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THE IMPACT OF LARGE SCALE AGRICULTURE ON FOREST AND WILDLIFE IN DIGA WOREDA, DIDESSA VALLEY, OROMIA REGIONAL STATE, WESTERN ETHIOPIA.

MSc THESIS

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Addis Ababa, Ethiopia

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MSc. THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES ADDIS ABABA UNIVERSITYIN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTERS OF SCIENCE IN BIOLOGY

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DECLARATION

I the under signed, declare that this thesis is my original work done under the guidance of Habte Jebessa (PhD), and has not been submitted for any other University. All reference materials used for the thesis have been duly acknowledged.

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TABLE OF CONTENTS

Contents page

List of Tables Page

List of Figures Page

List of Plates Page

Acronyms

CSA Central Statistics Authority

DA Development Agent

DAO District Agriculture Office

DV Didessa Valley

FAO Food and Agriculture Organization of the United Nations

FGD Focus Group Discussion

ERDA Earth Resource Data Analysis System

ETM^{+} Enhanced Thematic Mapper

GIS Geographic Information System

GLCF Ground Land Cover Facilities

GPS Global Positioning System

HH Households

KI Key-Informant Interview

Km Kilometer

LSA Large Scale Agriculture

m a s l meters above sea level

^{0}C Degree Centigrade

SPSS Statistical Package for Social Science

TM Thematic Mapper

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 1986 to 2006 in Diga district(Woyessa Dimtu, Bekiltu Gudina and Melka Beti Jirma kebeles) was compared with the present time using Geographic information system (GIS). The objective of this study was to investigate the impact of large scale agriculture on forest cover change by using the satellite image of the study area and other data collecting methods such as household's interview, KI, FGD and observation (survey) to detect its effect on wildlife. The study employed both qualitative and quantitative data as well as primary and secondary data sources to collect necessary information. The information providers were purposively selected from sample 'kebeles' based on their age and experiences, that is, to get a detail and accurate information elders and experts who have lived in the area for many years and who know more how and when the Hanger- Didessa state farm had established were selected. The state farm covered a large area, that is, about four districts such as Sasiga, Diga, Arjo and Guto Gida. For this study Diga was selected because of its socio economic characteristics, deforested (degraded) area, local loss of larger mammals and forest cover changes observed in the district. Descriptive research method was used to assess community's knowledge, perception, skill and feeling about the impact of LSA on forest and wildlife in the area. Land cover change analysis for 1986 to 2006 showed that the land cover of the study area is classified as grazing, wood, agricultural, settlement and degraded lands. The result of the analysis showed that agriculture, settlement and degraded lands increased from 19.68% to 32.72%, 12.12% to 26.85% and 2.76% to 4.72% respectively in an expense of decrease in grass (grazing) and woodlands. Therefore, LSA is the major cause for the loss of forest and wildlife in the study area.

Key words/phrases: Large Scale Agriculture, Didessa State Farm, Forest, Wildlife, Deforestation and Monoculture.

1. INTRODUCTION

1.1 Background of the study

Agriculture is the cultivation of plants, fungi and other life forms for food, fiber, bio-fuel, medicine and other products, and the raising of livestock that are used to sustain and enhance human life (ILO, 1999).Agriculture is the deliberate effort to modify a portion of Earth‟s surface through the cultivation of crops and the raising of livestock for sustenance or economic gain (Rubenstein, 2003).Agriculture is the systematic raising of useful plants and livestock under the management of man (Rimando, 2004). All forms of farming have major impacts on forest and wildlife especially 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

Large scale agriculture is the process of using 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 labors or by draft animals such as oxen, horses and mules (Miguel and Alfieri, 2010). Mechanization involves the use of an intermediate device between the power source and the work. Large scale agriculture includes the use of tractors, trucks, combine harvesters, air planes, helicopters and other vehicles for different purpose. Large Scale Agriculture increases production, reduces dependence, decreases the cost of crops and increases multiple cropping patterns which need quick land preparation, planting, weeding, harvesting and processing (Miguel and Alfieri, 2010).Even though large scale agriculture increases the production, it has a great impact on forest, wildlife, soil, water and the climate. Intensive monoculture depletes soil and leaves it 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 (Angelsen and Kaimwitz, 2001).

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 a long list of activities that affect forest and wildlife, in this study a great deal of emphasis was given to assess the impact of large scale agriculture on forest and wildlife in (Western Ethiopia, Oromia Regional State, Eastern Wollega Zone, Diga Woreda, Didessa Valley).Didessa Valley was selected for the reason that there was a dense forest with a variety of mammal species before the establishment of Didessa State Farm in 1974, which is now completely deforested and lost many of its plant and animal species.

1.2 Statement of the problem

The study area represents change in and loss of some wildlife in Didessa Valley for the following reasons:-

1. Large scale agriculture, that is, Didessa State Farm of the affected both the forest and the wildlife in the Didessa Valley.
2. The area which was under dense forest cover is now exposed to deforestation, illegal settlement and monoculture forests, which lead to environmental degradation and serious threat to wildlife.
3. There is a shortage of water in the area.
4. Local forest cover change has significant and cumulative impact on regional and global climate change. It also has an impact on the socio-economy of the local society.

In order to assess the change, it is necessary to conduct a research. Therefore, this study tries to identify the impact of large scale agriculture on forest and wildlife in the DV and provide recommendations which will contribute to the sustainability of natural forests and the conservation of wildlife habitat in the Woyessa Dimtu, Bekiltu Gudina and Melka Beti Jirma kebeles.

1.3 Research Question

Generally, this study tries to address the following questions:

1. What are the impacts of large scale agriculture on forest and wildlife in Woyessa Dimtu, Bekiltu Gudina and Melka Beti Jirma kebeles?

2. What are the major challenges that the wildlife and the local people face due to loss of forest in the study area?
3. What are the types of land cover changes observed in the study area?
4. What are the use of forest and wildlife to the local community

1.4 Objectives of the Study

1.4.1 General objective

The general objective of the study is to investigate the impact of large scale agriculture on wildlife and forest cover change by using the satellite image of the study area.

1.4.2 Specific Objectives:

- To assess the way how large scale agriculture caused impact on forest and wildlife in the study area.
- To examine the major problems that the wildlife and the local society faced due to the loss of forest in the study area.
- To identify emerging ecological problems associated with the new settlement in the study area.
- To map land use land cover change detection of the study area.
- To identify the cause for the loss of forest and wildlife in the study area

1.5 Significance of the Study

This research was conducted on the issue of the impact of large scale agriculture on forest and wildlife in Didessa Valley, West Ethiopia. In this study community‟s knowledge, attitude and experience about the impacts of Didessa State Farm on an area was explored. The result of this study was used as an input for the researchers to conduct further research on the same issue. In addition to this, the result of the study would benefit the agricultural workers and the concerned bodies to see untouched knowledge of the community as well as the type of home remedy to fill the gap on environmental protection with appropriate conservation program. Generally, this study was

identified the major factors that threaten forest and wildlife, and recommended appropriate solutions for the problems.

1.6 Delimitation of the study

The requirement of delimiting the study area to manageable size enables to carry out a research and helps to thoroughly make an investigation on the identified problem. Therefore, this study was intentionally restricted to the deliberately selected district, that is, Diga district where the area was „formerly known as "Didessa state farm" from which three kebeles are selected to identify the problem of large scale agriculture on forest and wildlife

1.7 Limitation of the study

Any study would not be complete enough unless all necessary requirements were fulfilled. The researcher was faced several constraints in data collection as well as analysis. Some of the most constraints were:

- Unavailability of recent adequate literature on the topic in the locality.
- Shortage of secondary data sources and the problem of getting a clear LULC change detection map of the study area on the satellite image for the periods before 1986 and after 2006.
- Time and financial constraints
- The problem of transportation in the study area

1.8 Ethical Consideration

During data collection communication with respondents and focus groups were inevitable. The communication and contact with information providers require good approach. Necessary respect was given to all informants and to their cultures, beliefs, and others. Every informant was asked to give information based on his/ her free will, not on obligation, cheating and giving benefits. Friendly approach helped to obtain honest response. Generally, all questions were prepared for scientific purpose and were free from any political implication and other unnecessary affairs.

2. LITERATURE REVIEW

2.1 Concept of Large Scale Agriculture, Forest and Wildlife

2.1.1 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, sorghum or other cereals. This inevitability brings a reduction in biodiversity for several reasons some of which are: the area is dominated by just one species reducing the number of niches for other organisms to fill, organisms that might live in the area regarded as pests, as they reduce the crop yield and they are controlled by the use of pesticides. 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.

2.1.2 Effects of large scale agriculture when compared with traditional Farming

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 fallow. 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 at „bay" with herbicides and pesticides, therefore it cause the local extinction of species. Modern agricultural methods and technologies brought spectacular increases in food product (Tillman *et al.,* 2002), but not without high environmental costs. 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 (Groombridge 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 (2004), in Ethiopia, annual loss of natural forest cover mainly for agriculture, has been estimated at 150,000 to 200,000 hectares per-year.

2.1. 3 Concept of Forest

A forest is a large area of land covered with trees and other woody vegetation. Forests are the dominant terrestrial ecosystem of the earth and they are distributed across the globe (Pan *et al.,* 2013). 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. 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 and reduce global warming; provide a wealth of natural medicine and protect soil erosion. A tree root protects against washout and helps to keep water in the soil. In addition forests are used for timber, house furniture, fire wood, and house and road construction. They are also 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 (Reid and John, 2011). 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. In present Ethiopia, 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).

2.1.4.Concept of Wildlife

Wildlife traditionally refers to non- domesticated animal species, but has come to include plants, fungi and other organisms that grow or live wild in an area without being introduced by humans (Usher, 1986).Wildlife is any living organism living in its natural habitat. It could be a plant, an

animal or microorganism other than the cultivated plant or domesticated animal (Aggarwal, 1995). Ethiopia is a large and ecologically diverse country with unique environmental conditions (Afework Bekele *et al.,* 2011).In Ethiopia, since many years ago; the natural vegetation of the country has been destroyed by human and natural catastrophic 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 include: deforestation and 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.

2.2. Problems associated with large-scale agriculture and their impact on forest and wild life

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, it 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 (Barraclough 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 though 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).

2.2.1.1 Deforestation in the World

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 most wide 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 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.

2.2.1.2. Deforestation in Ethiopia

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 locals clearing forests for their personal needs such as fuel, hunting, agriculture and at times for religious reasons. Deforestation in Ethiopia 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).

As it was indicated by Gessesse Dessie, (2007), the rate of deforestation in Ethiopia between 1972 and 2000, that is, within 28 years period 80 percent of the 1972 forest cover was lost. In Ethiopia, the proximate cause for 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). Human activity is largely altering the earth‟s vegetation cover. Such changes have considerable consequences for the health and resilience of ecosystems and for human welfare.

Deforestation also disrupts the global water cycle (Bruijnzeel, 2004).With the removal of part of the forest; the area cannot hold as much water creating 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

Monocultures are large areas of land cultivated with a single crop using methods that imply a high use of inputs such as agro toxic chemicals and machinery (Roségrant 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 takeover-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 out breaks, 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.

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

Remote sensing is defined as the use of electromagnetic radiation sensor to record images of the environment that can be interpreted to yield useful information (Paul, 1985; as cited in Netsanet Deneke, 2007). 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 supervised 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 databases 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 databases (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.

2.4 Land and Land-Cover Dynamics and Links -Use

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 vegetation 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 millennia. 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. The most significant historical change in land cover has been the expansion of agricultural lands, population increase, technological development and the requirements thereafter, altering entire landscapes, and ultimately affecting the 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

3. MATERIALS AND METHODS

3.1Description of the study area

3.1.1 Location

The study was conducted in three kebeles located in Diga Woreda; East Wollega Zone, Oromia Regional State; Western Ethiopia. The study area is found 388 km west of Addis Ababa and 60 km west of Nekemte town, which is the center of East Wollega Zone. Geographically, it is positioned between 9^0 0' 0" N to 9^0 11' 0" N latitude and 36^0 9' 0" E to 36^0 31' 0" E longitude (Figure1). Diga is bordered by Sasiga in the North, Guto Gida in the East, Leka Dulacha in the South, Illu Aba Bora (Chawaka) in South west ,West Wollega Zone and Benishangul Gumuz Regional State in the North west. Didessa River runs on the weste↓rn side of Diga woreda.

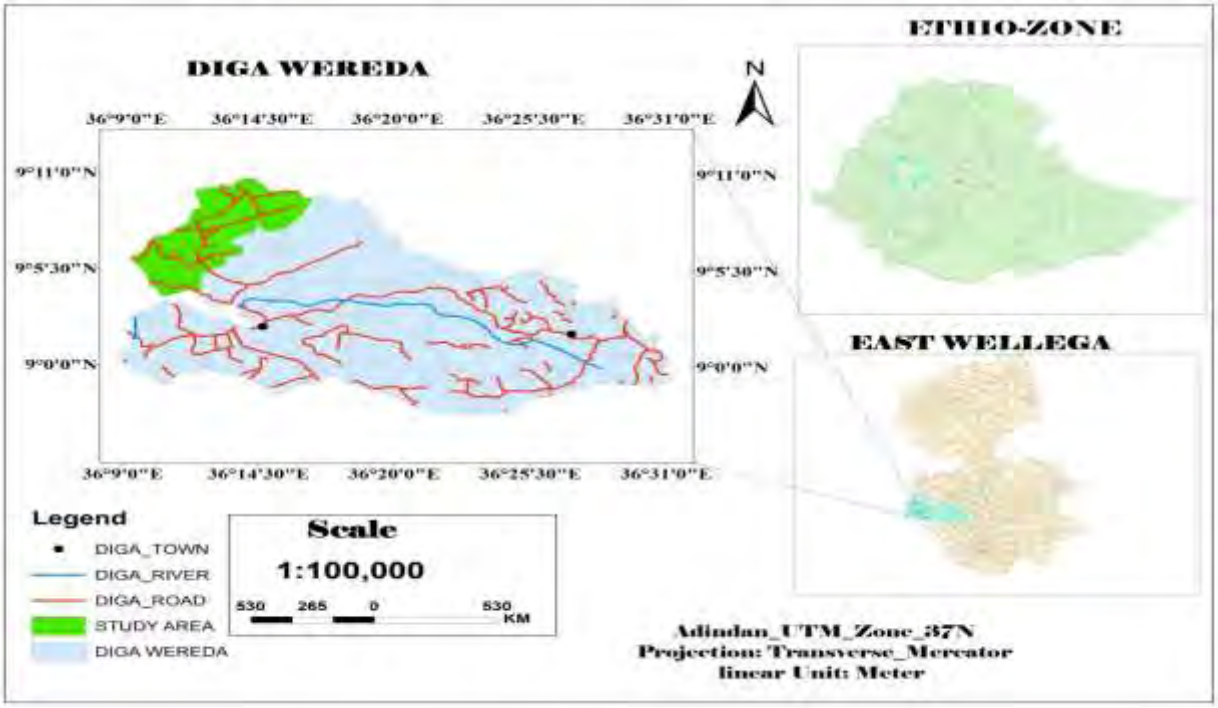

Figure1. Map of Diga woreda and its relative location in Ethiopia

3.1.2 Topography

The main land form of Diga woreda is nearly a slope having 0-55% with small undulating and sloping relatively steep. The elevation of the area in general ranges from 1200 to 2220 m a.s.l (source: DAO, 2016) and comprises two agro ecological zones, the lowlands which account 51.4 % and the midlands which account 48.6%.The midlands are steep formerly forested terrain which is being rapidly cleared of trees. Scattered communities tend to cultivate tops and bottoms of slopes because the slopes are too steep; therefore, it is exposed to soil erosion. The lowland bordering the Didessa River is less steep than the midlands comprising more rolling train.

3.1.3 Climate

The study area exhibits two ecological zones, the mid-land (medium temperate) which accounts about 48.6% and lowland which accounts about 51.4 % of climatic conditions with a yearly rainfall ranging from 1200-2100 mm. A peak rainfall occurs between June and September which is the long rainy season, and the short rainfall occurs between March and April .The average minimum and maximum annual temperature of the area was 18^0c and 32^oC respectively. (Source: Diga District Agriculture Office)

3.1.4 Soil

Based on FAO (2007) classification of the world soil, there are three types of soils in Diga District. Dystric nitosols (one of the best fertile soils) account about 54,744.7 ha of the Diga Woreda. Dystric gleysols, and orthic acrisols constitute the remaining areal share of the Woreda. The dominant soil color was red in the midland whereas black in the low land (Biranu, 2012; cited in Alemayehu Wudneh et al., 2014).

3.1.5 Water sources

Diga district was rich in rivers and streams which service the community for drinking, irrigation and other purposes. At present Didessa River serving as recreational area, Maka and Dimtu Rivers used for small scale irrigation and also they are a source of sand for Nekemte town and Chancho River serving Nekemte town for drinking. There are also other rivers such as Gulufa, Kiki, Bareda, Sororo and others. All of these rivers are tributary of the Didessa river (Source: Diga district Water

Source office and local elders).But in the study area there are only seasonal streams and two rivers Gebo and Fitesha which are used for small scale irrigation and drinking (Source: Survey 2016).

3.1.6 Land use and land cover of the study area

Currently, Ethiopian flora has been already mapped using GIS and remote sensing technologies and this region is located in B3 on the atlas of the potential vegetation map of Ethiopia (Friis *et al.,* 2011). The study area has been covered with dense native vegetation types before clearing or deforesting the area for LSA, that is, for the „Didessa State Farm" which was established in 1974. Before the establishment of this farm, the vegetation types found in the DV were important habitats for various wild mammals, birds, reptiles, amphibians", insects and other organisms. At present, most of the study area is converted to bare land and Agriculture land with a few remaining scattered native plant species and fragmented plantations of non-native plant species such as eucalyptus and mango trees. Even though the vegetation of the area is at risk, there is continuous deforestation of trees by new settlers for agricultural activities.

3.1.7 Wildlife

The lowland areas of Diga woreda previously were covered with dense forest in which different plant and wild animal species were living before it was cleared for the establishment of the Didessa State Farm. According to the community elders, the local people had moved to this area to hunt large mammals such as lion, buffalo, leopard and African wild dog for trophy and braveness, and warthog, bush pig, zebra, and others for their meat. But, at present these larger mammals are not found in the study area because they lost their natural habitat by LSA. As information was gathered from elders, DA, community leaders and HH during the field survey the most notable mammal species found in the study area at present are Spotted hyena, Anubis baboon, Grivet monkey, bush duiker and Menelik"s bushbuck (Appendix1,Table4) but other larger mammals were lost from the area with the loss of forest (Appendix1, Table5).

3.1.8 Socio Economic and Demographic Features

The total population of Diga district was 80099 out of the total population 39249 of them were males and 40856 of them were females (CSA, 2007).The number of population of the households in the Woyessa Dimtu, Bekiltu Gudina and Malka Beti Jirma was 500,506 and 664 respectively.

Therefore, the total population of the study area was 1670.Based on the number of population in each kebeles the sample household‟s number was purposively determined. Accordingly, 15, 15 and 20 households were selected from Woyessa Dimtu, Bekiltu Gudina and Melka Beti Jirma kebeles respectively. The people under the study area basically depend on mixed agricultural activities using oxen and their families‟ labor. 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. The major crops grown in the midland area include maize, onion, potato, beans, peas, barley and wheat (Source: own survey 2016 and Key-Informants).The lowland area produces corn, sorghum, oil crops, banana, sugar cane, tomato, nuts, avocado and mango. The major livestock‟s raised in the area include cattle, goats, sheep, mules, donkeys, and fouls (Source: Local elders, community leaders and DA). However, the production was not satisfactory because the local people used primitive methods of production. (Source: Diga district Agriculture Sector).

Diga district was organized into 21 rural and 3 urban kebeles. There are also other organizations such as: 63 Rural Development Zones, 422 Kebeles Development groups, 2100 the Five Rural Development (locally known as „‟Shanee Misooma Baadiyyaa‟‟‟).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/her self .Both „Edir‟ and „Eukub‟ are used to strengthen more social relationship among local societies and to save money that will be used during some sermonies like wedding, burial and to help one another at accident (Source: DAO, community leaders and elders).

3.2 Research Method

Qualitative research method was used to gain an understanding of underlying reasons, opinions and motivations that cannot be measured.

3.3 Design of the study

The study design selected for this research was descriptive survey method, Land use change mapping and comparison, and direct observation were used. Descriptive research can only describe

a set of observations or the data collected, (Jackson, 2009). The reason why descriptive method is used is that to describe the data and characteristics about what is being studied. After the participants answered the questions the researcher described the responses given. The method of sample selection used for three kebeles and farmer households was purposive sampling.

3.4. Materials used for the study of LULC change of the study area

The materials and software used for this research were:

- ArcGIS 10.2,
- Earth Resource Data Analysis System(ERDAS)IMAGINE 2010
- Global Positioning System (GPS),
- Digital Camera
- Other software (www.socscistatistics.com/tests/ztest) was used

3.5 Data Collection

Appropriate data types were gathered from their respective sources to conduct the study on land cover change of the study area. Pilot survey was conducted in the DV in November, 2015. 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.

3.5.1Types and sources of data collection

Both primary and secondary data sources were used in this study. Farmers were the major sources of primary data. As part of the primary data information was also collected from woreda Agricultural Experts, kebele leaders, community elders and water resource experts. Secondary data sources were obtained from published materials and internet/websites (Table1).

Table1: Data types and their sources as used in the current study

No	Type of data	Source
1	Satellite imageries and their date of acquisitions: ▪ Thematic mapper (TM) ✓ Date of acquisition 22/11/1986, 30 m resolution ▪ Enhanced Thematic Mapper (ETM+) ✓ Date of acquisition 26/11/2006 and 30 m resolution	Downloaded from internet
2	Demography data	Diga District, and central statistical agency (CSA 2007)
3	Soil type	Ministry of Agriculture &Rural Development
4	GPS ground truthing	Own measurement
5	Information as to conservation & support practices	WOreda Rural & Agriculture Sector

3.5.2 Sampling Techniques and Sample size

In Diga woreda there are 24 kebeles. From these, three kebeles were purposively selected for the study because, they were relatively more deforested for LSA and have lost vegetation cover. The total number of HHs in the three kebeles was 1670, of which 3% were included in the study because of the homogeneity of the population in ethnicity, language, culture, occupation and location. Therefore, this sample size can be enough to represent the whole population of the study area. Generally, the sample size adds up to 70 including those selected as Key informants and Focus group discussion participants.

3.5.3Data Collection Methods

Four types of data collection methods were used to conduct this study. These are: Household interview, Focus group discussion, key informant interview and direct observation. Secondary data from internet and written documents were also used to collect information about the impact of LSA on forest and wildlife. The questionnaire was prepared in English and translated to the local language Oromifa for communication convenience and responses converted to English language during analysis.

3.5.3.1 In-Depth (households) Interview

In-depth interview is one of the qualitative research method which serves to conduct extensive individual 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 to participants‟ life experience, attitude and view point of a particular problem. Therefore, in this study in-depth interview was used to assess the impact of LSA on forest and wildlife in the DV. Selection of the interviewees was conducted based on purposive sampling techniques. To get detail information from the local community priority was given to the elders and those who have good experience and information about the Didessa State Farm.

3.5.3.2 Key Informant Interview

To supplement the information collected using questionnaire and to have detailed insight about the impact of LSA on forest and wildlife in the study area, key informant interview was used as means of the data collection. Key informant interviewees were selected from Diga woreda in three kebeles namely Woyesa Dimtu, Malka Bayeti Jirma and Bikiltu Gudina. The participants were selected purposively based on their age, experience, and involvement in different activities and practices in the Didessa State Farm. Therefore, 10 key informant members were selected and interviewed.

3.5.3.3 Focus group discussion

Focus group discussion is one of the major qualitative research tools used to examine people‟s thought and feelings. It is mostly conducted by inciting “10 to 12” participants to explore information on specific issues (Flick, 2007). FGD 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 FGDs were conducted in the study area (one for each kebele). The FGDs consist of 10 members (that is, 3, 3 and 4 members in Woyessa Dimtu, Bekiltu Gudina and Melka Beti Jirma respectively). The members of the FGD were purposively selected from community leaders, elders, agriculture experts, water resource sector, health sector and senior farmers who were known to have good knowledge about the issue.

Figure 2. Focus Groups during Discussion in Melka Beti Jirma

3.5.3.4 Direct field observation

Direct observation is one of the data collecting tools that were used in this study. Field observation was made in the three kebeles to document the impact of LSA on forest and wildlife. Field observation was started in November, 2015 and continued throughout the whole process of data collection to make sure the validity of acquired information.

3.6 Methodology used to study LULC changes of the DV

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 study area included:-

- **Desktop review**
  - Organizing the Literature review so as to substantiate this study
  - Extracting the shape file of the study through clipping from Ethio-map in order to delineate the study area
  - Clipping of rivers and roads from Ethiopian map that cover the study area
  - Down loading Land sat image from GLCF web site
  - 1986 TM and 2006 ETM+ Land sat Image processing and making unsupervised classification
- **Data Collection**
  - ✓ Basic information about demography, topography, climate, soil type, water source, of the study area was gathered from Diga district Agriculture Sector, water source office and also HH interview, KI and FGD were conducted on a pre-set checklist questionnaires with the purposely selected informant groups of the three kebeles.
  - ✓Using Garmin Global Positioning System (GPS) ground truthing record was carried out.
- **Data compilation**
  - Conducted classification based on the ground truth
  - Change detection between 1986 and 2006 satellite imageries were made.
  - The rate of change was calculated for each land use/land cover using the formula:

    Rate of change in ha/year=(X-Y)/Z

Where; X = Recent area of land use/land cover in ha.

Y=Previous area of land use/land cover in ha and

Z= Time interval between X and Y in years

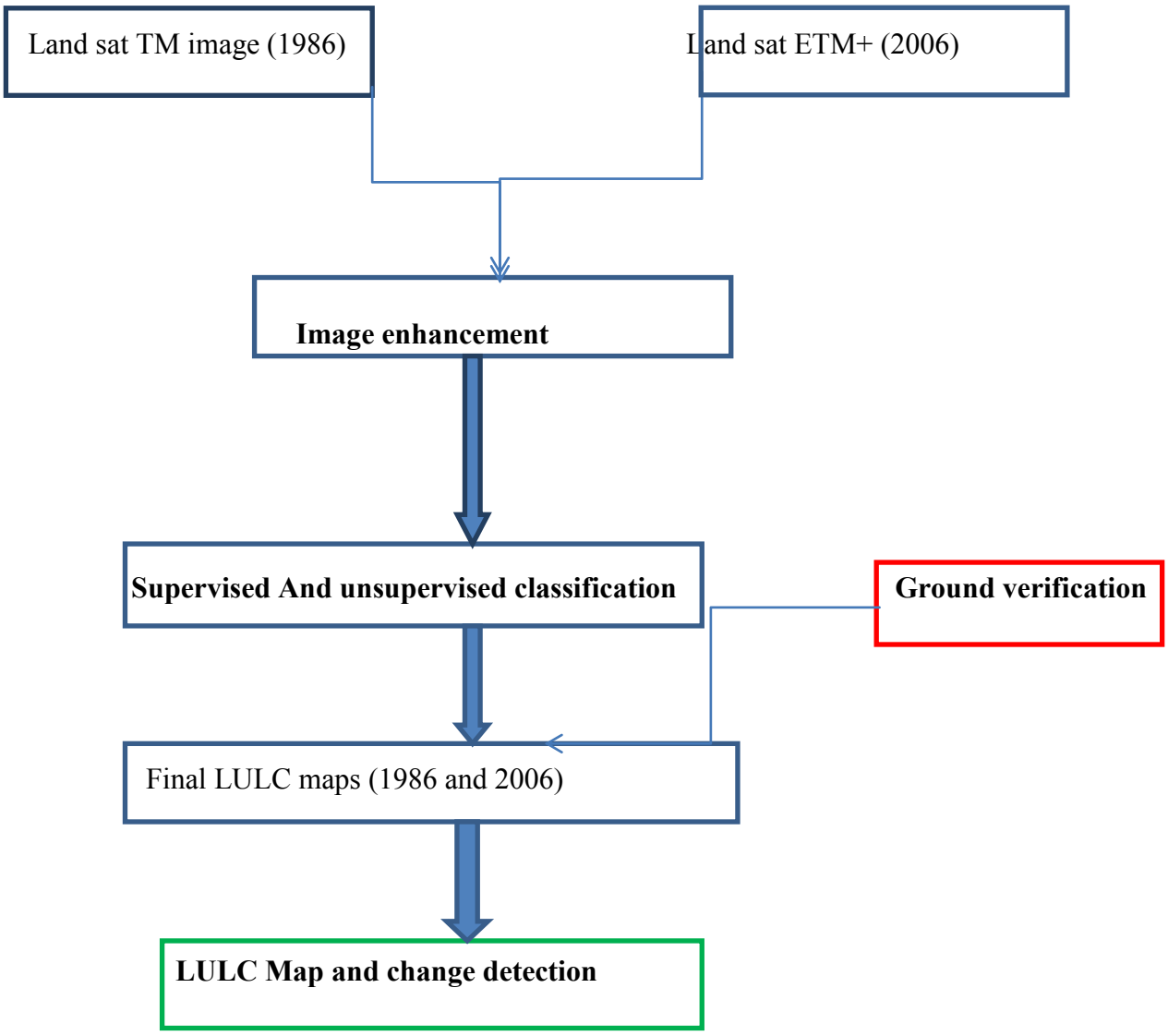

Figure 3. Flow chart for LULC evaluation and investigation of LSA in Didessa Valley

3.7 Data Analysis

3.7.1 Data compilation and presentation

The frequency, cumulative frequency and percent of the relevant data were analyzed using statistical package for social science (SPSS 20). Data collected from different sources using (HHs; KI, FGD, GPS, GIS and digital camera) were organized in to meaningful facts and were explained in detail. The compiled data were presented in the form of percentage, tables, charts, graphs, and textual description and photos to examine the extent to which LSA caused loss of forest in the study area. Finally, conclusion and recommendation are formulated based on the findings.

3.7.2 Image Processing and Classification

3.7.2.1 Image Processing

Digital image processing involves the manipulation and interpretation of digital image with the help of a computer (Lillesand and Kiefer, 1994). Satellite imagery has to be well processed prior to use for further applications. It is in fact essential to rectify the raw satellite image under the pre-processing stage such as geometric and radiometric correction. Image restoration also involves the correction of distortion, degradation, and noise introduced during the image processing. Image restoration produces a corrected image that is as close as possible, both geometrically and radio metrically, to the radiant energy characteristics of the original scene. To correct the remotely sensed data, internal and external error must be determined (Jensen, 1996). In pre-processing phase, it is usually necessary to geo-reference the images on projection and datum that Ethiopia has already selected, UTM projection and Adindan datum. In this respect, all the images used which are in WGS84 projection have been re-projected in to the country‟s datum and projection. This is mainly because datum and projection conflict would undoubtedly limit the use of various themes (layers) at time. In other way, if remotely sensed data are to be used in association with other data within the context of a geographic information system, then the remotely sensed data and the products derived from such data would need to be expressed with reference to the geographical coordinates that are used for the rest of the data in the information system.

Histogram equalization that is to apply a nonlinear contrast stretch that redistributes pixel values so that there are approximately the same number of pixels with each value within a range; haze and noise reduction with the view to overall reduce the amount of haze and noise from an input image were in general done so as to enhance the interpretability of the images. However, those enhancement techniques did not bring as such significant change consequently; spatial enhancement of resolution merge to increase the spatial resolution of multi-spectral image was also carried out. With regard to bands selection, all the bands that are present in each image are not used for land use / land cover classification. Depending on the nature of each band‟s application, some bands were selected. After attempting different band combinations by considering their specific applications, false color composite of band 2 (green), 3 (red) and 4 (blue) of TM and ETM+ were applied to classify the study area.

3.7.2.2 Image Classification

The overall objective of image classification procedures is to automatically categorize all pixels in an image into land use / land cover classes or themes (Lillesand and Kiefer, 1994). Remotely sensed data of the earth may be analyzed to extract useful thematic information. Notice that data are transformed in to information. Multispectral classification is one of the most often used methods of information extraction (Jensen, 1996). In classifying the images, both unsupervised and supervised image classifications techniques were applied, for the latter case training site was established based on the ground truth taken during field work. The unsupervised image classification was done before field work. Among different algorithms in the drop down lists of supervised classification, maximum likelihood image classification was utilized. By applying the techniques of image classification, LULC types have been identified so that to use the classified images for change detection and identifying the impact of large scale agriculture as well as deforestation on forest and wildlife. With the help of visual interpretation elements and the different reflection characteristics of the features in the satellite images of 1986 and 2006, the study area has been classified in to five LULC classes, namely, Agricultural area, Settlement area, grazing land, wood land cover and degraded land.

- **Agriculture land**: - is an area of land ploughed or prepared for growing different types of crops.

- **Settlement land**: - refers to the action of people coming together to live in an area. Is a general term used in archaeology, geography, history and other subjects for a place where people live (either permanently or temporarily). When they come from far away it is sometimes called a colony. Settlement, locality or populated place is a community in which people live. A settlement can range in size from a small number of dwellings grouped together to the largest of cities with surrounding urbanized areas. Settlements may include hamlets, villages, towns and cities.
- **Grazing land**:- a land used for grazing animals
- **Wood land cover**:- this class corresponds to plants which has undergone modifications from man‟s influence. It is composed predominantly of secondary vegetation indicative of a recovery stage from past disturbance. It occurs mostly near farm land and around settlements. Generally, it is an area covered with scattered wood.

Plate 1: Woodland in Bekiltu Gudina kebele May,2016)

- **Degraded/bare land**:- this type of land system has been last category classified from both satellite images which is really the most deteriorated or simply totally exhausted. Due to its bad situation, effort is being made along the road side to restore it. Plate 3.4a shows extent of the present land degradation in some part of the study area.

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Plate 2. Degraded land in Bekiltu Gudina Kebele May, 2016

Plate 3. Degraded land in Melka Beti Jirma

3.7.3 Post Classification Change Detection

In accordance with Lillesand and Keifer (1994) change detection involves the use of multi temporal data sets to discriminate areas of land cover change between dates of imaging. Moreover, ideally, change detection procedures should involve; data acquired by the same or similar sensor and be recorded using the same spatial resolution, viewing geometry, spectral bands, and time of day.

One way of discriminating changes between two dates of imaging is to employ post classification comparison. This kind of change detection methods identifies and provides where and how much change has occurred. It also provides to and from information and results in a base map that can be used for the subsequent year. In this approach, two dates of imagery are independently classified and registered. Then an algorithm can be employed to determine those pixels with a change in classification between dates. When evaluating the change detection made in this research against with the ideal scenario, the requirements stated by many authors are least met owing to unavailability of satellite images that fulfill the standard. Anyway change detection was carried out between the TM 1986 image with 30m spatial resolution, four spectral bands, varying radiometric resolution and ETM+ 2006 having 30m spatial resolution, eight bands including panchromatic only for ETM+.

As the process progressed to finalize change detection, basic steps such as having identical LULC classification category in their order, adjusting varied pixel size into 30m were done. Upon completion of all the necessary steps, the two classified images were taken into Geographic information system (GIS) analysis and calculated area coverage of the LULC classes between 1986 and 2006.

4. 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 1986 and 2006.

4.1. Response rate of respondents

Out of the total 50 HHs respondents that have been interviewed during the survey all of them (100%) were answered the questionnaires. In addition to this 10 key-informants and 10 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 LSA on forest and wildlife.

4.2. Demographic data of the respondents

Based on the sample farmers, the household‟s survey results show that the average family size of the study area is 6.5 persons per household head ranging from 1 to14 (Appendix 1, 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 50 household heads who participated in the survey, 29 household heads (58%) were illiterate, 13 (26%) elementary, 8(16%) of them were secondary school. This shows that most of the household heads were illiterate because they were daily laborer in the Didessa 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 (Appendix 1, Table 2) the number of HHs that joined secondary school were 8(16%) this indicates that there is no secondary school in the area, therefore after completing elementary school they dropout school and become a farmer who participated on different illegal activities such as deforestation, hunting and burning grass lands.

Exactly more than half of the households involved in the survey, 66 % were 60 and above years old 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 livestocks).As (Appendix 1, Table 2) shows 66% of the respondents livelihood was depend on mixed agriculture, 34% of them were practicing only farming, but only 4% of them were involved in rising livestocks. 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. Almost all (94%) of the respondents were males and 6% of them were females, this shows that males are mostly involved in agricultural activities.

4.3. Forest cover in Didessa Valley before 1974

Before the establishment of the Hanger-Didessa State Farm the Didessa Valley was covered with dense forest where different plant and animal species were found (Source: community elders, DAO and local society). Didessa Valley was inhabited by 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 areas used to go to the DV for hunting larger mammals such as buffalo, warthog, bush pig, antelope and others for their meat, and hunting popular dangerous mammals such as lion, leopard and African wild dog for braveness (Source: Local elders). At present there is no dense forest in the study area because of deforestation for LSA during the establishment of the Didessa State Farm in 1974 (Source: Elders and current survey).

4.4 Ranking the percent of forest cover in DV before 1974

Most (70%) of the household heads respond that the study area was covered with a very high percent of forest, 26% HH respond the presence of high present of forest and only 24% of them replied that the presence of medium forest coverage in the study area before 1974.Therefore, based on the result of and the information gathered from KI, FGD 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 (Figure 4 and 5. Appendix1, Table 3).In addition to this some non-native plant species were observed during survey (Appendix1, Table 4).

Figure 4. *Manikara butuji* and *Pouteria adolfi friederici in* DV

25

Figure 5. *Syzygium* Species in Bekiltu Gudina

4.5. **The cause for the loss of forest and wildlife**

The top most cause that is associated with the loss of forest and wildlife in the DV was the establishment of the Didessa State Farm in the area. As the listed causes compared on the basis of respondents of the study area there was significance difference between them ($p<0.05$, (0).Therefore, the top most cause for the loss of forest and wildlife in the DV was Didessa State Farm (Table 3). There are also other factors such as settlement and wildfire which cause loss of forest and wildlife in the study area. Generally, there are multiple factors such as agriculture, deforestation, population growth, fuel wood collection, illegal logging, expansion of towns and road construction that cause loss of forest.

Table 3: The top most cause for the loss of forest and wildlife in the DV

Item	Frequency	Percent
DSF	31	62
Settlement	17	34
Wildfire	2	4

4.6 Size of farmland of household heads in hectares

Based on the response given by respondents of the study area there was a significant difference between the farm land size of the HH at $p<0.05$, that is, the p value is Zero (0), (Table 4). occupation the size of farmland in the study area was different (Table 4).When the Didessa State Farm was dismantled some daily laborers hold wider area of farm land where as others were leaving the area and large area of the former farmland was remaining without land owner (Source: community elders). In 2002 the government set settlement program in the area and translocated people from Harege to DV. As shown in (Table 4) 70% of the HHs hold 1to 2 hectares because the government equally gave 2 hectares of farmland for each HHs during the new settlement in the area, 26% of the HH respond that they hold 3 to 4 ha and the remaining 4% holding 5 to 6 hectares. This shows that the indigenous people of the area were holding larger hectares of land than the translocated people into the area by settlement. Therefore, the destruction of forest is related to the size of farm land.

Table 4: Farm land size of the HHs in hectares

Item	Frequency	Percent
1-2	35	70
3-4	13	26
5-6	2	4

4.7.The present status of forest covers in the study area

As it was observed during survey there was no dense forest cover in the study area. The HHs also responded that there is no dense forest in the area. This shows that the dense forest was cleared away for LSA. As a result most wild animals were emigrated from the area.

4.8 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, prevents soil erosion and removes toxic gasses and maintains environmental quality. Therefore, forest cover change is associated with many effects. As indicated in (Table 5), 44% of the HHs respond that wildlife was immediately affected by forest cover change, 30% HHs answered that the rate of land degradation increases with the loss of forest, 14% HHs replied that poverty is another condition that appears with forest cover change and 12% HHs 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. Therefore, effect of forest cover change on wildlife and climate is significantly different at $p<0.05$ ($p=0.00038$).

Table 5: The immediate effects of forest cover change

Items	Frequency	Percent
Climate change	6	12
Loss of wildlife	22	44
Land degradation	15	30
Poverty	7	14

4.9. Difference between LSA and subsistence farming

Large Scale Agriculture is a mechanized farming practice that associated with different machines to cultivate large hectares of land. It is characterized with deforestation and spraying of chemicals that can cause several environmental problems (pollutions) and loss of the biodiversity of the area.

It also encourages monoculture where as small scale farming promotes biodiversity by growing different varieties of crop plants. (Table 6) shows that 34% of the HHs respond that LSA is identified from subsistence farming by deforestation of large area of land for intensification of agriculture, 26% of the HHs respond that it is encourages monoculture plantation, 24% of them respond that it aimed at holding large area of farm land and the remaining 16% were replied that it uses excessive chemicals that pollute the environment. Even though, LSA increases crop production

it has an environmental effect by polluting the environment because cultivators use different chemical substances such as fertilizers, herbicides, fungicides and pesticides. Hanger-Didessa State Farm covered about 5000 hectares (Diga Woreda Agriculture Sector). At present some portion of this area is occupied by monoculture forestation of *Eucalyptus* species and *Mangifera indica* with the land coverage of 1,100 ha and 241 ha respectively, and settlement. Therefore, both monoculture forestation and settlement caused an effect on the biodiversity of the DV.

Table 6. Effects of LSA on the wildlife and local society in the DV

Items	Frequency	Percent
intensification of farmland	12	24.0
Monoculture planting	13	26.0
deforestation of a large area	17	34.0
Use of chemicals	8	16.0

Table 7: The responsible bodies for the loss of forest and wildlife in the study area

Item	Frequency	Percent	Cumulative percent
The Government	24	48	48
Kebele leaders	9	18	66
Drivers of the bull dozers	10	20	86
Local society	7	14	100

Table 7, shows 48%of the respondents replied that the Government was more responsible for the loss of forest and wildlife in the area, 24% of them replied that the drivers of the bull dozers were responsible and other responsible bodies like kebeles leaders and the local society account about 18% and 14%, respectively. In case of taking responsibility for the loss of forest and wildlife there

is significance difference between the Government and the local society at $p< 0.05$ ($p=00024$). Therefore, the study result has indicated that the Government had set a program for Large Scale Agriculture in the Didessa 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, kebele leaders were involved in providing information to the local governance about the importance of the former DSF for settlement which used as a primary case for relocating the Harer people into the former Didessa State Farm who engaged in clearing of grass lands and wood trees to increase their farmland, to make charcoal and to collect firewood which increased 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.

4.10. Distance of fire wood from the households

Almost all (98%) of the respondents indicated that the local people travel up to 10 km to collect fuel wood. This result shows that the local society travelled a long distance to collect firewood because of deforestation for agriculture. As it was observed during the field surveys a few native plant species such as *Manikara butugi*, *Pouteria adolfi friederici*, *Syzygium* spp*, Albizia gummifera* and others were found in some degraded lands of the DV (Appendix 1, Table 3).This indicates that the area had been covered with different native plant species before deforestation for large scale agriculture. In the study kebeles there is a shortage of firewood. Therefore, some households have collected a pile of crop residue as a source of firewood to overcome the shortage of firewood (Appendix 1, plate 4).

4.11. Shortage of pure drinking water in the study area

All of (100%) of the respondents indicated that that there is a shortage of pure drinking water. This indicates that loss of forest in the area caused land degradation and soil erosion which lead into the shortage of water sources. During the field survey the scarcity of pure drinking water was more observed in Bekiltu Gudina and Melka Beti Jirma kebeles because these kebeles are highly populated due to settlement and destroyed the wood plants that are used for water retention and infiltration. In Bekiltu Gudina and Melka Beti Jirma the stream named Laga Taba uses as a point source of drinking water for most villages of the two kebeles and their livestock. Laga Taba stream is found in the most degraded area of the Melka Beti Jirma kebele bordering Bikiltu Gudina (Figure 6)

Figure 6. People fetching impure water from Laga Taba stream May, 2016.

As shown in the above (Figure 6) there is a scarcity of water during the dry season in the study area, as a result the local people have to travel more than 2kms to arrive at a point source of drinking water. This stream was used for drinking both for people and livestocks. Therefore, it is more contaminated and is a source of bacterial and protozoan diseases (Diga woreda Health sector 2016).

Factors that cause the scarcity of water in Melka Beti Jirma, Bekiltu Gudina and Woyessa Dimtu kebeles are population growth, deforestation, agriculture, overgrazing by livestock, land degradation and lack of soil conservation (Diga Woreda Agriculture Expert, Health Sector and Key informants). Before deforestation of the DV for DSF the local society found water and firewood from nearby sources (Source: Community elders).

4.12. Human-wildlife conflict because of deforestation in DV

All (100%) of the respondents indicated 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 8: The large mammal more encountered conflict with human

Item	Frequency	Percent	Cumulative frequency
Lion	9	18	18
Leopard	3	6	24
Buffalo	27	54	78
Warthog	11	22	100

As the listed wild animals compared on the bases of human-wildlife conflict there is significant difference between buffalo and leopard at $p<0.05$ ($p=0$) (Table 8). From this result it can be concluded that buffaloes 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 Buffaloes for their meat and for braveness. A person who killed buffalo or lion would have a good recognition in the local society. Therefore, the result shows that all wild animals faced conflict with humans but the degree of conflict varies from animal to animal.

Table 9: Problems faced by wild animals during migration due to loss of habitat

Item	Frequency	Percent	Cumulative percent
Exposure to predators	13	26	26
Killing by hunters	12	24	50
Death by starvation	7	14	64
Conflict with humans	18	36	100

Table 9 shows that 36% of the households replied that loss of habitat and food sources due to deforestation for LSA wild animals encountered conflict with humans. Herbivores animals fed on crop plants and carnivores animals decided to eat livestock, 26% of them replied that some wild animals were eaten by predators, 24% of them replied that some were killed by hunters and 14% of them respond that wild animals were die by starvation before arriving at their new habitat. When the problems faced by wildlife during migration was statistically tested there is a significant difference between human-wildlife conflicts and death by starvation at $p<0.05$ ($p=0.01108$) 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 wild animals live, find their food sources, breed and care for their young. Most wild animals were migrated from the study area because of deforestation and habitat disturbance. When they migrated from one area to another area they encountered several problems, because some were pregnant, some might have fragile young, some were aged (old) and others might be sick therefore, they can be exposed for any attack.

4.13. Relationship between forest and wildlife

All (100%) of the respondents replied that there is a relationship between forest and wildlife. That is, 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.

4.14. Access of different public services to local society, because of settlement in DV.

Most (90%) of the households answered that the local society has not got an access of no pre-existing services such as electric light, secondary school, road and pure drinking water, 10% of the households respond that there are some improvements regarding to elementary school, rural road and public health sector. Therefore, in the study area there are only three elementary school, three public clinics, and simple rural road (Source: own observation during survey 2016), there is no secondary school, electric light, pure(pipe)water and fixed line telephone. Most of the people in the study area were under poverty they walk by barefoot.

4.15. Land Use / Land Cover Changes

Land cover changes of 1986 to 2006 for Melka Bayeti Jirma, Woyesa Dimtu, and Bikiltu Gudina kebeles is presented in (Table 10). In addition, the statistics of LULC were computed and Change in

LULC in general and land cover in particular would have either direct or indirect impact 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 deforestation which may have been replaced by large scale agriculture, settlement and bare land which together lead to the loss of forest and wildlife from an area.

The areal extent of LULC of the study area was summarized to detect the nature of major changes occurred between 1986 and 2006.

According to the result of this computation, woodland and grazing lands revealed negative rate of change which implies decrease in areal coverage while agricultural land, deforest/barren land and settlement were in a position to increase their areal extent at the expense of the others (Table 10). From the 1986 land use / land cover classes, about 38.34 % was devoted to Grazing land, and 27.01% was covered by woodland and other vegetation whereas 19.68% agricultural land of different crops. The smallest share went to settlement and degraded lands which have 12.12% and 2.76% respectively. In 2006, settlement, agricultural and degraded/bare lands revealed an increase in areal coverage due to the increased population who settled in that area and used the land cover through cultivation. However, grazing land and woodland were liable to be converted in to other land use / land cover unit depicted change in decline/ decreased in aerial coverage. Apparently, degraded/ bare land, agriculture land and settlement lands coverage have got increment of 1.96%, 13.04% and 14.73 respectively.

Table 10: Summary Statics of LULC of the study area from 1986 to 2006

Land use/land cover classification	1986		2006		Rate of Change in hectares per-year
	Area(ha)	%	Area(ha)	%	Area(ha)
Grazing land	2838.33	38.34	1997.25	26.99	-42.054
Woodland	2004.47	27.10	645.02	8.72	-67.972
Agriculture land	1456.28	19.68	2421.84	32.72	48.278
Degraded/Bare land	204.12	2.76	349.09	4.72	7.248
Settlement land	896.81	12.12	1986.81	26.85	54.5
Total	**7400.01**	**100**	**7400.01**	**100**	

The following two classified maps have been used for post change detection Comparisons of the three kebeles of Diga woreda (Figure 4.4 and 4.6).

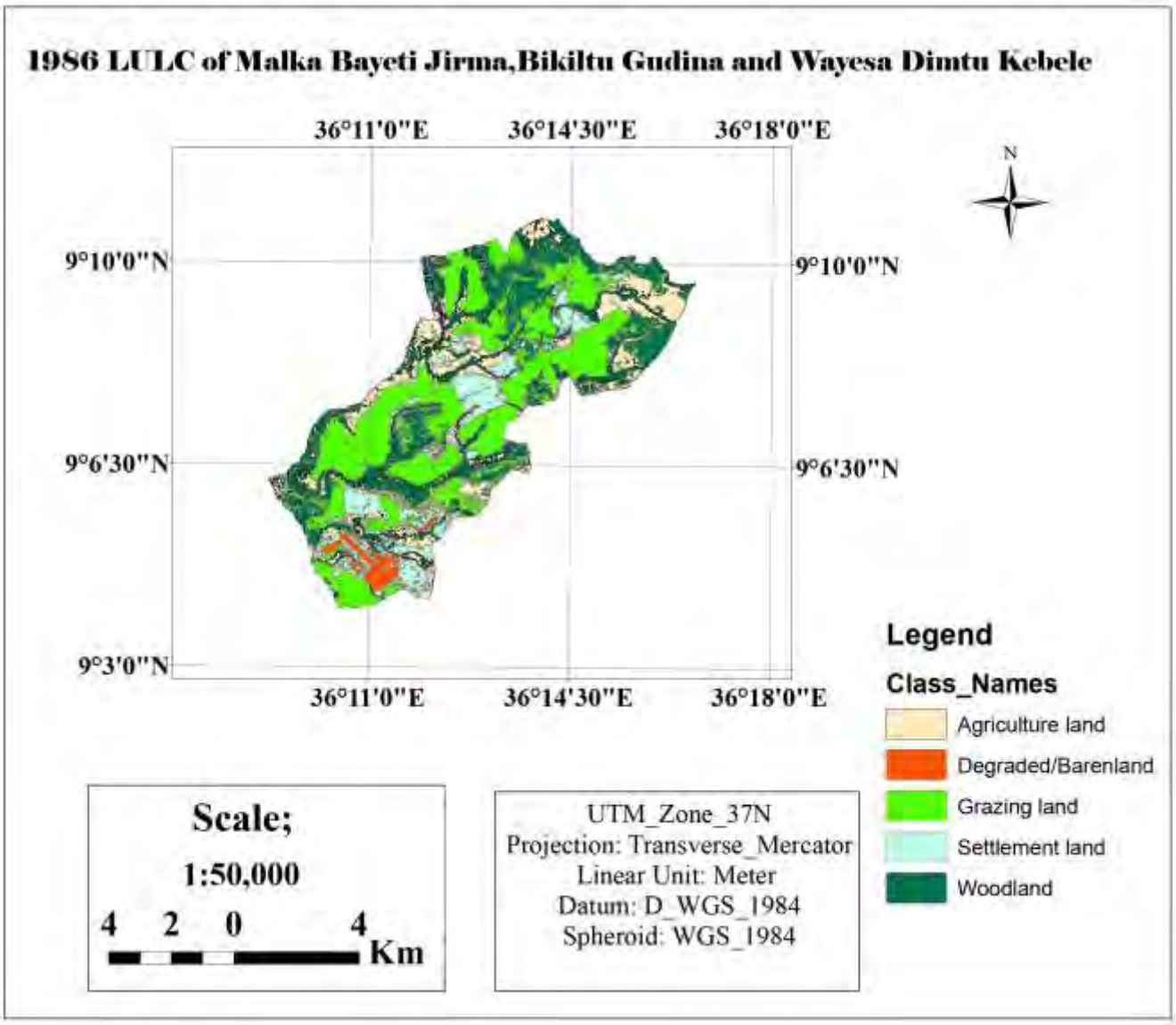

Figure 7. 1986LULC classes of Malka Beyeti Jirma, Bikiltu Gudina and Wayesa Dimtu Kebeles.

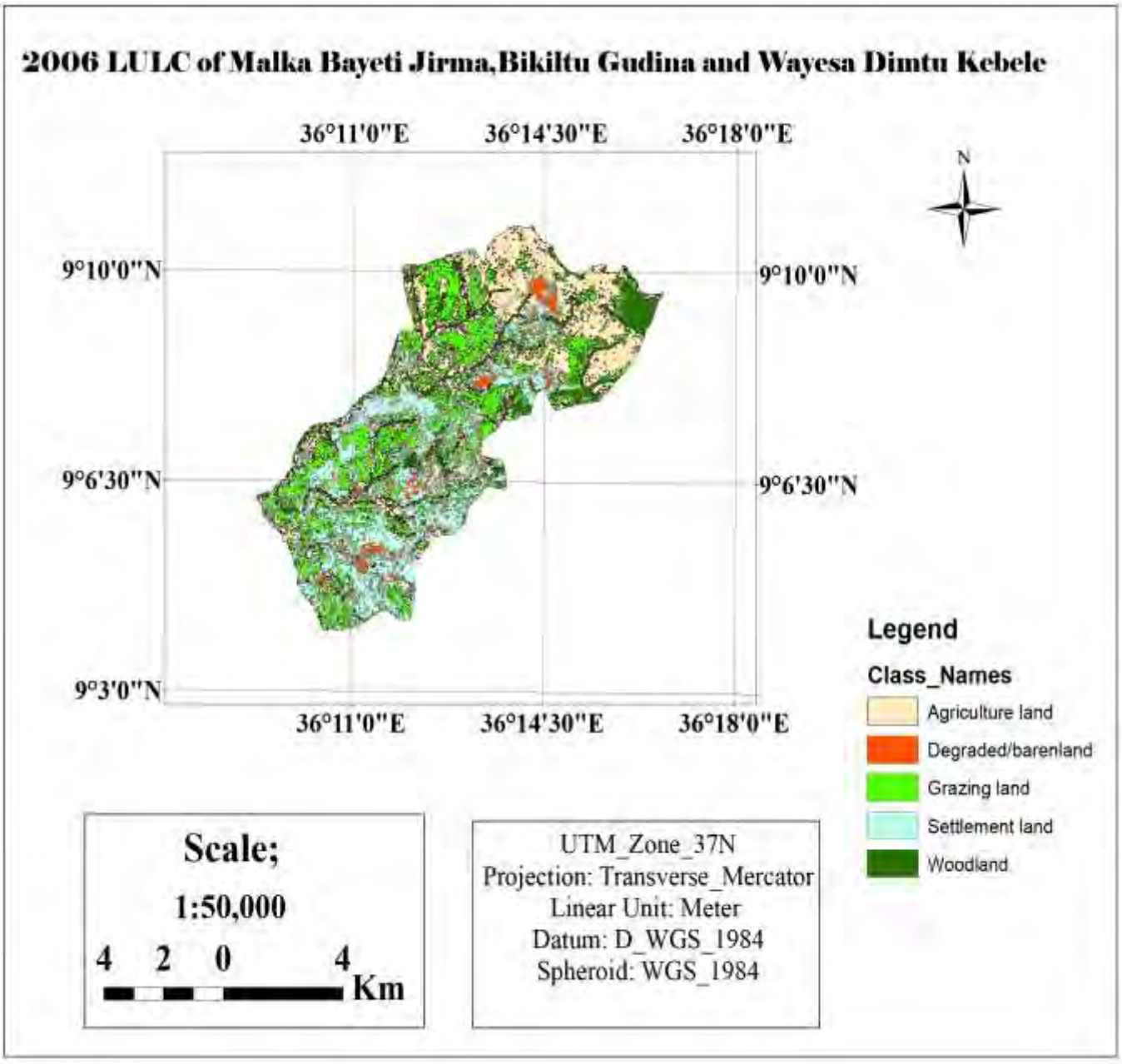

Figure 8. 2006LULC classes of Malka Bayeti Jirma, Bikiltu Gudina and Wayesa Dimtu Kebeles.

4.13. Land cover analysis for 1986

The land cover analysis for 1986 from aerial photos (Table 10) showed that the majority of the study area was under grazing (grass) land accounting to 2838.33 ha (38.34%), while woodland, agriculture land, settlement land and degraded land accounted to 2004.47 ha (27.10%), 1456.28 ha (19.68%), 896.81ha (12.12%)and 204.12 ha (2.76%), respectively. These land cover classes took

about 100 percent of the study area. There was no dense forest cover. The dense forest that covered the area was completely deforested since the establishment of the Hanger-Didessa State Farm in 1974, which was the main cause for loss of forest and wildlife in the study area.

4.14. Land cover analysis for 2006

The land sat. ETM^{+} imagery of 2006 (Figure 8) showed that the majority of the study area was covered by agricultural land accounted to 2421.84 ha (37.72%) while grazing land, settlement land, wood land and degraded land accounted to 1997.25 ha (26.99%), 1986.81 ha (26.05%), 645.02 ha (8.72%) and 349.09 ha (4.72%), 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. Much of the change from the base year (1986) occurred on agriculture land where it changes from 1456.28 ha (19.68%) to 2421.84 ha (32.72%) in 2006. This increase in agriculture land was at the expense of grazing and wood lands which decreased from 2838.33 ha (38.34%) to 1997.25 ha (26.99%) and from 2004.47 ha (27.10%), to 645.02 ha (8.72%), respectively. Other land cover classes such as settlement land and degraded land 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.

5. CONCLUSION AND RECOMMENDATION

5.1 Conclusion

Large Scale Agriculture is the major factor that negatively affected on the forest covers of the study 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 lose cover (shelter) as well as food sources and decided to leave the area. When wild animals are migrating from one area to the other area they might be killed by poachers, eaten by predators, then becoming extinct or reduced in number (endangered).

As information was gathered from HH, elders and focal persons during survey, different native plant species such as *Ficus sur* (local name: harbuu), *Syzygium* spp(goosuu), *Manikara butugi* (buttujjii), *Ficus vasta* (qilxuu) , *Cordia Africana* (waddeessa), *Albizia gumifera* (muka arbaa), *Pouteria adolfi friederici* (qararoo) and others were found in the dense forest of the study area before deforestation. According to LULC analysis made between periods of 1986 and 2006 the land use and land covers of the study area were classified as: Agriculture land, wood land, grazing land, settlement land and degraded land. Therefore, the LULC changes during twenty years were evaluated from the land satellite images. Then, the extent and trends of LULC changes were shown. Grass land and wood lands were decreased where as agriculture land; settlement land and degraded land were increased. During establishment of Didessa State Farm a large hectares of forest lands were deforested for the implementation of LSA. 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 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 such as 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 shortage of drinking water. Only few native plant species were found around the stream and where the land is not suitable for agriculture, this indicates that the area was covered with indigenous plant species before deforestation for agriculture. Therefore, in the case of this analysis the major driving force for the loss of forest and wildlife in the study area was Large Scale Agriculture.

5.2 Recommendations

The following recommendations are made from the present status of forest and wildlife as well as the land use and land cover changes of the study area:

- Creating a demand for planting indigenous trees by identifying 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.
- Controlling deforestation 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 especially giving priority to involve the young people.
- As it was observed in the three kebeles there is a shortage of pure drinking water in near point sources. This is one of the impacts of clearing forest for agriculture. Therefore, the Agriculture sector in general and the Development Agents (DAs) in particular should formally or informally educate the society to stop cutting of forests because they hold up soil and provide water in near point sources.
- To prevent land degradation caused by livestock‟s an alternative method of livestock management system like tethering should be encouraged, because it will reduce overgrazing and increase biomass productivity.
- Settlements and state farms or large scale agricultural investments should be based on the country‟s rule of Environmental Impact Assessment

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APPENDIX

ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

FACULTY OF NATURAL SCIENCE

DEPARTMENT OF BIOLOGY

Appendix 2:**Semi-structured questionnaire for formal interview of households**

Dear respondent! The aim of this questionnaire is to collect data as impute for the study titled as "**The Impact of Large Scale Agriculture on Forest and Wildlife in Didessa Valley, Western Ethiopia."** Therefore, the researcher is interested in using your response to investigate the problems associated with Large Scale Agriculture on Forest and Wildlife. Thus, you are kindly requested to read all questions, understand and fill the questionnaire with genuine response to issue conducted

General Direction: - Please! Note the following points before you start answering the questionnaire .Encircle the letter of the answer you wish to give to each question from the given alternatives for close ended questionnaires and give a short and clear answer for open ended questionnaires.

Part I: General Information of the households.

Name of Interviewer_____

Signature_____ Date_____ Month_____Year___

Household"s code number _____

Keble _____

District _____

Sex: 1) male 2) female

1. Marital status :- 1) Married 2) Single 3)Divorced 4)others
2. Level of education:- 1) illiterate 2) elementary 3) secondary 4) above 12
3. Family size:- 1) 1-3 2) 4-6 3) 7-9 4) 10 and above
4. How long have you been living in this area? 1) 10-20 years 2)21-30 years 3)31-40 years 4)41 and above
5. What is your occupation? 1) mixed agriculture 2) only farming 3) only livestock rearing 4) trading
6. Age : 1) 25-35 years 2) 36-47 years 3) 48-59 years 4) 60 and above

Part II: - General questions

7 How would you rank the percent of forest coverage before 1974 in your area?
1) Low 2) medium 3) high 4) very high

8 What was the major cause for the loss of forest and wildlife in your area***?***
1) Didessa State Farm 2) settlement 3) wildfire 4) natural disaster

9 How many hectares of farm land do you have? 1) 1-2 ha 2)3-4 ha 3)5-6 ha 4) 7 and above

10 Is there a dense forest in your kebele? 1) Yes 2) NO

11 If your answer for question" 10" is NO, what is the main cause for the loss of dense forest? 1) Large scale agriculture 2) deforestation 3) population growth
4) natural disaster

12 How would you rank the present time forest coverage in your area when compared with its coverage before 1974? 1) Poor 2) good 3) very good 4) equivalent

13 What do you think are the immediate effects of forest cover change? 1)climate change 2) loss of wildlife 3)land degradation 4) poverty

14 What makes LSA different from subsistence farming? 1) intensification of farmland 2) applying monoculture 3) deforestation of a large area 4)using excessive chemicals

15 Who do you think is more responsible for the loss of forest and wildlife in the Didessa Valley? 1) 2 3) drivers of the bull dozers 4) local society

16 How far is the source of firewood from your home? 1) 3 kms 2) 5kms 3) 7kms 4) 9 kms

17 Is there enough pure drinking water in your area? 1) Yes 2) No

18 If your answer for question 20 is No, what do you think is the reason for the shortage of water? 1)deforestation 2) degradation of the area 3) plantation of eucalypts tree 4) population growth

19 Have you seen any human and wildlife conflict, because of clearing of forest? 1) Yes 2) No

20 If your answer for question „22" is yes, which larger mammal do you think was more encountered conflict with humans? 1) lion 2) leopard 3) buffalo 4) warthog

21 What happened to wild animals when they were migrating from their natural place due to loss of habitat by deforestation? 1) exposure to predators 2) killing by hunters 3) death by starvation 4) conflict with humans

22 IS there a relationship between forest and wildlife? 1) Yes 2) No

23 Which one of the following is the effect of loss of vegetation cover in an area? 1) shortage of water 2) depletion of nutrients 3) climate change 4) loss of wildlife

24 Have you got any non pre-existing services, because of the translocation (settlement) of people in the former Didessa State Farm? 1) Yes 2) No

25 If your answer for question number „29" is Yes which services have you got? 1) Road and Electricity 2) Telephone and Hospital 3) Pure water and high school

4) Neither of these

26 List the name of larger mammals which used to live in the Didessa Valley before it was deforested

_____

27 From your observation and experience list the name of some larger mammals which are completely lost and present in your area?

a) Lost mammals

_____

_____

_____

b) Still present mammals

_____

_____

_____

28 What will you recommend to rehabilitate this affected area?_____

_____

_____

_____

____

Appendix 3: Check lists for focus group discussion

Discuss in the following points in context to the impact of large scale agriculture in your kebele (area):

1. When did Didessa state farm established?
2. Are there farmers who displaced by the expansion of the Didessa state farm?
3. Did the agricultural products of the Didessa state farm sold in the local market to the local society? If your answer is no, why?
4. What are the impacts of monoculture and using chemicals during the implementation of large scale agricultural activities in your area?
5. Did the state farm provide job for some jobless people‟s in your kebeles?
6. What are the major impacts posed by the Didessa state farm in your area?

   _____

7. Give your option how to rehabilitate this affected area?

   _____

   _____

   _____

8. Would you agree if the area is protected as National Park?

   _____

   _____

   _____

9. For what purpose do the natural forest and wild animals use for the local society?

   ---

   10 What are the major problems associated with the loss of forest and wildlife?

   _____

   _____

Appendix 4: Check list for key- informant interview (agricultural experts, community leaders, elders and better informed farmers)

1. Name _____date _____ sign _____
2. Education status _____ profession _____
3. How long have you stayed in this area?_____
4. What are the major factors that cause forest and wildlife loss in your kebele / district/?

   _____

   _____
5. How do you perceive about the perception of the local society towards forest degradation, wildlife loss and mono culturing?

_____

6. Describe the most significant problems caused by large scale agriculture on the environment, social and economic aspect in the Didessa valley (or in your area)!

   _____

7. How many hectares of land are covered by mango and eucalyptus plantation on the former Didessa State Farm?
8. Are there enough water sources in your area?
9. If your answer for question no "8" is „no" what causes a scarcity (shortage) of water?
10. List the name of some larger plant and animal species which had commonly found in the Didessa valley before the establishment of the State Farm? Which of them were lost and which of them are still present in the area?

_____

_____

_____

Appendix 5: Data collection sheet for direct observation of areas affected by large scale agricultural activities.

Kebele _____ site _____

Suggestion of forest development _____

A. Plant habits observed in the area

List of plant habits Observed	Coverage		
	Scarce	Dense	
Pioneers (lichen or mosses)			
Herbs			
Shrubs			
Trees			

]

B. Land cover type observed in the area during field survey

Observed land cover type	Coverage in hectare	Kebele			Distance from the main land in km
		Bikiltu Gudina	Melka Beti Jirma	Woyesa Dimtu	
Grass land					
Settlement land					
Dense forest					
Open wood land					
Agricultural land.					
Degraded land					

C. List of plant and animal species observed in the area during field survey.

List of plant species	List of animal species

D. Crop plants and tree plantations observed in the area.

List of crop plants observed (common name)	kebele	List of tree plantation observed (English name)	kebele

APPENDIKSII

YUUNIIVERSIITY ADDIS AABABAA

DAMEE SAAYINSII UUMAMAA

MUUMEE BAAYOOLOJII

Appeendixii 6: Bargaafii namoota naannoo Qorannoon itti gaggeefamu jiraataniif qophaa'e.

Kabajamtoota gaaffii kana deebiftan hundaaf! Duraandursee hirmaannaanii fi deebiin isin kennitan hundi milkaa'ina qorannoo kootiif bu'aa waan qabuuf kabaja guddaan isiniif qaba.Kaayyyoon bargaaffii kootii odeeffannoon isin biraa argamuun mataduree qorannookoo ''Miidhaa Qonnaan Ammayyaa Bosonaa fi Bineeldota irraan ga'u.''jedhuuf ragaa cimaa dha.Kanaafuu yaada keessanii fi yeroo keessan utuu hin qussatiin akka irratti hirmaattaniif filatamtaniittu.

Kutaa 1^{ffaa}: Odeeffannoo waliigala kan abbootii/haadhotii mana.

Maqaa----------

Mallattoo----------Guyyaa----------Ji'a----------Bara----------

Aanaa----------Ganda----------

Saala: Dhiira---------- Dhalaa----------

1. Haala fuudhaa fi heerumaa: 1) Kan fuudhe 2) Kan hin fuune 3)Kan wal-hiikan 4) Kambiraa
2. Sadarkaa barumsaa: 1)Kan hin baranne 2) Sadarkaa 1^{ffaa} 3) Sadarkaa 2ffaa 4) Kutaa 12^{ffaa} ol
3. Baayyina maatii: 1)1-3 2) 4-6 3) 7-9 4)10 fi isaa ol
4. Waggaa meeqa as jiraatte? 1)10-20 2)21-30 3)31-40 4) 41 ol
5. Ga'ee hojii: 1)Qnnaa fi horii horsiisuu 2)qonnaa qofaa 3)Horii horsiisuu qofaa 4)Daldaluu
6. Umrii:1) 25-35 2) 36-47 3)48-59 4) 60 fi isaa ol

Kutaa 2^{ffaa}: Gaaffii waliigalaa

7.Uwwisni bosona naannoo keetii bara 1974 dura ture peersentiidhaan maal fakkaata?

1) Gadaanaa 2) Giddugaleessa 3) olaanaa 4) Daranolaanaa

8. Badiinsa bosonaa fi bineeldota naannoo keetiif sababiin tokkoffaan maali jetta? 1) Qonnaan Mootummaa Sulula Dhidheessaatti jalqabamu 2) Qubsuma 3)Ibidda 4) Bala uumamaa

9. Lafa qonnaaf ta'u hektaara meeqa qabda? 1)1-2 2)3-4 3)5-6 4)7 fi isaa ol

10.Yeroo ammaa bosonni beekamaan ganda ati jiraatu keessatti argamu jira? 1) Eeyyee 2)Lakkii

11.Gaaffii 10ffaaf deebbin kee lakkiidha yoo ta'e sababiin isaa maali jetta? 1)Baballina qonnaa 2)Ciramuu bosonaa 3)Baay'ina Uummata 4)Balaa uumamaa

12. Haala bosona naannoo keetii kan ammaa kan durii bira qabdee yommuu madaaltu sadarkaa attamii laattaaf? 1)Gadaanaa 2)Gaarii 3) Baay'ee gaarii 4) wal-qixa.

13. Taateen yookiin balaan battala baduu bosonaan dhufu kami? 1) Jijjiirama qilleensa 2)Badiinsa bineeldotaa 3) Lafti tajaajila kennuu dadhabuu(land degradation) 4)Hiyyumma.

14 Qonnaa ammayyaa kan aadaa irraa maaltu adda godha? 1) Bal'na isaa 2) Midhaan gosa tokko qofaa oomishuu 3) Bosona mancaasuu 4) keemikaalota garaagaraatti fayyadamuu.

15. Manca'u bosonaaf kan sababa ta'u maali jetta? 1) Qonnaa 2) Qubsuma 3)Karaa baasuu 4) Balaa uumamaa

16. Qonnaa biratti kaanneen biroon manca'u bosonaaf sababa ta'an maalfa'I jetta? 1)Seeran ala mukeen muruun gurguruu 2) Qoraan funaanuu 3) Kasala oomishuu 4) Baayi'na uumataa

17. Kaayyoon hundeefamuu Qonnaa Mootummaa Sululaa Dhidheessa maali jetta? 1. Iyyeessa gargaaruu 2) Qaala'ina midhaanni hambisuu 3) Naannoo balaan gogiinsa hube gargaaruu 4) Icciitii siyaasaaf.

18. Manca'uu bosonaa fi baduu(godaanu)bineeldota Sulula Laga Dhidheessaaf kan itti gaafatama jettu eenyu? 1) Mootummaa Dargii 2) Mootummaa amma jiru 3) Konkolaachiftoota Doozerii 4)Hawaasa naannoo

19. Bakki qoraan itti argamu mana kee irraa kiiloomeetira meeqa fagaata? 1)3 2)5 3)7 4)9

20.Bishaan qulqul'uun dhugaatiif ta'u naannoo kee jiraa? 1) Eeyyee 2) Lakkii

21. Gaaffii 20ffaaf deebiin kee Lkkii dha yoota'e sababiin isaa maali jetta? 1) Ciramee baduu bosonaa 2)Lafti qorqamee tajaajila kennuu dadhabuu 3) Baargamoo dhaabuu 4) Garmalee baayacuu uummataa

22.Sababii manca'uu bosonaa irraan kan ka'e dhalanamaa fi bineeldota gidduutti walitti bu'iinsa uumame argiteettaa? 1) Eeyyee 2) Lakkii

23.Gaaffii 22ffaaf deebiin kee Eeyyee yoota'e hoosiftuun caalaadhumatti nama waliin walitti bu'uun miidhaan irra ga'e isa kami? 1)Leenca 2)Qeerramsa 3)Gafarsa 4) Karkarroo

24.Sababii ciramee baduu bosonaa irraan kan ka'e waytii bineensonni bakka jireenyaa isaanii irraa godaananii deeman balaa attamiiti irra ga'e? 1) Diinaan nyaatamuu 2) Adamsituun ajeefamuu 3) beelaan du'uu 4) Nama wajjin walitti bu'uu

25. Bosnaa fi bineeldota walitti dhufeenyi jira jettaa? 1) Eeyyee 2) Lakkii

26. Taateen badiinsa bosonaa waliin dhufu kami? 1) Hanqina bishaanii 2) Hanqina albudota biyyee keessa 3) Godaanuu bineensota

27. Qubsumni dhiyootti naannoo keetti hudeeffame jira? 1)Eeyyee 2) Lakkii

28. Gaaffii 27ffaaf deebiin kee Eeyyee yoo ta'e Qubattoonni bakka kam irraa dhufan?

1)Arsii 2)Walloo 3)Harargee 4)Shawaa

29. Sababii qubattootni naannoo kee qubachiifamaniif jecha wantotni bu'uuraa dhala namaaf barbaachisan kan duraan hin turre amma kan hawaasasichaaf guutan jiruu? 1)Eeyyee 2) Lakkiturre amma kan hawaasasichaaf guutan jiruu? 1)Eeyyee 2) Lakkii

30.Yoo deebiin kee gaaffii 29ffaaf Eeyyee dha ta'e, tajaajila attamiiti isiniif guutame? 1) karaa fi ibsaa
2) Bilbilaa fi Hospitaala 3)Bishaan qulqul'uu fi mana barumsaa sadarkaa 2ffaa 4) Kan guute hin jiru

31.Maqaa hoosistoota gurguddoo utuu bosonni naannoo kee ciramee hin badiin jiraachaa turanii tarreessi!

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32. Akkaataa argitee fi muuxannoo qabduun hoosistoota gurguddoo yeroo ammaa naannoo kee jiranii fi kan badan (godaanan) adda baasii tarreessi!

33. Naannoo sababii babal'na qonnaan miidhame kana attamittiin deebisanii haaromsuun danda'ama jetta?----------
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Appeendiksii7: Gaaffiilee cheekliistii gartuu namootaa dhimmicha irratti hubannoo ga'aa qabu jedhamaniif maree(FGD) dhiyaate.

1. Qonnaan Mootummaa Laga Sulula Dhidheessaa bara kam hundeeffame?
2. Sababii hundeefamuu qonnaa kanaaf namoonni noonnoo irraa buqa'an jiruu?
3. Bu'aan oomishaa qonnaa mootumaa sanaa rakkoo hawaasa naannoo furuu fi gabaa tasgabbeessuuf gabaa naannoo keessan jirutti gurguramaa turee? Yoo miti ta'e maaliif jettu?
4. Midhaan gosa tokko qophaa oomishuunii fi keemikaalota adda addaa lafa qonnaa irratti fayyadamuun hawaasa naannoo ft naannoo irratti miidhaa attamii fida?
5. Hundaa'uun Qonnaa Mootummaa sun hojii dhabdoota naannichaaf hojii uummeera?
6. Midhaan sababii hundeeffamuu qonnaa kanaan dhufan maalfa'i?
7. Naannoo qonnaan hubame kana attamittiin deebisanii bayyaanneffachiisuun danda'ama?
8. Utuu Paarkiin Naannoo kanatti hundaa'ee ni deggerta?
9. Hawaasni naannoo bosonaa fi bineensota bosonaa irraa bu'aa attamii argata?
10. Miidhaalee sababii manca'uu bosonaa fi baduu bineensota bosonaan hawaasa naannoo irra ga'uu danda'an tarreessi!

Appeendiksii 8: Cheekliistii gaaffiilee namoota murteessoo yookiin furtuu (KI) ta'aniif qophaa'e

1. Waggaa meeqaaf bakka kana jiraatte?

2. Baduu bosonaa fi bineensota naannoo keetiif sababii kan ta'e maali jetta?

3. Hawaasni naannoo keetii waa'ee manca'uu bosobaa, baduu bineensotaa fi midhan gosa tokko duwwaa oomishuu ilaalshisee ilaalchaa fi hubannoo attamii qaba jetta?

4. Miidhaa cimaa sababii hundeeffammuu Qonnaa Mootummaa Laga Sulula Dhidheessaatiin naannoo, hawaasaa fi diinagdee hawaassaa irra ga'e tarreessi!

5. Bakka qonnaa mootummaa duraanii irra, lafa hektaara meeqati biqiltuu baargamoo fi mangoon uwwifamee jira?

6. Bishaan qulqul'uun hawaasa ganda kee keessa jiraatan hunda tajaajiluu danda'u naannoo kee jira?

7. Gaaffii lakkoofsa 6^{ffaaf} deebiin kee hinjirudha yoo ta'e sababiin isaa maali jetta?

8.Maqaa mukeen gurguddoo fi bineensota beekamoo ta'anii hundeeffamuu qonnaa mootummaan dura jiraataa turanii tarreessi! Akkasumas warra amma ganda kee keessa jiranii fi warra badan adda baasii tarreessi!

APPENDIX

Appendix 1:List of different tables

Table1: The list of some native plants that were found in the study area before the area was deforested for LSA and lost at present

Local Name	Scientific Name
Akuukkuu	*Flacourtia indica*
Araarsoo	*Bersama abyssinica*
Dhqonuu	*Grewia ferruginea*
Didigsaa	*Gnidia glauca*
Doggomaa	*Macranga capensis*
Gatamaa	*Scheftera abyssinica*
Haanquu	*Embelia schimperi*
Kombolcha	*Maytenus addat*
Meexxii	*Phoenix reclinata*
Muka heexoo	*Hagenia abyssinica*
Qilxuu	*Ficus vasta*
Somboo	*Ekebergia capensis*
Sootalloo	*Millettia ferruginea*
Ulaagaa	*Ehertia cymosa*
Waatoo	*Osyris quadripartita*
Waddeessa	*Cordia africana*
Waleensuu	*Erthrina brucei*

Source: Local elders, Key-informants and Focal groups of the study area

Table 2. Sex, Age, Level of education, marital status, Family size, Duration in the residential area and occupation of the respondents.

Item	Characteristics	Frequency	%
Sex	Male	47	94
	Female	3	6
Age	30-39	3	6
	40-49	5	10
	50-59	9	18
	60 & above	33	66
Level of education	Illiterate	29	58
	Elementary(1-8)	13	26
	Secondary (9-12)	8	16
	Above 12	-	
Marital status	Married	45	90
	Single	2	4
	Divorce	3	6
Family Size	1-3	6	12
	4-6	14	28
	7-9	19	38
	10 & above	11	22
Duration in the residential area	10-20 years	1	2
	21-30	7	14
	31-40	13	26
	41 & above	29	58
Occupation	Farming only	17	34
	Raring live stock only	2	4
	Mixed farming	31	62
	Trading	-	-

Table 3: The list of some Indigenous (native) plants observed during survey

Local Name	Scientific Name	Observed place(Kebele)
Buttujjii	*Manikara butugi*	Melka Beti Jirma
Dambii		>>
Goosuu	*Syzygium spp*	Bekiltuu Guddina
Makkaannisa	*Corton macrostachyus*	>>
Mukaa Arbaa	*Albizia gummifera*	In all three kebeles
Odaa	*Ficus spp*	Woyyeessa Diimtuu
Qararoo	*Pouteria adolfi friederici*	Melka Beti Jirma
Harbuu	*Ficus sur*	>>
Laaftoo	*Acacia abyssinica*	In all kebeles

Source: Own survey April, 2016

Table 4: The list of some Non-native plants observed along the road sides and in some villages during the field survey.

Scientific Name	Found in
Eucalyptus camaldulensis	All three kebeles
Gravillea robusta	>>
Jacaranda mimosaefolia	>>
Juniperus spp	>>
Mangifera indica	>>
Spathodea campanulata	>>

Source: Own survey April, 2016

Table 5: The list of some wild animals found at present in the study area

Local Name	Common Name	Scientific Name
Dhaddee	Porcupin	*Hystrix cristata*
Jaldeessa	Olive baboon	*Papio anubis*
Qamalee	Grivet monkey	*Chiorocebus aethiops*
Quruphee	Bush duiker	*Sylvicapsa grimmia*
Waraabessa	Spotted hyaena	*Crocuta crocuta*
Bosonuu	Menelik's bushbuck	*Teragelaphus seriptus meneliki*

Source: Community elders, Key-Informants and Development Agents

Plate 4. Agricultural land in Melka Beti Jirma April, 2016

Table5: The list of some wild mammals that have been living in the study area before deforestation for LSA and which were lost or migrated from the area at present

Local Name	Common Name	Scientific Name
Booyyee	Bush pig	*Potamochoerus larvatus*
Canoo	Blue monkey	*Cercopithecus mitis*
Gafarsa	Buffalo	*Syncerus caffer*
Harree diidoo	Zebra	*Equus quagga*
Karkarroo	Warthog	*Phacopithecus africanus*
Leenca	Lion	*Panthera leo*
Qeerramsa	Leopard	*Panthera pardus*
Yeeyyii	Afrikaan wild dog	*Lycaon pictus*

Source: Local elders, Key-Informants and households