated in the survey, 26 (34.64%) were illiterate, 21 (28%) elementary, 15(20%) of them were secondary school. This shows that most of the household heads were illiterate because they were daily laborer in the Fincha State Farm and paid a few birr; most of them came from different regions of the country and belongs to poor families which had not got an opportunity of education, lack of education forced them to engage themselves in clearing forest for different purpose that cause land degradation. As shown in (Table 2) the number of households that joined secondary school were 15(20%) this indicates that there is no secondary school in the area, therefore after completing elementary school they dropout school and become a farmer. Most of them were a daily

laborer in Fincha sugar factory and few were participated on different illegal activities such as deforestation, hunting and burning grass lands.

Exactly more than half of the households involved in the survey, 52(69.33 %) were 30-39 years old. And few of them (5.33%) were above 60. This shows that most of them are under poverty, so they could not improve their economic status and actively participated in clearing forests to increase farm lands, as a result they cause land degradation and wildlife loss. But they were purposively selected for this study because they have good information about the study area.

Most of the people in the study area were engaged in mixed agriculture (farming and rearing live stocks). As Table 2 shows, 26(34.64%) of the respondents livelihood was depend on mixed agriculture, 18(24%) of them were practicing only farming, but only 15(20%) of them were involved in rising live stocks and the rest 16(21.34%) were low grade Fincha sugar factory workers. This shows that the area was affected by agriculture and grazing animals". According to community elders, key-Informants and Development Agent (DA) of the study area when the farm land lost its fertility farmers were clearing trees remaining in some areas to hold another farm land. This result shows that agricultural intensification leads into land degradation and loss of wildlife.

Table 2 Sex, Age, Level of education, marital status, Family size, duration in the area

Item	Characteristics	Frequency	%
Sex	Male	54	72
	Female	21	28
Age	30-39	52	69.33
	40-49	11	14.67
	50-59	8	10.67
	60 & above	4	5.33
	Illiterate	26	34.64
Level of education	Elementary(1-8)	21	28
	Secondary (9-12)	15	20
	Above 12	13	17.33
Marital status	Married	64	85.33
	Single	11	14.66
Family Size	1-3	26	34.66
	4-6	41	54.64
Duration in the residential area	7-9	8	10.66
	10-20 years	8	10.66
	21-30	14	18.66
	31-40	41	54.64
Occupation	41 & above	12	16
	Farming only	18	24.00
	Raring livestock only	15	20.00
	Mixed farming	26	34.64
	Lower grade workers of FSF	16	21.34

Table 2 also showed that 72% of the respondents were males and 28% of them were females, this means males are mostly involved in agricultural activities.

5.3. Forest coverage in the Fincha Valley (in the study area) before 1974

Before the establishment of the Fincha State Farm, Fincha Valley was covered with dense forest where different plant and animal species were found (Source: community elders and local society). Fincha Valley was hosting different native plant species that provided the wildlife with shelter, food and other uses. It was also the area where people found cultural medicines, timber trees, firewood and different wild animals that were used as a source of food for the local society. People from different area had gone to the Fincha valley for hunting larger mammals such as Buffalo, Water back, Warthog, Bush pig, Antelope and others for their meat, and hunting aggressive mammals such as lion, leopard, Buffalo and African wild dog for braveness (Source: Local elders).At present there is no dense forest in the study area because of deforestation for large scale agriculture during the establishment of the Fincha Sugar in 1974and expansion of built area (Ahimed Amdihun, 2006).

Table 3. Ranking the percent of forest coverage before 1974

Ranking item	Frequency	Percent	Cumulative percent
Medium	4	5.33	5.33
High	21	28	33.33
Very high	50	70.67	100

As (Table 3) indicates 50(70.67%) of the household heads respond that the study area was covered with a very high percent of forest, 21(28%) households respond the presence of high present of forest and only 4(5.33%) of them replied that the presence of medium forest coverage in the study area before 1991. Therefore, based on the result of (Table 3) and the information gathered from key informants focal group discussion and community elders the area was covered with dense forest where different species of wild animals were living. During the survey few remaining native plant species were observed that support the information gathered from different sources.

5.4 The present status of forest covers in the study area

As it was observed from the interviewees during survey there was no dense forest covers in the study area. This shows that the dense forest was cleared away before 42 years ago for LSA and local domestic agriculture. This activity largely influenced both the wildlife and the local society. As a result most wild animals were emigrated or extinct from the area.

The natural vegetation and tree species of the East bank, West bank and Neshe villages have been under threat. Focus group discussions confirmed that *Teclea nobilis*, *Ficus sur* Forssk., *Clausena anisata*, *Ekebergia capensis*, and *Pennisetum thumbergi* are some of the most Critically endangered species of trees, which are on the verge of extinction. Even *Cordia africana* and *Syzygium guineense* are becoming endangered due to excessive and unwise use of woody trees for house construction and woodwork. In addition, *Flacourtia indica* and *Pavonia urens* trees are becoming extinct in the study area. Regarding food crops, peas (*Pisumsativum*) and lentils (*Lens culinaris*) are avoided by peasants due to their vulnerability to attacks by pests and monkeys. Generally, the Implications for biodiversity loss are very high and present forest status of the study area was very poor (Zelege Kebebew, 2005).

5.4.1 Diversity of plant species at the study area

N O	Large mammals	Pi						lnPi			-PilnPi		
		East B	Pi	West B	Pi	Neshe	Pi	East Bank	West Bank	Neshe	East Bank	West Bank	Neshe
1	<i>Teclean obilis</i>	14	0.10	15	0.29	37	0.11	-2.30	-1.24	-2.20	-0.23	-0.35	-0.24
2	<i>Ficussu r</i>	2	0.01	0	0	7	0.02	-4.60	0.00	-3.91	-0.04	0.00	-0.07
3	<i>Cordiaa fricana</i>	18	0.14	2	0.03	61	0.19	-1.96	-3.50	-1.66	-0.27	-0.10	-0.31
4	<i>Syzygium guineense</i>	43	0.33	18	0.35	78	0.25	-1.10	-1.04	-1.42	-0.36	-0.37	-0.34
5	<i>Ekeberg iacapensis</i>	13	0.10	0	0.00	41	0.13	-2.30	0.00	-2.04	-0.23	0.00	-0.26
6	<i>Acetia absinica</i>	39	0.30	16	0.31	89	0.28	-1.20	-1.20	-1.27	-0.36	-0.36	-0.35
Σ		129		51		313	0.98	-13.46	-6.98	-12.5			
H'											<u>0.95</u>	<u>1.18</u>	<u>1.57</u>

Table 4. Diversity of some plant species

As the above table shows, the highest diversity of plant species was observed in Neshe Village followed by West bank and East bank respectively. As East bank is near to Guduru and Hababo Guduru woredas, it is exposed to the illegal settled people. Thus, plant diversity at East bank is critically endangered.

5.5. The cause for the loss of forest and wildlife

There are several reasons for the loss of forest and wildlife. Forests are homes for wildlife therefore, loss of forest is directly associated with the loss of wildlife. There are many human activities that increase the rate of forest loss; some of them are Large Scale Agriculture, deforestation, mining, road construction, wildfire and others. Therefore the first cause that associated with the loss of forest and wildlife in the FV was the establishment of the Fincha State Farm in the area (Table 5).

Table 5. The first cause for the loss of forest and wildlife in the Fincha valley

Item	Frequency	Percent	Cumulative Percent
LSA at FSF	52	69.33	69.33
Built areas	18	24	93.33
Wildfire	5	6.67	100
total	100	100	100

As indicated in the (Table 5), 52(69.33%) of the house hold respond that Fincha sugar State Farm was the cause for the loss of forest and wildlife, 18(24%) of the households responded that population growth due to built area (settlement) was another factor and 5(6.67%) of the households responded that during the dry season wildfire can destroy a large hectares of forest. Therefore, based on this result it is possible to generalize that there are multiple factors that cause forest cover change and wildlife loss but, agriculture and population growth are the two major ones(Zeleke Kebebew, 2005).

5.6 Effects of forest cover change

Forest is one of the natural resources that use to maintain the biodiversity of the ecosystem. It is home for wildlife, it holds and improves soil fertility, filters water, prevent soil erosion and remove toxic gasses and maintain environmental quality. Therefore, forest cover change is associated with many effects (Table 6).

Table 6. The immediate effects of forest cover change

Items	Frequency	Percent	Cumulative percent
Climate change	6	8.00	8
Loss of wildlife	44	58.67	82.67
Land degradation	18	24.00	90.67
Poverty	7	9.33	100

As indicated in Table 6: (58.67%) of the households respond that wildlife was immediately affected by forest covers change, 18 (24%) households answered that the rate of land degradation increases with the loss of forest, 6(8%) households replied that poverty is another condition that appears with forest cover change and 7(9.33%) households replied that climate change can appear with the loss of forest. This implies that loss of forest is associated with loss of wildlife, land degradation, climate change and poverty.

5.7 Cause of deforestation

As it was shown in Table 7 below 48(64%) of the households respond that agriculture is the leading factor for deforestation, 18(24%) of them replied that large area of land was deforested for built area (settlement), 6 (8%) households respond that new road construction is another factor for deforestation and 3(4%) of them replied that natural disaster such as wildfire can destroy vegetation. Therefore, the result shows that agriculture is the leading cause for deforestation.

Table 7. Cause of deforestation

Items	Frequency	Percent	Cumulative Percent
Large scale agriculture	48	64.0	64.0
Settlement	18	24.0	88.0
Road construction	6	8.0	96.0
Natural disaster	3	4.0	100.0

In addition to agriculture there are other factors that affect the vegetation of an area by cutting trees for different social and economic purposes (Table 8). Clearing forest for different activities leads to the loss of wildlife, soil erosion, land degradation and climate change.

Table 8. Other factors influencing the forest cover of the area

Items	Frequency	Percent	Cumulative Percent
Illegal logging	6	8.0	8.0
Firewood collection	5	6.67	14.67
Making charcoal	20	29.33	44.0
Population growth	42	56.0	100.0

As shown in the above table 42(56%) of the HHs replied that population growth affects the forest cover by clearing the area for different activities, 5(6.67%) of them were respond that firewood collection was another factor that cause the forest cover change of the study area, 20(29.33%) of the HHs replied that felling trees to make charcoal for selling purpose leads to the loss of forest cover in FV and 6(8%) of the HHs also replied that illegal logging was associated with the loss of some species of wood plants such as *Cordia africana* in the West bank, East bank and Neshe Village.

Table 9 the responsible bodies for the loss of forest and wildlife in the study area

Items	Frequency	Percent	Cumulative Percent
Plantation expansion by FSF state farm	48	64.0	64.0
Kebele leaders	8	10.66	74.66
Drivers of the bull dozers	2	2.66	77.32
Local society	17	22.67	100.0

Table 9 shows that 48% of the respondents replied that the Plantation expansion by Fincha Sugar factory state farm was more responsible for the loss of forest and wildlife in the Fincha valley, 22.67% of them replied that the local society were responsible and other responsible bodies like EPDRF and the local drivers of bull dozers accounts about 10.67% and 2.67% respectively. Therefore, the study result has indicated that the Plantation expansion by FSF state farm had set a program for Large Scale Agriculture in the Fincha Valley that deforested (cleared away) the dense forest which was the main cause for the loss of many species of plants and wild animals from the area. Drivers of the bull dozers removed trees with their roots and roaring (sound) of the bull dozers and other machines frustrated the wild animals which forced them to migrate from the area. The EPDRF trans located people from the Harerge Zone into the

former Fincha Valley (Neshe) who engaged in felling of trees to increase their farmland, to make charcoal and to collect firewood which increases loss of wood plants and land degradation. Some people in the local society also involved in hunting wild animals, clearing wood plants and destroying grasses by overgrazing system which deflected ecological succession and cause land degradation.

5.7.1 Problem of pure drinking water in the study area

All of the households (100%) replied that there is a shortage of pure drinking water. This indicates that loss of forest in the area causes land degradation and soil erosion which leads into the shortage of water sources. During the field survey the scarcity of pure drinking water was more observed in East Bank West bank and Neshe kebeles. Agul River is used as source of drinking water for humans and their live stocks. Therefore, it is more contaminated and is a source of bacterial and protozoan diseases (Fincha Sugar Factory Health center). Factors that cause the scarcity of water in East Bank, West bank and Neshe kebeles were: population growth, deforestation, agriculture, overgrazing by livestock, land degradation and lack of soil conservation (Fincha sugar factory Agriculture Expert, Health Sector, Key informants and Ahimed Amdihun, 2006).

Agul River comes directly from Fincha Hydroelectric power and found in the most degraded area of the East Bank and West bank.



Figure 9. Untreated water from Agul river used for drinking purpose (Photo: By Jajabe Dheressa)

5.8. Humans' wildlife conflict in the study area

The response of all respondents“ shows, 100% of the households replied that there was a human-wildlife conflict in the study area. As a result many larger wild animals faced several problems. The major cause for the appearance of conflict between humans and wild animals was the destruction of wildlife habitat by deforestation for large scale agriculture.

Table 10 the large mammal more encountered conflict with humans

Item	Frequency	Percent	Cumulative Percent
Lion	18	24	24
Leopard	3	4	28
Great kudu	36	48	76
Water back	15	20	96
Warthog	3	4	100.0

As table 10 shows that 48% of the households answered that Great kudu had encountered more conflict with humans, 24% of them answered that Lion had conflicted with humans, 20%, 4% and 4% of them answered that Water back, leopards and warthog had conflicted with humans respectively. From this result it can be concluded that great kudus were more attacked by humans because of the deforestation of the dense forest and the roaring of bull dozers they flee from their natural habitat and stormed human dwellings and killed by hunters. People hunt Great kudu for their meat and for braveness. A person who killed buffalo, great kudu, leopard or lion would have a good recognition in the local society. Therefore, the result shows that all wild animals faced conflict with humans (Table 10 and Appendix 1H).

5.8.1. Diversity of large mammals at the study area

N O	Large mammals	Pi						lnPi			PilnPi		
		East B	Pi	West B	Pi	Neshe	Pi	East Bank	West Bank	Neshe	East Bank	West Bank	Neshe
1	Lion	6	0.24	2	0.06	9	0.15	-1.42	-2.81	-1.89	-0.34	-0.17	-0.283
2	Leopard	5	0.2	2	0.06	6	0.1	-2.81	-2.81	-2.30	-0.17	-0.17	-0.23
3	Water buck	4	0.16	8	0.24	9	0.15	-1.83	-1.42	-1.89	-0.29	-0.34	-0.283
4	Great Kudu	3	0.12	12	0.36	18	0.3	-2.12	-1.02	-1.20	-0.25	-0.36	-0.36
5	warthog	2	0.08	6	0.18	12	0.2	-2.52	-1.71	-1.60	-0.20	-0.30	-0.32
6	Buffalo	0	0	0	0	2	0.03	----	----	-3.50	-----	-----	-7
Σ		25		33		60	1	-12.31	-12.17	-11.69			
H'											1.25	1.34	8.476

Table 11. Diversity of some mammals specious

As the above table11 shows, the highest diversity was observed in Neshe Village followed by East bank and west bank respectively. As West bank is near to the main town, it has the least large wild mammals'' diversity.

5.8.2 Problems faced by wild animals during their migration due to loss of habitat

Table 12 Problems faced by wild animals during their migration due to loss of habitat

Items	Frequency	Percent	Cumulative Percent
some of them were exposed to predators	36	48	48
some were killed by hunters	23	30.67	78.67
death because of starvation	5	6.67	85.34
conflicted with humans	11	14.67	100.0

Table 12 shows that 48% of the households replied that wild animals exposed to their predators before arriving at their new habitat, 30.67% of them answered that some wild animals were killed by hunters, 14.67% of them replied that some were conflicted with humans and 6.67% of them answered that some of them died because of starvation. Therefore, deforestation in the study area for LSA causes a series problem on wild animals living in the area, because forest is a place where animals live; find their food sources, breed and care for their young. Most wild animals had emigrated from the study area because of loss of forest and habitat disturbance.

As the response of respondents" shows, all the households (100%) answered that there is a relationship between forest and wildlife. This means forests provide wild animals" with food, nesting place, cover (shelter), shade and oxygen. Animals provide plants with carbon dioxide and nutrients during death and excretion.

Table 13. Effects of vegetation cover change in the study area

Item	Frequency	Percent	Cumulative Percent
Shortage of water	12	16.0	16.0
Shortage of food	7	9.33	25.33
Climate change	8	10.67	36
Loss of wildlife	48	64.0	100.0

5.8.3. New settlement in Neshe Plantation expansion Farm

As the response of respondents“ shows, 100% of the households answered that there is a new settlement in the former Fincha State Farm. As it was observed during Field Survey there are people from the Hararge Zone who settled in the area by being relocated by the government. At present there has been large influx of people into the former FSF State Farm (Source: Observation, Key informants and community leaders), as a result there is a high population growth in the study area. As the number of population increases the demand for farm land, grazing land and firewood increases therefore, this leads to the deforestation of wood plants and removal of grasses by grazing animals which increased the rate of land degradation and scarcity of water in the area.

5.9. Effect of monoculture in the study area

According to the sample respondents“, 100% of the households answered that large scale agricultural expansion of sugar cane farm land in the study area is the cause for change in physio-chemical nature of water. Bioaccumulation and biomagnification are the other impact of monoculture at the study area. Moreover, the chemical fertilizers and bio fertilizers used at cane field is one of the major cause for reproduction problem and behavior change of wildlife particularly large mammals of the study area (Source: eye wittiness, focal group discussion and key informants).

5.10. Land Use / Land Cover Changes analysis

In East bank, West bank, and Neshe kebeles, from the 1972 land use / land cover classes, about 45.02 % was devoted to Forest cover land, and 29.34% was covered by Tree mixed grass land and other vegetation whereas 7.34% agricultural land of different crops. The smallest share went to built (settlement) area and degraded lands which have 0.72% and 1.02% respectively. In 2000, agricultural land, degraded/bare lands, built area (settlement) revealed an increase in areal coverage due to the increased amount of populations who have been settled in that area and used land cover of it through cultivation.

However, Water body, Forest cover, swamp and wet land, woody shrub land and tree mixed grass land were liable to be converted in to other land use / land cover unit depicted change in decline/ decreased in areal coverage. Apparently, degraded/ bare land, agriculture land and built area (settlement) lands coverage have got increment of 14.16%, 31.71% and 8.04 respectively (Ahimed Amdihun, 2006).

Table 14 Statistics of land use / land cover of the study area from 1972 to 2000

Class name	1972		2000		changes
	Area(ha)	%	Area(ha)	%	1972 -2000
Built area	496.81	0.72	5549.7	8.04	234.98
Water body	2743.2	3.97	7218.2	10.47	-159.82
Forest cover	31064.5	45.02	18136.57	26.28	-534.28
Swamp and wet land	6019.4	0.14	4885.4	7.08	-40.5
Agriculture land	5067.88	7.34	16487.64	23.87	516.13
woody shrub land	2649.1	3.83	768.3	1.11	-67.17
Tree mixed grass land	20249.3	29.34	6268.2	9.08	-499.32
Degraded/Bare land	704.2	1.02	9776.81	14.16	324.02
Total	69,000	100	69,000	100	

(Source: FSF Harvesting and Land management Department, January 2016)

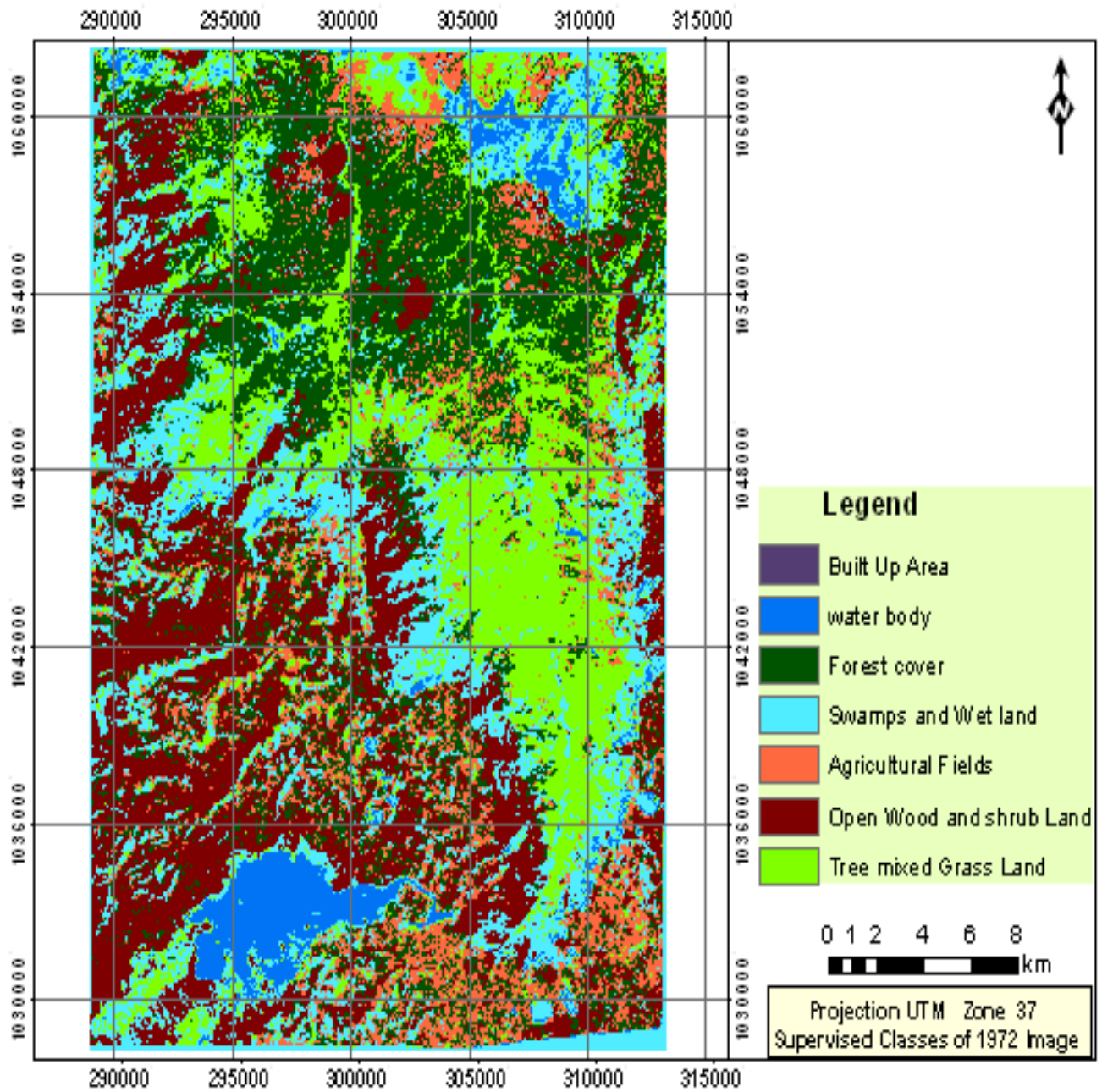


Figure 10 Supervised Land use/ land cover Map Of 1972 image (Source: Ethio-GIS 2015)

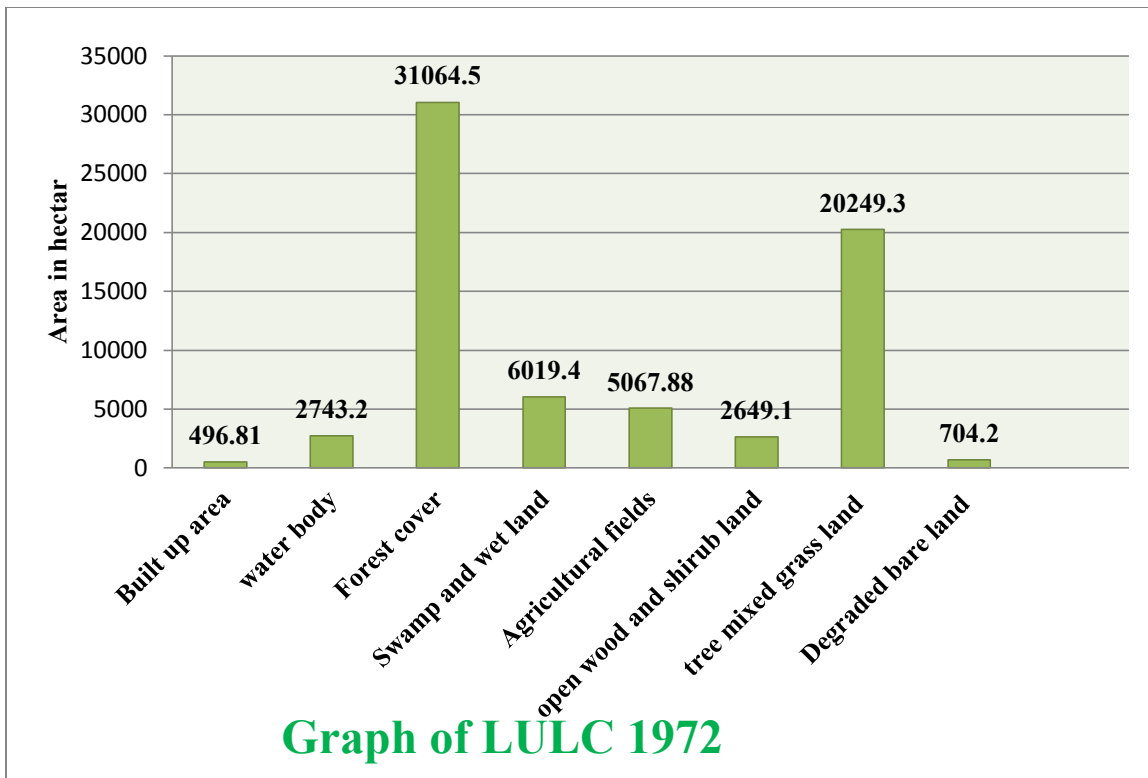


Figure 11 Graph of 1972 LULC of the study area (Fincha Valley)

(Source: FSF Harvesting and Land management Department)

The land cover analysis of 1972 from aerial photos (Table 14) showed that the majority of the study area was under forest cover land accounting 31064.5 ha (45.02%), while agriculture land, built area(settlement) land and degraded land and the rest were accounted about 5067.88 ha(7.34%), 496.81ha(0.72%),704.2 ha(1.02%) and 31661ha (37.28%) respectively. These land cover classes took about 100 percent of the study area. Moreover, there were no dense forest covers. The dense forest that had covered the area was completely deforested since the establishment of the Fincha Valley State Farm in 1975, which was the main cause for the loss of forest and wildlife in the study area.

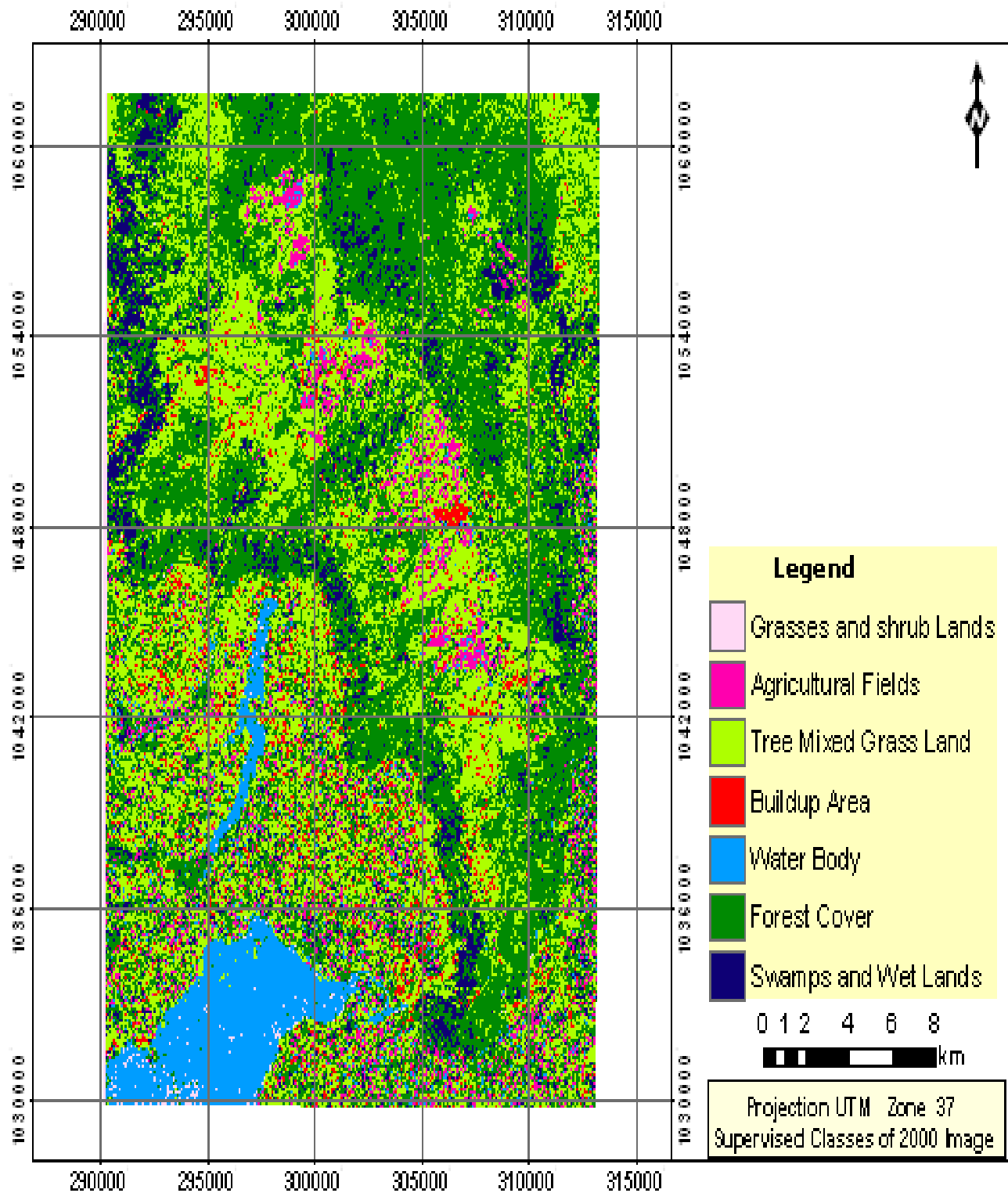


Figure 12. Supervised land use/ land cover map of 2000image (Source: Ethio-GIS 2015)

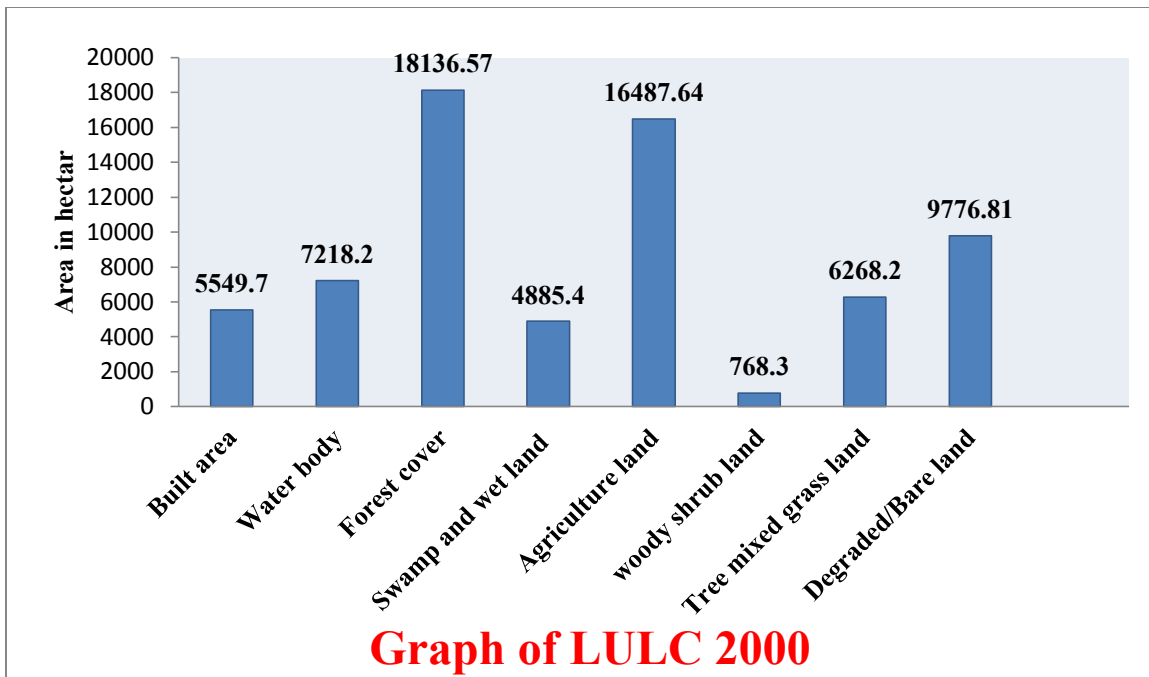


Figure 13. Graph of 2000 LULC of the study area

The land sat. ETM⁺ imagery of 2000 (Figure 13) showed that the majority of the study area was covered by agricultural land accounting for about 16487.64 ha (23.89%) while, built area (settlement) land, wood land, grass land and degraded land accounted about 5549.7 ha (8.04%), 768.3 ha (1.11%), 6268.2 ha (9.08) and 9776.81 ha (14.16%) respectively. This shows that as the demand for more agriculture land due to settlement (population growth) increases both grass land and wood lands decrease, leading to an increase in degraded land. This increase in agriculture land was at the expense of grazing and wood lands which decreased from 20249.3 ha (29.34%) to 6268.2 ha (9.08%) and from 2649.1 ha (3.83%), to 768.3 ha (1.11%) respectively. Other land cover classes such as settlement land and degraded land were increased. Therefore, agriculture and population growth are the major factors for deforestation and land degradation which are the cause for the loss of forest and wildlife, scarcity of water, soil erosion and shortage of energy sources (firewood) in the study area.

Digital Image Differencing Analysis of LULC of the study area

The digital image differencing analysis of the 1972 and 2000 images indicates that some features have increased in size while some others decreased. The size of Fincha and Amerti lakes, the valley mouth and artificial structures including agricultural fields have increased. On the other hand the vegetation biomass, swamps and water body lands decreased. These changes are partly related to the population explosion and expansion of agricultural and industrial developments in the area.

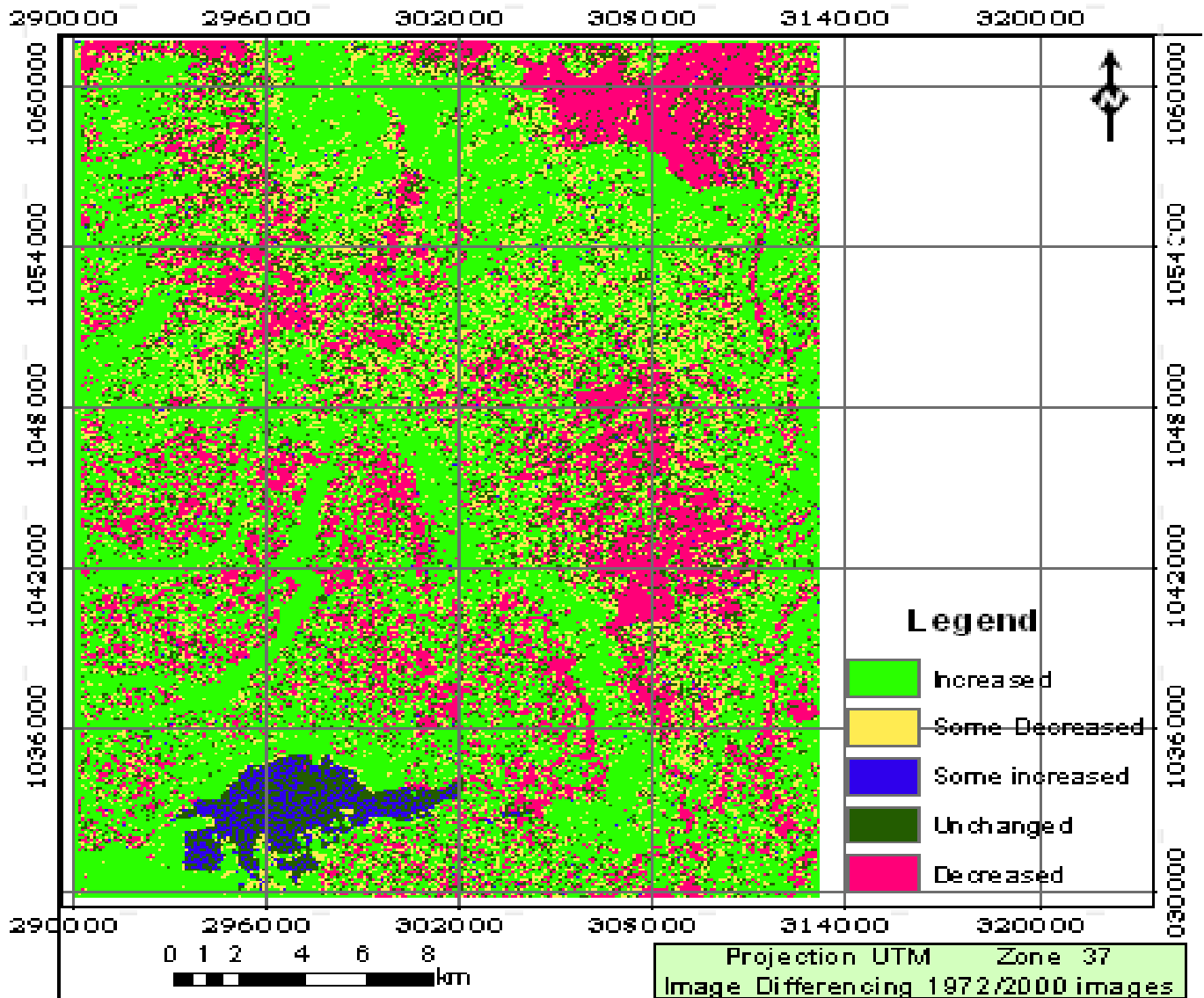


Figure 14. Image differencing results of the 1972 and 2013 Images. (Source: Ethio-GIS 2015)

CHAPTER SIX

6. CONCLUSION AND RECOMMENDATION

6.1 Conclusions

As it was observed from the study, the natural environment in Fincha sugar factory area has been modified due to agricultural expansion and industrial developments since 1975. Following this modification the plantation expansion through irrigation project have both positive as well as negative impacts on the environment. From the positive contributions the project opened up large scale job opportunities for many thousands of people. It has also some socioeconomic benefits for the valley. In addition Fincha Sugar factory play a key role to address the current sugar demand in a national market. There are also many efforts to exploit the byproducts of the factory for other extra purposes like gasohol for fuel. The project has also an important role for the growth of national GDP. On the other hand the attention given for natural resource conservation is approaching to null. And this has been devastating clearance of forest coverage and loss of wild life at the environment. One of the big problems is clearing forest for the purpose of large scale agriculture.

Large Scale Agriculture is one of the major factors that have a direct effect on the forest cover of the area. Large Scale Agriculture is linked with deforestation of large areas of forest land which are the habitat of wildlife. When forests are cleared away wildlife that has been living in the forest would loss cover (shelter) as well as food sources and decided to leave an area. When wild animals are migrating from one area to the other area they might be killed by poachers, eaten by predators or died because of old age or illness, then becoming extinct or reduced in number (endangered). In this regard, this study was conducted in East Bank, West bank and Neshe kebeles in Fincha district to assess and quantify the impact of LSA on forest and wildlife by associating it with land use and land cover changes that occurred in the period ranges between 1972 and 2000.

The three kebeles were purposively selected for the reason that they were covered with the dense forest before the establishment of the „Fincha State Farm“ in 1975, where different species of larger mammals such as Buffalo, lion, leopard, water back, Greater kudu, African wild dog, warthog, bush pig, and others were used to live (Source: community elders and key-informants during survey 2016).

As information was gathered from households, elders and focal persons during survey, different native plant species such as *Ficus sur*, *Clausena anisata*, *Syzygium spp*, *Syzygium guineense*, *Manikara butugi*, *Ficus vasta*, *Cordia africana*, *Albizia gumifera*, *Pouteria adolfriederici*, *Ekebergia capensis*, *Phoenix reclinata*, *Carton macrostachyus* and others were found in the dense forest of the study area before deforestation. According to LULC analysis made between periods of 1972 and 2000 the land use and land covers of the study area were classified as: Agriculture land, Forest cover, wood land, grazing land, built area (settlement) land, Water body, Wet land, and degraded land. To accomplish the objective of the study basic data gathering tools like remote sensing and GPS were used. Data collecting methods such as household heads interview, key informants, focal group discussion and observation were made. Remotely sensed data for 1972 and 2000 were used to analyze the LULC of the study area. Therefore, the LULC changes during over three decades were evaluated from the land satellite images. Then, the extent and trends of LULC changes were shown. The major changes were happened by increasing or decreasing. According to this Forest cover land, grass land, wood lands, Swamp and Wet lands, and water body were decreased whereas agriculture land, settlement land and degraded land were increased. Based on the data gathered and observation made during survey, the primary cause for the loss of dense forest and loss of wildlife specifically large mammals in the study area was the establishment of the Fincha sugar factory which was one of the mechanized farming in Ethiopia. During its establishment a large hectares of forest lands were deforested for the implementation of large scale agriculture. This type of agriculture encourages monoculture, leaving mixed farming behind and reducing the biodiversity of the area. Monoculture is associated with the use of different chemicals to increase sugar production but it can cause environmental damage.

Deforestation leads to the loss of wildlife, that is, there is a direct relationship between forest and wildlife. The second change was observed on wood and grass lands which were brought about by intensification of agricultural land and settlement (population pressure). Population growth is associated with clearing forests for many purposes like agriculture, charcoal, firewood, construction, fencing and others. As it was observed during the field survey large areas of land were left bare land without vegetation cover and exposed to soil erosion that caused a shortage of drinking water. A few native plant species were only found around the stream and where the land is not suitable for agriculture, this indicates that the area had covered with indigenous plant species before deforestation for agriculture. Therefore, in the case of East bank, West bank and Neshe kebele analysis, the most driving force for the

loss of forest and wildlife in the study area was plantation expansion through irrigation of Fincha sugar factory (large scale Agriculture).

Generally despite of its positive consequences, the plantation expansion through irrigation in Fincha valley area specifically, (EB, WB, and Neshe Kebeles) has a negative impact on the forest cover and loss of wildlife. But this does not, in any way, mean that the problems out weight the benefit of the factory and that the problems are out of control. The degradation is in its severe stage and even not difficult to address and alleviate them all. The possible solutions are much easier and cheaper in this severe stage of the environmental degradation. But undoubtedly if the current trend keeps on the problem would get more complex and difficult to reclaim. Thus, if proper value is given for forest coverage and wildlife specifically, large mammals; the present condition is not that much discouraging to rehabilitate these resource"s.

6.2 Recommendation

In line with the findings of this selective parameter based environmental impact assessment of Plantation expansion of FSF on East bank, west bank and Neshe kebeles, the following recommendations are presented:

- ✓ The environmental considerations should not be disregarded in any way and with any justification seeing that well organized environmental management positively contribute for better productivity and sustainability.
- ✓ The rehabilitation of devastated vegetation biomass should be given first line attention as it helps to maintain the soil, water, climate and biodiversity of the area. Fincha sugar factory should tackle the problem of frequent Forest fire and large scale deforestation that are observed inside the valley.
- ✓ There should be well organized and effective afforestation and reforestation programs to reestablish the ecosystem. Some areas like the surrounding escarpments, river sides, agriculturally non suitable and marginal lands can be delineated and protected as the forest area.
- ✓ Controlling deforestation and hunting by employing a series of rules and laws to govern it.
- ✓ Awareness creation among the population and governing bodies about the importance of conserving forest and wildlife Particularly Large mammals.
- ✓ Settlements and state farms or large scale agricultural investments should be based on the country's rule of Environmental Impact Assessment.
- ✓ Creating a demand for planting indigenous trees by identifying a potential use of them like medicine, water filtration, soil holding and improving soil fertility, source of food, environmental quality (reducing toxic gases), habitat for wildlife, and host of cultural and social benefits.
- ✓ Creating of awareness to the society in order to work on Rehabilitation of natural resource on agro industry business activity by planting Evergreen aromatic, spice and timber trees.
- ✓ Giving great attention care to Endogenous trees of the study area, this can be used for wildlife study area.

References

- Agrawal. M.L. and Dikshit A.K. (2002). Significance of Spatial Data and GIS for Environmental impact Assessment of highway projects. Delhi, India.
- Ahmed A. (2002). A Geographical study on Fincha Sugar Factory. A senior essay. Haramaya University.
- Ahmed Amdihun (2005). GIS and Remote Sensing Integrated Environmental Impact Assessment of Irrigation Project in Finchaa Valley. Addis Ababa University, Addis Ababa.
- Alfieri; M., and Nicholls, C.I., (2004). Biodiversity and Pest Management in Agro ecosystems, (2nd ed) CRC Press, Boca Raton, FL, USA.
- Barracough, S .and Grimier, K.B., (2000). Agricultural expansion and tropical deforestation. Earth scan.
- Barberi, P., (2002). Weed management in organic agriculture: Are we addressing the right issues? Weed Research.
- Bengtson, Janne 2005, the effects of organic agriculture on biodiversity and abundance.
- Birhanu. M. (2005). Remote sensing and GIS techniques in land use/land cover mapping, change detection and evaluation of environmental degradation in the main Ethiopian Refit valley (MER) between Koka and Ziway.
- Bruijnzeel, L, A., (2004). Hydrological functions of tropical forests: not seeing the soils for the trees? Agriculture, ecosystems and environment.
- Choritz 2007 assessing the impact of Celaque National park on process of landscape fragmentation and analysis of land use land cover change forest fragmentation
- Conover, (2002). Resolving human-wildlife conflicts, the science of wildlife damage management, Lewis, New York
- CSA 2007 Central statistical agency on agricultural sampling survey

- Darout Gum'a (2004). The socio-economic Aspect of irrigation management. Addis Ababa University. Addis Ababa.
- Dereje. A. (2005). Assessment of Socio-economic Impacts of Irrigation in Finchaa valley, Addis Ababa University, Addis Ababa.
- Demeke Datiko and Afework Bekele (2011). Population status and human impacts on the endangered Swayne's hartebeest in Nechisar plains, Nechisar Nati Park, Ethiopia.
- Diamond, (1989). Overview of recent extinctions. Conservation for the Twenty first century. New York, Oxford University press.
- Dudley, N. and Stolton, S., (2003). Running pure, World Bank and WWF, Washington, DC
- Ethio GIS 2015, Land use land cover map of Fincha sugar factory.
- Food and Agricultural Organization, (2010a). Global Forest Resource Assessment main report (www.fao.org)
- Food and Agricultural Organization, (2011). Assessing Forest degradation: towards the development of global applicable guide. Rome
- Fincha sugar factory public state and relation office, (2016) Fincha valley, Agemsa.
- Food and Agricultural Organization, 2012 Food agricultural organization
- Flick, U., (2007). An introduction to qualitative research (3rd ed). Sage publication Limited, London.
- Gessese Dessie, (2007). Forest Decline in south central Ethiopia. Extent, history and process. Department of Physical Geography and Quaternary Geology, Stock Holm University.
- Groombridge and Jenkins, (2002). Global land use change and scenarios of biodiversity loss. GRLD - Arendal publication

International labor organization 1990 Convention concerning Safety in the use of Chemicals at Work (Entry into force: 04 Nov 1993).

Jackson, S.L., (2009). Research Methods and Statistics. A critical thinking approach (3rded). Belmont, CA: Wadsworth.

Jenkins, M., (2003). Prospect of biodiversity science. 332, 1175-1177

Jansen 1994

Jenson and John R. (1996). Introductory Digital Image Processing: a remote sensing Perspective, second edition. Prentice hall. New Jersey.

Kahsay Berhe, (2004). Land use and land cover change in central Highlands of Ethiopia. The case of Yerer Mountain and its surroundings

Kimberly, (2002). Environmental issues in Modern Agriculture. (<http://www.actionbioscience.org>)

Lile Sand 1999

Miguel, A and Alfieri (2010). modern agriculture: Ecological impacts and the Possibilities for truly sustainable farming.

(http://www.cnr.berkeley.edu/-agroeco3/modern_agriculture.htm)

Netsanet Deneke, (2007). Land use and land cover changes in Harenna Forest and Surrounding area, Bale Mountains National Park

Reid and John, F., (2011). The impact of Mechanization on Agriculture the Bridge on Agriculture and Information Technology

Rimando, T.J., (2004). Crop Science: Fundamentals of Crop Science. U.P. Loss Banos: University Publication.

Rosegrant, M.W., Paisner, M.S., Meiger, S. and Witcover, J., (2001). 2020 Global Food Outlooks. Trends, alternative choices. International Food Policy Research Institute, Washington, DC

- Rubenstein, J.M., (2003). *The Cultural Landscape: An Introduction to Human Geography*, (7thed), coddles River, N.J: Pearson Education, Inc.
- Rube, T.k., (2000). "Tropical forests, regional paths of destruction and regeneration In the let 20th century" "Columbia University press ISBN 0-231-13195.
- Richard, 2013 Socioecological responsibility and Chinese overseas investment on plantation expansion.
- Shannon, C. and Wiener, N. (1949). *The Mathematical theory of communication*. The University of Illinois, Urbana, pp. 117.
- Scoff, E, (2003). "Deforestation" Environmental Encyclopedia at, PP.358-359. Detroit: Gale.
- Shawinigan Company. (1981). Fincha Sugar project Design Report. Ethiopian Sugar Corporation. Addis Ababa. 9 -11pp.
- Sherbinan, 2002 how will oil palm expansion affect biodiversity?
- Tadesse Weldemariam and Masresha Fetene, (2007) forest of Sheka, multidisciplinary case studies on impact of land use/ land cover changes in south west Ethiopia.
- Tewodros Kumsa and Afework Bekele, (2008). Human-wildlife conflict and population status of Swayne's hartebeest in Senkele Sanctuary. Thesis in Biology (Ecology and Systematic Zoology)
- Tillman .D, Kenneth. G. Cassman, Pamela. A, Matson, rosamond Mayor and stephen pulaski, (2002). Agricultural Sustainability and Intensive production practice. Nature review Article.
- Turner, W, (2010). Qualitative Interview design, Nova south eastern university.
- Usher, M.B. (1986). *Wildlife Conservation Evaluation Articles, Criteria and Values*, London, New York: Chapman and Hall ISBN 978-94-010-3315-7
- Unite National Development Program 2014 *The Impacts of Oil Palm on Recent Deforestation and Biodiversity*.
- Williams, M. (2002). *Deforesting the earth: from prehistory to global crisis*. Chicago, USA. University of Chicago press.

Zelege K. (2005).GIS and remote sensing in Land use/Land cover change detection in Fincha valley area. East Wollega .Addis Ababa University. Addis Ababa.36-44pp.

The impact of Fincha Sugar Factory Plantation Expansion on forest cover change and wildlife specifically on large mammals

Research Questions for KI and FGD

1. What do you think about forest and wildlife? What important they have in ecosystem?

2. Is there any deforestation at your living area? Use this sign

3. Based on Q₃ if your answer is Yes, what do you think is the cause for deforestation of forest?

4. What are the impacts of large scale agriculture on forest and wildlife?

5. Is there hunting of wildlife at your living area? Use this sign

If your answer is yes, when they undergone hunting of wildlife? Which wildlife is commonly hunted?

6. What are the major impacts of deforestation on forest cover change, on wildlife especially on large mammals, and on the local society?

7. Which species of larger mammals were used to live in Fincha Valley before deforestation of the area? What is their present status?

8. For how long do you live in the study area (FSFSF) _____ Year _____

9. Is there settlement or translocation of people to FSF area?

 Yes No

10. If your answer is yes, what was the forest coverage of the area before and after settlement?

11. Which types of mammals were affected more by the loss of habitat in the area? And why?

12. Which wild animals had completely migrated/disappeared from the area?

13. On what activity does the local society engaged currently? What is the life status of the society?

14. Which plant species are more dominating an area in the past? How about know? Why?

15. What do you think is the attitude of the peoples of FSF on forest and wildlife?

**16. Who do you think is the responsible body for the cleaning of forests and wildlife of FSF area?
Why?**

Full Name: _____

Job _____

Sign _____

Appendices

(Source by: Jejebe Dheressa, 2016)

Appendix 1 Some samples of photo taken during field study



1A. Photo that indicates the LULC of the study area (Total Station)



1B. Photo that indicates the topography of the study area (GPS)



1C. photo of tall grass species that covers Study area during Wet season



(a)

(b)

1D. Photo that shows Study area at Wet season (A) and Dry Season (B)



Preparation of land for LSA using heavy machine at FV





- 1F. a photograph of illegal deforestation of forest for farming at study area.
1F. (East bank, west bank, and Neshe Villages)



- 1G. a photograph of illegal deforestation of forest for charcoal production at the study area.
(East bank, west bank, and Neshe Villages)



Water back (*Kobus defassa*) Local Name (Warabboo)



Great Kudu (*Tragelaphus strepsicors*) Local name (Gadamsa)

1H. A photograph of illegal hunting of large mammals at Fincha Valley

Appendix 2 Large mammal species identified inside EB, WB, and Neshe Village in the study area

Nº	Scientific name	Common name
1	<i>Angola colobus</i>	Gureza
2	<i>Chlorocebus pygerythrus</i>	Vervet Monkey
3	<i>Orycteropus afer</i>	Aard vark
4	<i>Civetticits civetta</i>	African Civet
5	<i>Canis adustus</i>	Side-striped jackal
6	<i>Chlorocebus aethiops</i>	Grivet Monkey
7	<i>Lycaon pictus</i>	African wild dog
8	<i>Kubus defessa</i>	Water back
9	<i>Crocota crocuta</i>	Spotted hyena
10	<i>Atilax paludinosus</i>	Marsh mongoose
11	<i>Galerella sanguinea</i>	Slender-tailed mongoose
12	<i>Genetta genetta</i>	Common genet
13	<i>Genetta tigrina</i>	Blotched genet
14	<i>Hylochoerus meinertzhageni</i>	Giant forest hog
15	<i>Hystrix cristata</i>	Crested porcupine
16	<i>Ichneumia albicauda</i>	White-tailed mongoose
17	<i>Lophiomys imhausi</i>	Crested rat
18	<i>Mellivora capensis</i>	Honey badger
19	<i>Panthera pardus</i>	Leopard
20	<i>Papio anubis</i>	Olive baboon
21	<i>Potamochoerus africanus</i>	Warthog
22	<i>Potamochoerus larvatus</i>	Bush pig
23	<i>Sylvicapra grimmia</i>	Bush duiker
24	<i>Syncerus caffer</i>	Buffalo
25	<i>Tragelaphus scriptus</i>	Bushbuck
26	<i>Oreotagus oreotagus</i>	Klipspringer
27	<i>Canis aureus</i>	Common Jackal
28	<i>Panthera leo</i>	Lion

Appendix 3 Monthly average rainfall data from 1979 - 2014

(a) RAIN FALL(mm)													
Years	Month	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
1979	—	—	17.5	9.7	135.3	171.8	287.5	249.3	166.7	83.6	4.5	15.0	
1980	1.0	19.2	30.1	87.1	91.0	168.9	412.6	254.0	139.1	78.9	3.2	0.0	
1981	5.2	0.0	27.9	56.6	133.6	142.4	352.8	187.6	243.7	66.2	1.8	0.0	
1982	11.7	18.4	32.5	26.5	41.0	90.9	464.3	195.2	138.2	77.4	15.5	0.0	
1983	1.6	24.7	17.1	16.9	134.9	109.5	310.5	267.6	205.9	183.1	31.8	0.0	
1984	0.0	2.8	10.4	3.2	129.0	244.0	320.8	200.5	255.3	0.0	1.5	1.0	
1985	3.0	0.0	13.3	30.8	116.7	156.7	327.4	426.4	194.2	52.1	28.2	2.0	
1986	0.0	19.3	39.1	68.7	14.8	190.6	289.3	186.6	125.9	53.4	0.0	0.3	
1987	1.8	6.0	44.4	96.5	159.8	190.3	285.8	219.9	105.1	62.7	0.2	4.2	
1988	0.9	16.6	19.9	20.9	33.0	241.8	490.0	307.0	172.1	102.6	1.3	0.2	
1989	0.0	1.6	85.6	62.2	41.5	168.0	310.6	331.8	137.6	64.9	25.9	96.3	
1990	1.1	8.4	46.0	67.2	80.8	205.5	410.2	327.0	211.8	5.5	13.0	0.0	
1991	0.6	2.8	66.2	62.3	88.6	222.6	381.3	346.7	203.1	4.9	0.7	6.8	
1992	8.5	6.4	53.5	72.5	111.5	304.6	256.3	236.7	130.5	146.2	15.3	14.6	
1993	0.1	0.3	18.1	111.7	148.1	200.1	474.6	332.0	292.3	115.3	0.0	0.0	
1994	0.0	0.0	24.7	55.5	223.3	250.7	356.9	280.4	153.6	2.3	7.4	0.0	
1995	0.0	0.7	32.9	51.8	241.6	241.9	314.6	249.5	180.6	13.0	0.1	4.8	
1996	7.1	0.0	40.9	70.8	145.7	160.3	399.4	235.6	214.8	20.1	5.5	0.0	
1997	9.8	0.0	19.8	90.1	147.4	239.0	215.3	224.2	137.5	124.1	25.9	1.9	
1998	0.0	1.0	24.6	23.7	179.1	196.3	296.4	302.8	205.5	199.3	12.5	0.0	
1999	17.9	0.0	1.0	63.7	78.5	322.3	248.8	333.2	148.8	305.1	0.4	12.0	
2000	0.0	0.0	0.9	115.2	73.0	355.1	262.1	271.7	293.4	212.0	6.4	9.0	
2001	0.0	0.4	66.3	46.1	115.7	263.2	295.6	283.6	111.0	60.4	1.6	4.1	
2002	6.4	2.7	33.8	42.0	46.6	239.3	320.1	221.0	156.7	12.3	0.0	18.6	
2003	1.5	24.9	52.7	11.5	5.0	292.7	294.3	271.6	217.7	11.6	5.5	4.0	
2004	0.4	0.4	2.3	56.6	36.6	251.9	295.4	272.2	194.7	42.1	4.9	0.0	
2005	9.6	0.0	112.1	30.5	53.8	418.7	351.8	232.1	244.3	77.0	15.7	0.0	
2006	0.0	1.0	27.7	13.7	115.9	185.8	465.4	290.8	253.0	73.9	3.3	22.6	
2007	3.5	38.2	36.6	36.4	126.1	259.4	273.9	237.5	192.8	61.9	0.0	0.0	
2008	0.0	0.0	0.0	55.1	174.8	161.9	477.6	280.8	170.5	58.3	76.2	5.7	
2009	0.1	11.7	14.7	43.1	16.6	200.8	304.2	431.6	98.1	137.7	0.0	4.1	
2010	3.5	2.9	0.0	23.4	180.2	66.7	486.9	360.0	156.0	27.0	8.2	0.0	
2011	9.5	0.0	48.6	46.3	196.9	23.8	238.9	203.5	253.3	0.0	66.9	0.0	
2012	0.0	0.0	21.8	4.2	29.0	143.6	315.6	337.5	370.3	17.5	0.0	0.0	
2013	0.0	0.0	13.4	2.9	157.3	301.5	310.0	363.6	128.4	111.5	43.0	0.0	
2014	0.0	1.4	43.9	59.3	296.8								

total	104.8	211.8	1140.3	1734.7	4099.5							
average	3.0	6.1	31.7	48.2	113.9							
years	35	35	35	35	35	35	35	35	35	353	35	35

Appendix 4 Monthly average temperature data from 1990 - 2014

Years	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
1990			22	21	25	35	60	59	57	37	28	23
1991	22	18	23	24	28	40	60	62	54	35	27	25
1992	27	23	24	25	31	43	57	63	54	50	29	33
1993	28	24	21	33	36	60	62	62	62	47	31	23
1994	20	18	19	22	38	52	63	66	57	32	29	24
1995	20	18	19	26	39	46	64	63	57	38	34	33
1996	28	20	27	30	45	54	58	63	54	37	29	26
1997	28	18	23	30	36	53	62	60	49	42	40	28
1998	29	23	26	21	33	50	67	67	58	52	32	22
1999	26	16	18	22	36	47	66	65	56	54	33	32
2000	23	18	19	32	33	45	62	63	58	50	37	30
2001	27	24	30	27	36	53	64	66	54	42	32	28
2002	29	22	28	24	22	44	56	62	53	32	25	28
2003	24	24	27	24	19	43	60	63	60	39	31	25
2004	25	22	23	28	25	47	61	63	58	44	34	27
2005	25	19	27	27	28	46	63	62	59	44	32	21
2006	22	21	24	26	35	47	62	67	59	44	38	33
2007	30	27	24	30	37	56	63	64	61	37	31	24
2008	23	21	18	30	47	56	64	66	60	43	47	40
2009	35	32	31	34	31	44	69	69	61	52	39	40
2010	34	35	33	36	50	54	66	69	62	47	41	38
2011	47	36	48	44	51	60	66	69	61	42	47	36
2012	30	21	30	28	34	48	70	69	68	50	53	48
2013	38.0	36.0	30.0	29.0	44.0	57.0	62.0	66.0	53.5	41.2	35.4	25.1
2014	24	23	25	29	44							
total	664.0	559.0	639.0	702.0	882.9							
average	27.67	23.29	25.56	28.08	35.32							
Years	24	24	25	25	25	24	24	24	24	24		24

Addis Ababa University

School of Graduate Studies

Declaration

I, the undersigned declare that this thesis is my original work and has not been presented for a degree in any other university and that all sources of materials used for the thesis have been duly acknowledged.

Alemayehu Deressa

This thesis has been submitted for examination with my approval as a university advisor.

Name Habte Jebessa (PhD)

Signature _____

Date of submission _____