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LAND DEGRADATION AND CHALLENGES OF ITS MANAGEMENT PRACTICES: THE CASE OF LEMO WOREDA, HADDIYA ZONE, ETHIOPIA.

A Thesis submitted to Addis Ababa University, the School of Graduate Studies, in Partial Fulfillment of the Requirement for the Degree of Masters of Art in Geography and Environmental Studies.

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This is to certify that the thesis prepared by Melese Erwaro, entitled: *Challenges of Land degradation and its Management Practices* and submitted in partial fulfillment of the requirements for the Degree of Master of Art (Geography and Environmental Studies, specialization: land resource management) complies with the regulations of the university and meets the accepted standards with respect to originality and quality.

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CAADP	Comprehensive African Agricultural Development Program
CAS	Central Statistics Agency
DAs	Developmental Agents
EEP/EEPRI	Ethiopian Economic Association/ Economic Policy and Research Institute
EPA	Environmental Protection Authority
FAO	Food and Agricultural Organization
FGAE	Family Guidance Association of Ethiopia
FGD	Focus Group Discussion
FTCs	Farmers Training Center
HZFED	Haddiya Zone Finance and Economic Development
ILRI	International Livestock Research Institute
LWARD	Lemo Woreda Agriculture and Rural Development
LWFED	Lemo Woreda Finance and Economic Development
Masl	Meter above sea level
MOA	Ministry of Agriculture
MOAPED	Ministry of planning and Economic Development
MOARD	Ministry of Agriculture and Rural Development
NAPS	National Action Plans
NEPAD	New Partnership for African Development
PRSPS	Poverty Reduction Strategy Paper
PSNP	Productive Safety Net Program
SHHs	Sample Households
SLM	Sustainable Land Management
SSA	Sub-Saharan Africa
SPSS	Statistical Package for Social Science
SWC	Soil and Water Conservation
TLU	Tropical Livestock Unit
UNCCD	United Nation Convention for Desertification
UNDP	United Nation Developmental Program
USID	United States International Development
WFP	World Food Program

Abstract

Land degradation is nowadays threatening millions of people in the world particularly in developing countries affecting all spheres of social, economic and political life of the population. In Ethiopia land degradation is one of the major challenges for agricultural development and food security. In order to solve the problem of land degradation, a lot of efforts have been made since 1970's in conservation practices. However, these conservation techniques have not been sustainably implemented. Thus, identification of challenges in relation to land management practices is of paramount importance. The study was undertaken in Lemo woreda, Haddiya Zone, SNNPR. In order to achieve the objective of the study, both primary and secondary data were generated by generating qualitative and quantitative data. 168 household heads were selected from three kebeles by using systematic random sampling as it is believed that the households are similar with respect to the characteristics that influence the research output. The process of analysis of the study was carried out using qualitative description and quantitative analysis. The quantitative data was analyzed using statistical software for social science (SPSS). Frequency, percent, mean and chi-square taste when appropriate. The qualitative data was discussed to substantiate the study. The findings of the study indicated that decrease in productivity of farm land, involvement in off-farm activities, increase in size of human population, lack of full cooperation of family members to involve in land management practices, low assistance gained from neighbor-hoods, less access to extension service and inadequate attention from Woreda Agriculture and Rural Development Office are the major challenges encountering the implementation of land management practices in effective way. Awareness creation, continuous training, resettlement program, creating opportunities for alternative means of livelihood and promoting NGOs effort to involve in land management practices help solve the problem encountering land management practices in the study area.

Key Words: Challenges, Land degradation, Land management practices.

CHAPTER ONE

1. Introduction

1.1. Background of the Study

The twenty-first century is a time by which the world is getting seriously concerned by issues of sustainable use of natural resources. Despite the emerging recognition of their decisiveness for the survival of humanity on the planet, these days, water and land ecosystems are being degraded at an alarming rate (Hannam 2003; cited in Teketel 2009). The problem is worse in developing regions, where the majority of the population depends on these resources for their livelihoods. Hence, the conservation and management of land and water resources for sustainable intensification and agriculture and poverty reduction in developing regions has remained one of the most challenging policy issues for a long time (Bekele *et al*., 2007).

Ethiopia has a population of about 80 million; 83 percent live in the rural areas (CSA, 2007). Ethiopia is a highland country with 65 percent of its total area having an elevation of more than 1400m (asl) and a substantial area lying well over 3000 m. About 50 percent of Ethiopia can be defined as mountainous, because of its high altitude above about 1500m. The country's highland areas include about 90 percent of its arable lands and are occupied by 90 percent of the human population and 60 percent of all livestock (Hurni, *et al*., 2010). Population has expanded all over the highland parts of Ethiopia as they are very suitable places for living and agricultural activity. The Ethiopian Highlands, once endowed with rich natural resources, are agriculturally used since millennia and now heavily degraded (Gete, 2010).

The agrarian population prefers to stay in higher altitudes though the declining soil quality and general environmental degradation is often driving the farming population into lower altitudes. The interplay between the physical environment and population distribution in Ethiopia explains, to a great extent, the ever worsening problem of land degradation (Aklilu, 2001).

In Ethiopia, land degradation has become a serious problem affecting all spheres of social, economic and political life of the population. It is one of the major challenges to agricultural development and food security of the people. The rate of the country's land degradation is very high. A large portion of the agricultural land, which is mainly located in the highland part of the country, is affected by severe to moderate land degradation (Kruger *et al.*, 1997).

Addressing the root causes reinforcing cycle of declining crop and livestock productivity; natural resource degradation, high population growth and, poor farmers are crucial challenge facing Ethiopia today (Alemneh, 2003). Therefore, understanding the current status and causes of land degradation is very important (Girma, 2001). The current "Intensified Package Approach" has over played the production aspect, with inadequate attention to economic, social and environmental sustainability (Alemneh, 2003).

In Ethiopia land degradation in general and soil erosion in particular still remain the major challenges in adversely affecting the agricultural performance of the country. Hence the call for improved land management practices is timely (Woldeamlak, 2003).

1.2. Statement of the Problem

Land resources degradation, resulting from different causes, is threatening long-term productivity. Nowadays, land degradation is significantly reducing yield and it is more acute in some parts of the world than the others. For example in Central America, 75% of cropland is seriously degraded while in Africa, 20% of the total land area is at risk of unrecovered (Sida, 2007).

In Ethiopia, the heavy dependence of people's livelihoods on agriculture and inappropriate use of natural resources resulted in fast and vast land degradation (Genene, 2006). On the other hand, development of agricultural sector largely depends on land productivity. However, this resource is seriously threatened by land degradation and aggravates the problem of food insecurity in the country through its adverse impact on crop yield. The country could not feed its population at present

and it will have difficulties doing in the near future largely due to serious constraints of land degradation (Kruger *et al*., 1997; Genene, 2006).

Markos (1997) underlined that rain-fed agricultural areas are mostly under human pressure. As to the magnitude of the severity of erosion 50% of the highlands are significantly eroded, while 25% is seriously eroded (Alemneh, 2003). In general, the extent of land resources degradation in Ethiopia, especially the degree of soil erosion, nutrient depletion and deforestation in highland areas, above 1500 m.a.s.l of the country is very high. A significant amount of arable land lost soil fertility in highlands of the country due to land degradation (Lakew *et al*., 2000).

This problem is further aggravated by the expansion of agriculture to marginal areas (Gete, 2002). Land particularly soil degradation has significant negative impact on productivity of land. Because soil degradation and soil productivity are inversely related. It is manifested by a reduction in the actual or potential productivity of soils. This productivity of soil is significantly affected due to the serious soil degradation in Ethiopia. It is indicated that the soil in cropping land of Ethiopia is not sufficiently fertile to support the required level of food production. (MOPED 1994; cited in Desta, 2009).

To solve the problems of land degradation in the country, many efforts have been made since 1970s. A large number of soil and water conservation activities were implemented in different parts of the Ethiopian highlands in the 1970s and 1980s with a huge resource obtained from international community, particularly World Food Program (WFP).

However, at the end, the intervention couldn't be sustainable to bring the intended impact (Yohannes *et al.,* 1999). Among the very reasons behind the failure were: the top-down nature of the conservation approach itself, improper planning, inadequate resource allocation, recurrent drought, costliness of the structural conservation measures, labor intensive-nature of the technologies, little short- term benefits gained from the programs, little systematic efforts made to incorporate indigenous conservation

practices and political constraints (Alemneh *et al.*, 2003).

Different researchers have done studies on land degradation in different parts of Ethiopia. These researchers have mainly focused on nature of land degradation; traditional farmers' land management practices, ongoing soil and water conservation by government and other actors; farmers' perception on decline of soil fertility and causes of land degradation (Yeraswork *et al*., 2000). Most of these researchers generally found out that there is high degree of land degradation in Ethiopia in general and in the highland areas in particular. However, as far as the researcher's knowledge is concerned, there is a research gap on the issue of what social, economic, and institutional factors that determine the management of degraded lands.

In an attempt to contribute in bridging the above research gap, the study would focus on assessing challenges of land degradation and land management practice in the highland of Haddiya Zone taking with Lemo *woreda* as a case study. This site is selected for the study since it is among the Ethiopian highland that is severely challenged by land degradation. In addition, in this area, so far no study has been done on the constraints of land degradation practices.

1.3. Objectives of the Study

The general objective of this study is to examine the challenges of land degradation and its management practices in Lemo Woreda.

The specific objectives of the study attempt to:

1. Identify the major causes of land degradation in the study area.
2. Assess land management practices in the study area.
3. Identify the social, economic and institutional factors that affect land management practices in the study area.
4. Examine major challenges in undertaking different land management practices in the study area.

1.4. Research Questions

Based on the specific objectives indicated above the research tries to answer the following research questions.

1. What are the main causes of land degradation in the study area?
2. What are land management practices in the study area?
3. What are the main social, economic and institutional factors affects land management practices in the study area?
4. What measures should be taken to sustainably manage degraded land in the study area?

1.5. Significance of the Study

The agricultural sector is given particular emphasis for the overall future transformation of the country's economy. One of the factors for its success is the sustainable utilization of the land resources.

Despite recent moves in Ethiopia is made to develop sustainable land management practice in degraded areas, researches done on this area is still quite inadequate. Accordingly, studies pertaining to evaluation of problems and solutions of land degradation are significant. This study is carried to make a contribution along this line. It could also be used as a springboard for further studies. In addition, it was enrich the literature in the area under consideration.

1.6. Scope of the Study

The above mentioned problem is not only limited to the study area, but the whole country. Even though it is difficult to examine all areas, studying some specific area is of a great importance for through investigation. In order to investigate the problem attempts were made to look into land management practice in the study area.

1.7. Limitation of the study

Any research undertaking faces certain limitations. Similarly, this research is not free from such limitations mainly unwillingness of some office workers and experts to provide secondary data and some respondents were refused to give information about family size, age and land holding ways. As the study stressed on three *kebeles as* its

major sources of primary data hence it is difficult to generalize the results to the entire *woreda.*

1. 8. Organization of the Study

The paper was organized in to six chapters. Chapter one deals with introductory part. Chapter two reviews related and relevant literatures and presents the empirical and analytical frameworks. Chapter three that deals with description of the study area and research methodology, including data collection and analytical methods. Chapter four discusses socio-economic characteristics of the respondents and assessment of land degradation in the study area. Chapter five deals with land management practices and challenges affecting land management practices are presented and finally, Chapter six presents conclusions and recommendations of the study.

CHAPTER TWO

2. Review of Related Literature

2.1. Land Degradation and Management: Concepts

There is no single universally accepted definition for land degradation (Blaikie and Brookfield, 1987; cited in Hussien, 2006). It is a broad concept and defined by different people in different ways. World Commission on Environment and Development (WCED), (1987 cited in Taffa, 2002) defined land degradation as "the loss of utility or potential utility or the reduction, loss or change of features or organisms which cannot be replaced." (Young, 1998, cited in Hussien; 2006) gave a more similar definition of land degradation as the process that causes temporary or permanent lowering of current or future productive capacity of land. Alemneh *et al*., (1997) also defined the concept of land degradation as the degradation of soil, water, climate, fauna and flora.

The World Bank (2007b) defines land degradation as a reduction of resource potential, the loss of utility or potential utility resulting in temporary or permanent lowering of current or future productive capacity of land. It has been attributed to one or a combination of natural and human processes that act on the land such as water erosion, wind erosion, salinization, or sodification.

In all of the above definitions, the common denominator is that land degradation is actual or potential reduction in the productive potential of land. Almost all countries, rich or poor; arid or humid; cool or tropical experience some form of land degradation, but the rate significantly varies among different countries based on variation in their biophysical, social and economic structure (WCED, 1987; cited in Taffa, 2002). For this study, land degradation is loss of soil fertility or substantial decreasing of land productivity and soil erosion, deforestation and degradation of grazing lands.

The broad concept of **land management practices;** refers to activities on the ground that uses appropriate technologies for the improvement or maintenance of productive capacity of the land. This includes activities such as soil and water conservation, soil fertility management and controlled-grazing. Thus sustainable land management approach emphasizes economically viable, socially acceptable and ecologically sound solutions at a local level. It promotes participatory land management practices to deal with land degradation. In doing this due emphasis is given to the use of appropriate technologies (Hurni, 2000; cited in Yilkal, 2007).

2.2. Ethiopian Highlands: A General Overview

The highlands of Ethiopia (areas over 1500 m.a.s.l), which make up about 45% of the total land area, support over 84% of human population and two-thirds of animal population. They are also the sources of many of the country's major resources (Alemneh, 2003). Different studies have revealed that there is a widespread belief that the Ethiopian highlands used to have an adequate fauna and flora, dependable soils, and climatic conditions. In the course of time, however, the highlands have become the most degraded area in Africa if not in the world (Terefe, 2003).

Due to the high degree of degradation, important renewable natural resources such as soil, water, forest and biodiversity are highly deteriorating in the Ethiopian highlands.
Soils in Ethiopia are becoming resistant to fertilizer since they are degraded to the extent of not absorbing water with fertilizers thus resulting in low crop yield (Abbi 1995; cited in Desta, 2009).

2.3. Causes of Land Degradation in Ethiopia

The main causes of land degradation are very complex and attributed to both biophysical and socio-economic factors. Many empirical studies have indicated that land degradation such as deforestation, overgrazing, cultivation of marginal lands and soil fertility depletion can be attributed to population pressure (Yohannes, 1999). The causes of land degradation can be divided into natural hazards, direct causes and underlying causes.

2.3.1. Human Causes

Human causes are the causes of inappropriate land use management practices. For example, steep slopes may be cultivated by landless poor people to produce their food (FAO, 1994). The main cause of land degradation in Ethiopia is soil erosion. The erosion in Ethiopian highlands, amounting to nearly one billion tons of soil lost each year is due to natural causes exacerbated by human activities, particularly overgrazing, over cultivation and deforestation. In addition, (Yohannes, 1999) reported that many environmentalists, policy makers and researchers agree that land degradation mainly caused by soil erosion has been one of the chronic problems in Ethiopia.

- **Overgrazing**

Overgrazing is one of the major causes of land degradation. Overgrazing results when livestock density becomes excessive and too many animals are grazed at the same area of rangeland. This lead to degradation of vegetation, the compaction and erosion of soil. The degradation of sparse rangeland vegetation by overgrazing exposes the soil to erosion by wind and water. In Africa as a whole, overgrazing is the major factor accountable for half (49%) of the soil degradation (Aklilu, 2001: 32).

Livestock pressure and poor stock management (Mainly based on the free grazing system) are other major sources of land degradation. Only 25 percent of Ethiopia's high livestock population which includes 35.3 million cattle-graze in the rangelands (the lowland areas of Afar, Somali, and Borena), while the remaining 75 percent graze in the highlands, leading to serious overgrazing of areas already under high agrarian pressure (EPA, 2003). In the highlands, the expansion of grazing beyond the land's carrying capacity occurs at the expense of the remaining natural vegetation and further land degradation. The scarcity of grazing land and livestock feed has forced the widespread use of crop residue to feed livestock. When crop residues are removed for feed and cow dung is used for fuel, the soil loses organic matter and nutrients. This breach in the soil nutrient cycle seriously depletes soil quality, increases erosion, and eventually reduces soil productivity (MOARD, 2007).

- **Deforestation**

World's tropical forests were reduced by an average of 15.4 million hectares. Historical sources indicate that high forests that might have covered about 35- 40% of the total area of Ethiopia have now been reduced to 2.7% according to recent government sources, estimates of deforestation currently "vary from 80,000 to 200,000 hectares per annum", and the main cause is believed to be the relentless expansion of rain-fed agriculture (EPA, 1997).

According to Dessalegn (1996), massive destruction of forests and woodlands in Ethiopia occurred on three significant occasions in the decades following the 1960s. This was when the imperial regime proclaimed in the mid-sixties that all large-scale forests belonged to the state; the second occasion was in 1975, following the land reform and expropriation of all forests; and the third was at the time of the fall of the Derg in 1991.

However, in recent decades, particularly after the 1950s, an increasing trend of degradation of local natural resources, such as farmland, soil, water, forest and pasture, has been witnessed in Ethiopia (Tegegn quoted in Teferi, 1999). Deforestation presents major problem in Ethiopia, since it is one of the main causes of the prevailing land degradation (via facilitating soil erosion).

Deforestation and poor land husbandry practices have resulted in accelerated run-off, reduction on the recharge of groundwater reserves, increased sediment load of rivers, siltation of reservoirs and increased incidence in the degree of flooding (Shibru 1998: 11).

The underlying causes of deforestation are, however, closely linked with the vicious cycle of mutually reinforcing factors, i.e. poverty, population growth, poor economic growth and the state of environment. With the reported annual loss of high forests estimated at 150,000 -200,000 ha, it has been projected that the area covered by high forests may be reduced to scattered minor stands of heavily disturbed forests in inaccessible parts of the country within a few decades (Gedion, 2003). The destruction of forests is caused for most part by land clearance for agricultural purposes. In 2000, the estimated annual rate of destruction of natural high forest for agricultural expansion is estimated to about 65,540 ha per annum in the three main forested regional states of

Oromia, SNNPRS and Gambella. In the three main forested regions, the analysis indicated that approximately 1.24 million ha of natural high forest would be destroyed by the expansion of agriculture between 1990 and 2014(MoARD, 2005).

- **Population pressure**

Though there are many arguments about the population growth being the cause of land degradation in Ethiopia it has undoubtedly direct consequences for the environment; growing demand for more land for crop production; for fuel wood; shortening of fallow cycles and contribution to over cultivation.

Moreover, because of high population growth, the size of individually owned plots is shrinking in the relatively fertile highland and medium altitudes. This diminution will lead to intensive cultivation, which will inevitably result in a loss of soil fertility. In the absence of modern techniques for enriching the soil, and with dung being increasingly converted into a source of fuel, the reduction in soil fertility is imminent. This diminishing land degradation lead to reduced soil fertility and subsequently a decline both the capacity soil to produced food and to it's in capacity to resist drought (Engida, 2002).

- **Poverty**

Poverty and natural resource degradation are negatively reinforcing, that is, as the land is degraded, agricultural productivity is lowered, resulting in decreasing incomes and food security. This in turn leads poor people from both rural and urban areas to engage in activities that further degrade the land resources in order to obtain supplementary incomes and to sustain a living. (Badeg *et al*., 2003).

Poverty is very likely to contribute to land degradation for many reasons. When people lack access to alternative sources of livelihood, there is a tendency to exert more pressure on the limited resources available to them. There is intensified pressure on the natural resources. One of such pressures is land degradation. The situation has led to drought and reduced household assets (Shiferaw and Holden.1999). As a result, deforestation, burning of dung and crop residues are increased due to people's inability to afford or lack of alternative fuel sources. For example, electricity and kerosene are expensive and in most cases not available for the rural people. Even households with electricity supply avoid

using it except for lighting at night. For cooking, most households prefer the three stone open fire. This is believed to be only about 10 percent efficient in the overall thermal energy production and use. Improved stoves such as improved biomass, fuel saving stove, etc are believed to be around 45-82 percent more efficient than the three stone open fire.

However, they are not used since they are not affordable by rural households (Lakew *et al*., 2000) without adequate alternative sources of energy; population growth increases the demand for fuel wood, which in turn leads to the destruction of forests. It also contributes to the use of crop residues and animal dung for fuel rather than using them as source of organic fertilizer to improve the soil. This situation is true in the highland areas of Ethiopia where-by about ninety-four percent of the peasant households meet their principal energy demanded from fuel wood and dung (Lakew *et al*., 2000; Badeg *et al*., 2003).

- **Poor Arable Land Management**

Ethiopian farmers still continuing implementing unscientific way of cultivation. Wind and water erodes the top soil. As a result of erosion much water could not percolate into the soil instead it is wasted as run-off. Therefore, the soil cannot maintain the required amount of soil moisture. As a result of depletion of soil moisture and soil nutrients, the soil cannot sustain plant growth (Tilahun and Eylachew, 2002). In Ethiopia, a continuous cultivation of the land without any improvement in land management and farming practice has led to severe soil erosion. It is widely believed that land degradation is mainly caused by cultivation. According to (Hurni, 1986) study, soil loss on cultivated land is estimated to be 4-10 times higher than grazing land, and 80% of the eroded annual soil loss occurs in month of plowing in the first month after planting. The Ethiopian highland reclamation study (Constable and Belshaw, 1989) stressed the condition of land prior to sowing during the short rainy season (belg) or during the first month of the growth is important in averting soil erosion.

Berry (2003) indicated that most arable land (70%) in the highland is in cereals, with wheat and barley in the higher ground and teff, sorghum and maize in the lower elevation. All these crops leave bare areas of soil during some or all of the growing

season exposing soil to erosion. Twenty percent of the cultivated area is in perennial crops including coffee, enset (false banana), oil seeds, fruit trees and cotton. Pulses occupy the remaining 10%. (Enset found only in Ethiopia) in particular provides good ground cover, needs manure, and is a good crop to maintain fertility.

He further explain the annual crops are mainly planted after the rains begin, allowing early rains to directly impact the soil contributing to high erosion levels. Additionally, as population grows more fragile marginal lands are used. A further result of population growth is the reduction in fallow periods in some areas from a five year rotation to a two-year and even shorter rotation.

Agricultural activities that can cause land degradation including shifting cultivation without adequate fallow periods, absence of soil conservation measures, cultivation of fragile marginal lands, unbalanced fertilizers use, and a host possible problem arising from quality planning or management of irrigation (Eswaren, 2001).

- **Tenure Right and the Problem of Land Degradation**

The arrangements by which tenure is granted to the land user can influence the practice of soil conservation techniques. Where farmers own the land, they are more likely to consider the long-term consequences of their actions and adopt soil protection measures unless the need for short-term survival dictates otherwise (Morgan, 1995).

In Ethiopia, insecurity of tenure has been strongly accused of leading to resource degradation. The insecurity prevailing prior to the Revolution is believed to be "one of the main factors responsible for the widespread degradation that occurred in the past" (Tomas, 1984 quoted in Aklilu, 2001).

The effects of land tenure on the adoption of land management practices are mainly to the transferability of property rights, which in turn affects the reversibility of land investments and the ability to use land as collateral.

The current land policy in Ethiopia is based on the notion that land is both a factor of production, contributing to growth, and the essential element in providing for the welfare of the population. Under the 1994 constitution, land is the state property and farmers have use rights over the plots they farm. Land cannot be sold or exchanged. Land is

heritable, but with conditions in some regions, Private property on land is prohibited in all regions. Land is transferred through periodic redistributions with each person reaching the age of 18 being entitled to land in this Kebele (MOARD, 2007).

2.3.2. Natural Causes

In addition to socio economic and institutional factors, there are also natural factors that are contributing to land degradation in Ethiopia. The most important one are slope of land and high intensity of rainfall. Steep relief is among the major natural causes for land degradation in the country. Rain with high intensity on bare, unprotected soil is also resulting in erosion by water in the Ethiopian highlands (Lakew, 2000). The erosive capacity of rainfall is a function of its intensity and distribution. Intense tropical storm, which is poorly distributed (only with in the months of June to September) is the major cause of erosion in most highlands of the country. The erodibility of soil, which is a function of its intrinsic properties (texture, structure, organic matter content) and, degree of vegetation cover are other determining factors for loss of soil through run-off. Mountains and undulating terrain characterize relief in most highlands of Ethiopia; this coupled with poor physical and chemical properties of some soils make the highlands erosion prone (Lakew *et al*., 2000).

2.4. Consequences of Land Degradation

Land degradation has already resulted in noticeable and wide ranging effects on the Ethiopian community-both rural and urban. (Aggrey-Mensah, 1984) has categorized such effects into non-economic and economic. The effects of land degradation on the individual, the community or the nation as a whole, are according to (Aggrey-Mensah, 1984), hard to quantify owing to the length of time over which degradation takes place (Aggrey Mensah, 1984 quoted in Aklilu, 2001).

2.4.1. Non-Economic Consequences

Some of the effects of land degradation which could be categorized as non- quantifiable (or very hard to quantify) include (Aggrey-Mensah, 1984; Wood, 1990; Berhanu, 1998 quoted in Aklilu, 2001):-

- **Loss in water resource**

Due to depletion of forests and the resultant increase in runoff, the storage of water has greatly diminished and a large number of water points for human and animal use have dried up.

- **Loss in Livestock production**

Land degradation leads to decrease both in the quality and number of livestock; any change in livestock sectors has tremendous effects on the living standards of the rural people as a whole:-

First, in places where the wheel has not yet penetrated, animal transport still provides a reliable and well suited mode of transport. Second, oxen are extensively used for traction power.

- **Unemployment and out-migration**

Where agricultural and livestock production reach very low levels are a result of reduced cultural land yields, a situation will be created where there is insufficient land leading to shrinkage of average farm size which, in turn, creates a disguised unemployment.

Ethiopia may stand number one in Africa (perhaps in the world) to witness the power of land degradation deriving people out of their homes. In 1984/85 more than half a million people were forced to leave their homes mainly in the highly eroded northern regions to the south-western parts which are less degraded so far.

- **Long walking distance**

Plots have been abandoned and given up grazing owing to the persistent erosion. It is reported that "about 20,000 to 30,000 hectares of land in the highlands are abandoned each year because cropping can no longer be supported by the soil" (Berhanu, 1998 as quoted in Aklilu, 2001). The consequence is use of marginal lands on steep slopes or relatively unsuitable soils.

- **Shortage of food and malnutrition**

Dung is by and large the most readily available source of energy for cooking in rural Ethiopia. Its value as fuel is more appreciated and recognized than its use as fertilizers. It has been estimated that the burning of dung for fuel instead of using it as fertilizers causes an annual reduction in grain production by some 550,000 tons (Mekuria, 2005). This in turn leads to shortage of food and malnutrition.

- **Lack of fire wood and building materials**

Over much of northern Ethiopia, most of the land is absolutely treeless, so much so that in some rural areas only stones are used for building houses, and cow dung for fuel, wood, even for ploughs and other implements, is very scarce, and farmers have to walk long distances into the more remote valleys to get it' (Mesfin, 1984 quoted in Aklilu, 2001).

2.4.2. Economic Consequences

The average soil loss rate for the whole country was predicated to be 12 tons per annum while the absolute total yearly, loss was estimated at 1.5 billion tons (Muluneh, 2000). Soil erosion in 1990 has cost the nation an annual loss of grain production estimated at about 40,000 tons. The permanent in values of the country's soil resources caused by erosion in 1990 was estimated to be Birr 59 million (EPA, 1997).The Amhara RCS indicates that soil erosion is greatest on arable land, and the average annual soil loss is estimated total of about 1.1 billion tons per year. The situation is pretty much the same (Gedion, 2005).

Livestock play a number of vital roles in the rural and national economy but according to one estimate some 2 million hectares of pasture land will have been destroyed by soil erosion between 1985 and 1995. Land degradation is estimated to have resulted in an annual loss of livestock production in 1990 equivalent to 1.1 million tropical livestock units (TLU's), and, unless arrested, will rise to 2.0 million TLUs or to 10 percent of the current national cattle herd by 2010 (MoARD,2007).

2.5. Land Management Practices

2.5.1. Land management Practices in Other Countries

Poverty and land degradation are the major challenges in Sub-Saharan Africa (SSA). About 41% of the population of SSA- more than 300 million people- lived on less than 1 US dollar per day in 2005-the highest poverty rate of any region of the world (World Bank 2007). In recent years there has been some progress in reducing poverty in Sub-Saharan Africa, but the rate of progress falls far short of millennium development goal of cutting poverty in half by 2005.

Over 70 percent of the SSA population of over 750 million people live in rural areas, depending heavily on natural resources for their livelihoods (Thirtle, Lin, and Piesse 2003; UNDP 2004). Agriculture is the major sector on which two-thirds of the population depends (Diagana 2003; Thirtle, Lin, and Piesse 2003). Unfortunately agricultural productivity in most of the region has been stagnant or declining. SSA is the only region in the world where average cereal yields have not significantly increased and per capita food production has declined since the 1980s (Muchena *et al*., 2005).

Poor inherent soil fertility and other biophysical factors are important constraints to agricultural productivity in much of SSA (FAO 1995; Voortman, Sonneveld, and Keyzer 2000). However, land degradation is also a major cause of poor agricultural performance in the region. Nearly two-thirds of agricultural lands in Africa were degraded between 1945 and 1990, with serious degradation (involving major loss of productivity) on nearly one-fifth of agricultural land (Oldeman *et al.*, 1991). Degradation is particularly severe in the dry lands of SSA (Oldeman et al. 1991), with about half of these lands estimated to be severely degraded (Dregne and Chou 1992). The most important forms of degradation are soil erosion, caused by both water and wind, and soil nutrient depletion, caused by overgrazing, devegetation, crop production on fragile lands without sufficient soil cover or use of conservation measures, declining use of fallow, and limited application of soil nutrients.

At the regional and country levels, several strategies have been formulated to reduce poverty and land degradation (Anonymous, 2007a). Of 49 African countries, 38 have

developed National Action Plans (NAPs) under the United Nations Convention to Combat Desertification (UNCCD), and 18 countries have incorporated the NAPs into their Poverty Reduction Strategy Papers (PRSPs) (Anonymous 2007a; UNCCD 2007).The Comprehensive African Agricultural Development Program (CAADP) of the New Partnership for African Development (NEPAD), in collaboration with African governments and donors, places high priority on promoting sustainable land management (SLM) in its investment plans. CAADP has emerged as one of the important programs for coordinating country and regional level agricultural and SLM investments in collaboration with international donors who are currently seeking to harmonize their support through the Paris Declaration. Terr-Africa, a global partnership to scale up, mainstream, and finance country-driven SLM approaches in Africa, is currently working in partnership with CAADP to coordinate country- and regional-level SLM investments.

2.5.2. Land Management Practices in Ethiopia

Several efforts have been made to promote sustainable land management in Ethiopia, with mixed success. For example, in most places where soil conservation was implemented in the 1970s, farmers either totally or partially destroyed the conservation structures. Of the total conservation measures implemented between 1976 and 1990, only 30 percent of soil bunds, 25 percent of stone bunds, 60 percent of hillside terraces, 22 percent of the planted trees of the reserve areas were still in place by 1994 (Nurhusen, 1995).

In Ethiopia, since the 1970s, considerable efforts have been made to reverse the problem of land degradation. What were once considered to be sustainable land management practices such as soil and water conservation, soil fertility management, controlled-grazing and other land management practices were introduced.

However, the impact of those efforts did not curb the impact of land degradation in a meaningful and sustainable manner. Various reasons are often given for the lack of success.

Among these the most commonly cited factors include failure to consider indigenous land management practices, high initial costs which are not affordable to poor farmers and also trying to apply uniform techniques in different agroecological regions (Aklilu, 2006).

Traditionally through time, farmers have developed different soil conservation and land management practices of their own. With these practices, farmers have been able to sustain their production for centuries. Even up to now, it has been acknowledged that these technologies, which include ploughing of narrow ditches on sloping fields to control run-off, farmland terraces, traditional ditches and furrows, contour ploughing, fallowing, crop rotation, farmyard manure and agro-forestry continue to play a significant role in the production of subsistence agriculture (Betru, 2003).

Several soil and water conservation measures were introduced in the early 1970's to improve land management practices. These projects were supported by development food aid USAID and the World Food Program (WFP). The main activities under those projects were reforestation and soil and water conservation in the drought prone areas of the country. In the 1980s, the WFP consolidated its support to include rehabilitation of forest, grazing and agricultural lands. On government's part, the watershed or catchment approach became it key strategy. The major elements of the soil conservation activities were a range of physical structures such as farmland and hillside terracing, cut-off drains and waterways, micro-basins, check dams, water harvesting structures like ponds and farm dams, spring development, reforestation, area closure and management and gully rehabilitation (Betru, 2003).

However, efforts made up to the early 2000 were considered inadequate as they covered only 7% of the total land area that needed treatment, and at that rate, it was estimated that treating all the remaining land could take seven decades. Evaluations of efforts made concluded that the interventions were ineffective, insufficient and unsustainable (Woldeamlak, 2003; EEA/EEPRI, 2002).

2.5.2.1. Afforestation and Reforestation

Girma (1988) states, that the most important measure to restore the disturbed rural ecology is the implementation of afforestation and reforestation… on a scale large enough to cope with the problems of soil erosion and wastage (Girma, 1988; as quoted in Aklilu, 2001).

Many countries now have afforestation programmes aimed at arresting erosion and regulating floods (Morgan,1995). Afforestation trails were also successfully implemented, with bamboo, teak and eucalyptus as the promising species (Tejawani, 1981 quoted in Morgan, 1995).

The role of eucalyptus is unclear because of evidence that when planted in wet areas they result in a reduction of water supply in springs and rivers (Gosh, Kaul and Sobbarao, 1978 quoted in Morgan, 1995) yet when grown in drier areas they do not consume large quantities of water (Konuche, 198 quoted in Morgan, 1995).

A successful implementation of afforestation and reforestation schemes requires an ability to form pressure groups in the community or involve existing local groups. Activities like starting nurseries in villages, planting and protecting multipurpose trees along roads, on farms and around houses, etc., for instance, call for an ability to garner the knowledge, support, and energy of rural people (Postel and Heise, 1988 quoted in Aklilu, 2001).

2.5.2.2. Conservation Oriented Crop Combination and Land Management

The underlying principles include making conservation part and parcel of the farming work cycle; and making farming practices involve not only a few new inputs but also provide farmers with short-term economic benefits (Wood,1990; Naire and Muschler, 1993; quoted in Aklilu, 2001). This method appears to combine the three broad techniques of controlling soil erosion referred to by Belay (1992): agronomic methods, which aim at controlling erosion by improving the vegetative cover; soil management techniques, which try to control erosion by improving the aggregation of the soil particles; and structural soil conservation methods, which control erosion by shortening the length and minimizing the gradient of the ground slope. This technique involves

construction of tied ridges, bunds, fanya juu terraces, bench terraces, hillside terraces, diversion ditches (cutoffs) waterways and special water harvesting structures (Thomas, 1984; MOA, 1986 quoted in Aklilu, 2001).

Certain farming practices which are believed to conserve the natural resource base and at the same time raise productivity are noted (Blackwell, 1991; Wood, 1990 quoted in Aklilu). These include intercropping and relay or sequential cropping; crop rotation; integration of livestock farming with arable cultivation; the cut and carry method of using degraded pasture, controlled grazing and tethering; widespread use of semi-permanent crops like enset (false banana) and cassava or self-seeding and volunteering crops, such as legumes and sweet potatoes. It is not surprising that emphasis has now been put on agro-forestry (Nair and Muschler, 1993; Blackwell, 1991; MOA, 1986 quoted in Aklilu, 2001) which, in broader terms, includes most of the land management practices described above.

2.5.2.3. Agro-forestry

Trees can be incorporated within a farming system by planting them on land which is not suitable for crop production. Where trees are deliberately integrated with crops or animals or both to exploit expected positive interactions between the trees and other land uses, the practices is defined as agro-forestry (Lundgler and Nair, 1985).

Trees help to preserve the fertility of the soil through the return of organic matter and the fixation of nitrogen. They improve the soil's structure and help to maintain high infiltration rates and greater water holding capacity. As a result less runoff is generated and erosion is better controlled. Trees are also attractive to the farmer where they provide additional needs; especially fuel, fodder and fruits multipurpose trees and shrubs are thus fundamental to agro-forestry (Morgan, 1995).

Agro-forestry is being encouraged in many countries as a way of modifying existing farming systems to promote soil fertility, erosion control and a diversified source of income. Furthermore, agro-forestry systems require carefully selected of both crops and tree species of beneficial interactions to be obtained.

2.5.2.3 Controlling the Rate of Population Growth

All efforts will bear little fruit or no fruit at all if population growth in Ethiopia continues at its present pace. Any improvements introduced will be nullified by a fast growth ofpopulation. Concretesuggestions have repeatedly been put forth with respect to controlling the rate of growth. An appropriate population policy aimed at reducing fertility is one of the proposals often underscored (Markos, 1990).

Intensive education on population and family planning are part of the recently issued population policy. There is also a lesson to be learned from the experience of the Family Guidance Association of Ethiopia (FGAE) (Jansson et al., 1990). Through a cautious policy emphasizing the value of child spacing and the welfare of the entire family, the FGAE has, according to these writers, sensitized the government and religious authorities to the need for family planning

2.6. Determinants to land Management Practices

2.6.1. Economic factors

Farmers will adopt soil conservation practices if they have the necessary labor, capital and technological inputs to do so and if they perceive an immediate economic benefit (Morgan, 1996). Individuals with few current incomes and inability to obtain capital for conservation investments may not be willing or able to forgo income to maximize expected net returns over a long period. Similarly, individuals in uncertain economic situations will be inclined to use short planning horizons because they are unable to predict future costs and prices (Ervin and Ervin, 1982).

As poor farmers generally posses less land, they are more often engaged in off farm activities such as petty trade. This can decrease their interest to invest on soil conservation practices. According to (Hagos *et al.,* 1999), small farm holdings and land fragmentation may undermine farmers' interest in undertaking some kind of land improvement. For example, farmers may find the cost of hauling manure or other organic materials to distant and small plots not worth the considerable effort required. In addition, investment that can be easily damaged by free ranging livestock or subject to theft (such as trees) are less likely to be made far from the household where it is different to protect them.

2.6.2. Policy/Institutional Support Factors

Appropriate policy environment is the pre requisite for being able to implement natural resource management process that satisfy the objectives specified by the interested profits. Government policies are not translated in to action unless there is the political will to make them work. Therefore, the situation in many countries today is that plans are made for the conservation of natural resources but they have little practical effect.

Whatever the historical background, many developing countries have sizeable portion of land that was previously reserved. As the authoritarian management has decline, population pressure and land hunger have increased. So has the chance of evading punishment for illegal encroachment on reserved land. The restriction of land was often to preserve the income or power of the ruling elites; there are also many examples where the land was deliberately with held from settlement because it was ecologically unsuitable.

2.6.3. Socio-cultural factors

In the past, there was enough land for everyone to have some, and an increase in population just means to bring more land in to use. Getting this new land is not a simple task and it resulted in the expansion of farming activities to erosion prone marginal areas, serious deforestation, and a decrease in fallow period and continues cultivation (Habtamu, 2006; Hussen, 2006).

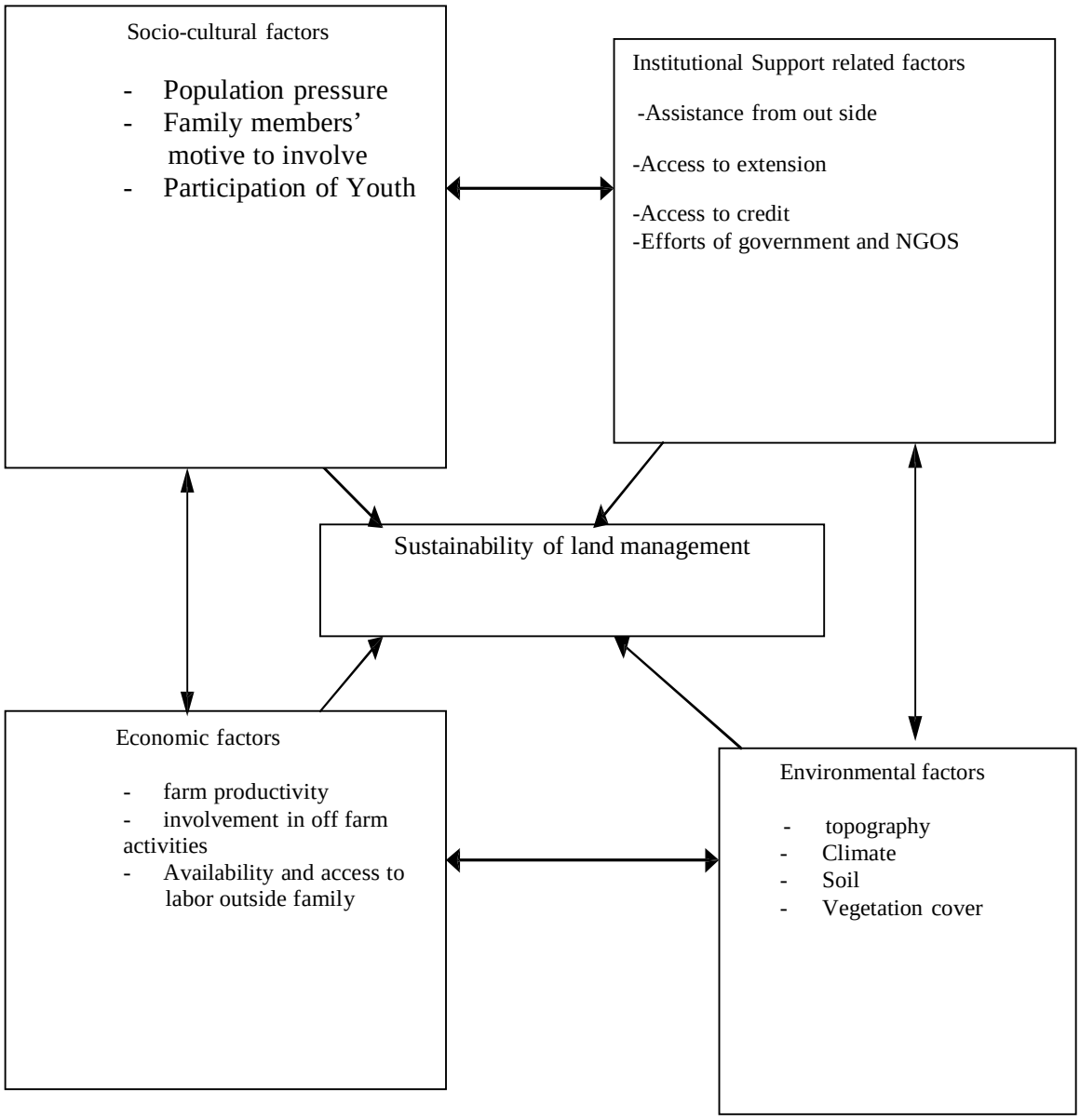
Many people in developing countries can barely eke out a living from their land by hard work such as a hard tillage. They know that traditional management has kept them and their predecessors alive, and that they have nothing to spare for gambling on a new method. It is difficult for them to change their techniques even for immediate benefits such as higher yields and less soil loss. It is still more difficult for them to adopt a practice that requires an investment, especially if the benefits are delayed or disturbed over several years. The establishment of conservation practices under such conditions requires a reliable guarantee that those people will not starve to death if the new practice fails (Napier and Summers, 1993 cited in Troeh *et al*., 1999).

Short term tenancy prevents the adoption of many desirable practices. Theoretically, the landowners should be willing to invest in sound long term practices, but many owners are too far removed from the land to realize what practices are needed. Short- term tenancy makes it easy for both tenants and owners to overlook problems, when those problems reach a critical stage. Another constraint to the sustainability of conservation practices is social significance of cattle population. The part played by livestock in adding pressure on the land resource base varies a great deal from one country to another. In area where cattle are symbol of status, evidence of wealth and have religious significance, focus is given to quantity than quality. Associated with this are low standards of livestock management and low level of production. The total effect of these combined factors is unnecessary stress on the ecological system.

2.7. The Analytical Framework

As it is stated in section 2.6, there are different factors that could affect sustainable land management practices. These factors are interlinked with one another and operating at different scales. Among these factors, some have direct influence on sustainable land management practices whereas others have indirect influence. For this research, the analytical framework illustrated in Figure-1 is adopted. It is adopted since it shows the factors that are determining sustainable land management practices in comprehensive way. It indicates that sustainable land management practices are affected by socio-cultural, economic, policy/institutional support, and environmental factors. The socio-cultural factors include population pressure, family members' motive to involve and participation of youth. The economic factors include, farm productivity, involvement in off farm activities and availability and access to labor outside family. The policy/institutional support related factors include assistance from outside, access to extension, access to credit, efforts of government and NGOs. Similarly, the environmental factors include topography, climate, soil and vegetation cover. The framework generally indicates how the factors are complex and how they affect sustainable land management practices in a given area

Figure 1: Analytical framework of sustainable land management practices.



Source: Modified from (Hudson, 1986 and Troe *et al*., 19 99).

CHAPTER THREE

3. Description of the Study Area and Research Methodology

3.1. Description of the Study Area

3.1.1. Location

Geographically, Lemo district is located between 7°.22'- 7°.45' north latitude and the difference is 23minutes, which is 42km and 37°.40'- 38°.00' east longitude and the difference is 20 minutes, which is 37km covers an area of 34,953 hectare. The district is bordered by Silte Zone in the North, Kembata-Tembaro Zone in the South, Gombora and Misha Woreda of Hadiya *Zone* in the North-West, Ana- Lemo and Shashogo *Woreda* of Hadiya Zone in the North-East and Soro *Woreda* of Hadiya *Zone* in South-West. The district is found around the capital of Hadiya *zone*, Hosanna Town, which is located at 230 km South of Addis Ababa and 175km from *regional* capital, Hawassa. The three study kebele: Belessa, Hayise and Kode are located about 10 km in the south, 7km in the east and 12km in the southeast away from Hosanna town, respectively (LWFED,2010).

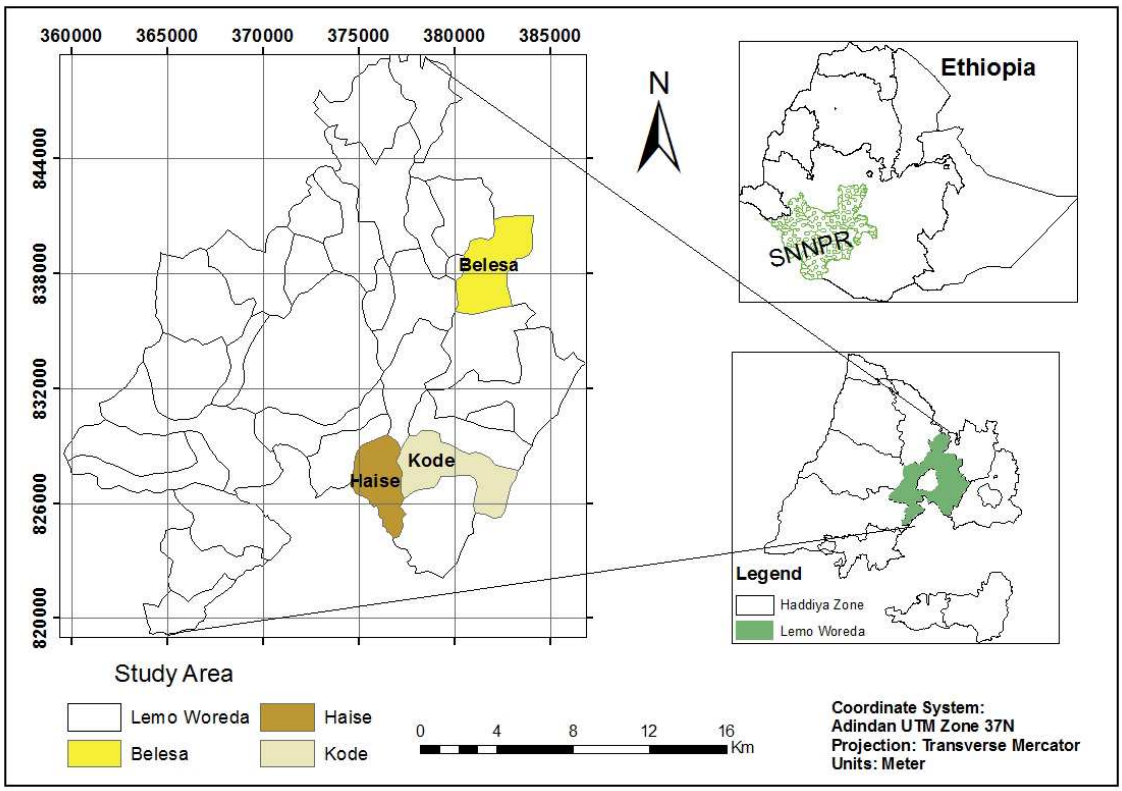


Figure: 3.1 Map of the study area

3.1.2. Topography and Geology

The district's land mass lies between 1780 - 2780 above sea level altitude. Which entirely falls into Dega and *Woina-dega* agro-climate. The soil types are exposed to the risk of erosion due to topographic features in some area. The study area is dominated by sedimentary (soft weathered rocks) that are particularly susceptible to erosion (LWARD, 2009).

3.1.3. Climate, Vegetation and Soil

Climate has great influence on human activities and life in many ways. So that it is probably the most important factor in socio-economic development. It, in turn, largely determines the type and location of industrial activities of man and the amount of food produced in the areas as well as materials required for building shelters and making clothing. As indicated in (Table 3.1) the annual mean minimum and maximum temperature is 15.1℃ and 18.8℃.

The mean annual rainfall of the area is 1346mm. Rainfall distribution in the study area is seasonal. Rainfall tends to be bimodal with rainfall becoming more continuous as elevation increases. Most of the rainfall falls during the "*Meher*" season from June to September (it is most intense during July and August). The study area has relatively high amount of rainfall that causes rockslides and landslides from the highly degraded up slopes. In addition to its high rainfall the study area is drained by about more than seven seasonal streams such as *Bugita, Batenna, Guderra, Gomborra, Kollo'o, Ajjo'o and Shilansha*. There is short rainy season called "*Belg*" which falls during the months of mid February to May. However, the short rains are highly variable and since they often fail, farmers claim they are relying on them for grain production less and less (LWARD, 2009).

Table 3.1: Temperature and rainfall of Lemo *woreda.*

Moths	Jan.	Feb.	Marc.	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Temp	16.7	17.4	18.2	18.2	18.4	18.8	17.1	15.1	15.8	16.5	17.5	15.5
R.F	25	117.8	76.6	134.9	251.8	76.2	230	211	173.7	46.4	2.1	0

(Source: EthiopiaNational Meteorology Agency, 2013/2014)).

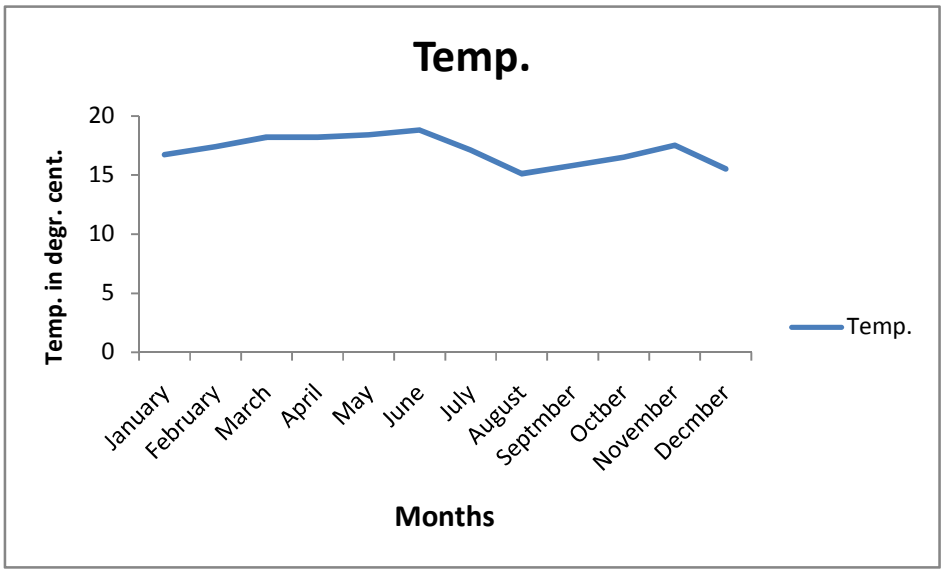


Figure 3.2: Mean monthly Temperature.

Source: National Meteorology Agency (2014/2015).

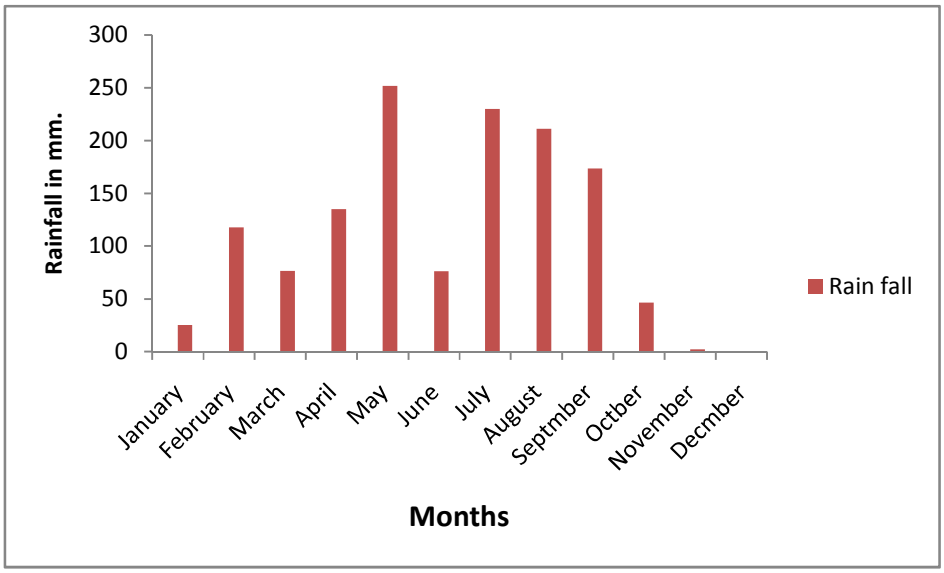


Figure 3.3: Annual Rainfall of study area.

Source: National Meteorology Agency (2014/2015).

To describe the vegetation pattern, manmade plantation that dominantly covers the woreda is eucalyptus significantly around farm boundaries, homesteads and home gates while, the natural vegetation is decreased from time to time. The vegetation cover has

been removed, and replaced by cultivation fields, grazing land and plantation of exotic species such as eucalyptus. Remnants of the indigenous vegetation such as *Juniperus procera, Podocurpus falcatus, Olea africana, Abyssinia haygeinica* and other indigenous species are found scattered here and there. Thus, like other parts of the country, the natural vegetation of the area has been victim of the influence of man and its domestic animals. The remnant tree species in the study district witness the land cover/ land use change that occurred because of the impact of human activities (Adbacho, 1991 and LWARD, 2009).

3.1.4. Land use and Agriculture

Agriculture in the area is characterized by small-scale subsistence mixed farming-system, with livestock production as an integral part. Crop production is mainly rain-fed. Livestock are also very important to agriculture in the district. The current land use can be categorized broadly into three categories: arable land covering the largest proportion of the district with about 84.3%, grazing land covering 10.5% and forest 5.2%. The dominant activities under land use pattern in the study area include cultivation of perennial crops such as *enset*, stimulants (coffee, *chat*), eucalyptus. Whereas the annual food crops, including cereals (maize, sorghum, barley, wheat, *teff*), pulses (beans, soybeans), and root crop (potatoes). A very small fraction of farmers produce vegetables or fruits. These crops are grown mainly in homestead gardens or where irrigation exists (LWARD, 2009). Perennial crops such as *enset*, stimulants (coffee, chat), timber (eucalyptus), are also grown in considerable amounts. Livestock are also very important to agriculture in the woreda. The woreda has an estimated population of 126,786 cattle, 27,488 sheep, 24,395 goats, 7,839 horses, 15,934 donkeys, 5,820 mules and 78,563 chickens. Out of the total 26,811 farm households found in the woreda around five percent have no ox. The remains own at least one ox. Donkeys are the most common pack animal. The availability of feed and water are serious constraints to livestock production in the woreda. Communal grazing areas, private pastures and crop residues are the principal sources of feed (LWARD, 2009).

Land and soil degradation, reoccurring drought, small farm plots, high population density and input shortage including draught animal and improved seed are the major

agricultural problems of the woreda. These agricultural production problems are enhanced with poor delivery of research technology and extension support. Cash income for household financial requirements is mainly generated from sale of livestock and crop products. Households facing seasonal food shortage receive cash or food transfer, either 'for work' (through a public work program to employ beneficiaries in SWC works, building roads and other infrastructures) or 'for free', from productive safety net program (PSNP). A total of 10,745 families have got support from food security program (LWARD, 2009).

Table 3.2 : The land uses of Lemo *Woreda*

Land use pattern	**Area covered in hectare**	**%**
Annual crop land	23,697	67.76
Perennial crop land	3,745	10.70
Grazing land	1,078	3.08
Natural forest	519	1.48
Cooperative and private forest	1,040	2.98
Cultivable land	349	1.00
Unproductive land	859	2.46
Construction	3,686	10.54
Total	34,973	100

Source: Lemo Woreda office of agriculture, 2001E.C.

According to Lemo *woreda* office of agriculture, the average farm size per family head is (0.98 ha) crop land, (0.05 ha) grazing land, (0.16 ha) forest cover and (0.10 ha) other.

3.1.5. Demographic and socio-economic background

3.1.5.1. Population size and density

Based on figures published by the (Central Statistical Agency 2007), district has an estimated total population of 153,783 of whom 75,819 were males and 77,921 were females and 93% of which live in rural areas are mostly subsistence farmers depending on rain fed production and 7% of its population is urban dwellers, which is less than the Region and Zone average of 10.28% and 8.1% respectively (LWFED, 2010). With an

estimated area of 432.50 square kilometers, the district has an estimated population density of 355.6 people per square kilometer, which is less than the Zone average of 378.7 and greater than the Region average of 133.9 people per square kilometer. The District has an estimated population density of 440.5 persons per km^2 of arable land and the average arable land holding is 0.98 hectares per household, varying from 0.25 ha to 3.0 hectares. More than 85% of households own less than one hectare of farmland (LWARD, 2009).

3.1.5.2. Ethnicity and Religion

According to information given in (Table 3.3) Hadiya (95%) is the dominant ethnic group in Lemo district followed by Kambaata (3.5%), and the all other ethnic groups made up 1.5% of the population (HZFED, 2009). And also the most dominant religion in the Lemo district is protestant (46.4%) followed by orthodox accounting for (38%).

Table 3.3: Lemo district population by ethnic and religion group

Ethnic group	No	%
Hadiya	249,735	95
Kembata	9,200	3.5
Others	3,944	1.5
Total	262,879	100
Religion	No	%
Orthodox	43319	38
Protestant	57834	46.4
Catholic	2630	2.1
Muslims	15247	12.2
Traditional	526	0.4
Others	1051	0.84
Total	124,607	100

(*Source: LWFED socio-economic profile, 2010/11).*

3.1.5.3. Economic Activities

The major economic activity that the population of the study district engaged in is agriculture. Thus crop production and animal rearing are collectively carried out as economic importance. In short, mixed- agriculture is the basic economy. The major crops grown in the area include Wheat, Barely, *Inset,* Field pea, Fababean and Potato. Cash crops such as *Chat* are also available in few parts of the Woreda. With regard to livestock production, Cattle, Small ruminants, and Equines are the major reared for different purposes such as power source, liquid asset, and means of transport (LWARD, 2009).

3.2. Research Methodology

3.2.1. Sampling Design, Sampling Procedures and Techniques

In order to draw valid inferences from the sample and to ascertain the degree of accuracy of the results, the sample needs to be drawn following the laws of probability. The appropriateness of a sample method thus depends on how it was successfully meet the study objectives.

3.2.2. Sampling Techniques

In order to generate the required sample units, the determination of sampling frame is essential. The basic sampling unit in this case was the farmers' household who derive their livelihood entirely from agricultural activities. Determining the size of the universe of the frame also requires demarcation of the boundary in which this survey was conducted reasonably with the available time and financial resources.

Lemo is one of Ten *Woreda's* that is found in Haddiya zone. Three *kebeles* namely: Belessa, Hayise and Kode were selected purposively, out of 35 based on severity of land degradation problem and land management practices intervention by local NGOs, namely Productive Safety Net Program (PSNP) in addition to government efforts to manage degraded lands. And based on agro-ecology, the district is both Dega(15%) and Woina-dega(85%) agro-ecology. Belessa from Dega and Hayise and Kode from Woina-dega agro-ecologies based on their proportion of *kebeles* in the woreda.

3.2.3. Sample Size Determination

Due to the limited resources and time at the disposal of the researcher, the total size of the sample would be 168 farm household heads (Table 3. 4). The sample size was determined using statistical procedures. The estimation of population proportion, p = 0.11 was used, as this value gives sample size sufficiently large to guarantee an accurate prediction, at 95% confidence interval and 5% error of estimation. The following formula was used to decide the sample size (Naing *et al.,* 2007).

$$\mathbf{n} = \frac{[\mathbf{p}(\mathbf{1}-\mathbf{p})\ \mathbf{z}^2]}{\mathbf{E}^2}$$

Where:-

n = sample size

z = level of confidence = 1.96 which means 95%

E = maximum allowable error = 0.05 which means 5%

P = estimate of population = 0.11

$$n = \frac{[0.11(1-0.11)\ 1.96^2]}{(0.05)^2}$$

$$n = \frac{[0.11(0.89)\ 3.8416]}{0.0025}$$

$$n = \frac{0.38}{0.0025}$$

n= 152

n= 152 household heads with contingency of 10% hence, the 10% of 152 is 15.2 and then the total sample size became 168.

The number of household heads were selected from each kebele was determined based on the proportion of household heads (population) in the representative kebeles. The household heads were selected by simple random sampling method. To determine sample size of each *kebele* proportionally, Kothari's, (2004), formula were implemented.

Table 3.4: Distribution of Sample Household Heads in Study Area

StudyArea Kebeles	Total Household Heads (Nh) Frequency	% Percentage	Sampled Household Heads (nh) Frequency
Belessa	469	30.6	51
Hayise	455	29	50
Kode	620	40.4	67
Total	N= 1544	100	n= 168

(*Source: Lemo Woreda Rural Development Office, 2014/2015).*

3.2.4. Data Sources and Instruments of Data Collection

Both primary and secondary data were generated by employing quantitative and qualitative methods. The quantitative methods involve the use of household survey while the qualitative methods used include: focus group discussion, key informant interview and direct personal observation.

- **Primary Data Collection**

✓ **Survey questionnaires**

Both close-ended and open-ended structured questionnaires were administered for 168 randomly selected households from the three kebeles. The questionnaires were prepared in English and translated to Amharic language in order to understand respondents the questions perfectly. For clear understanding of survey questions, enumerators were trained and orientation was given.

✓ **Focus Group Discussion**

Focus Group Discussions from each target kebele with 7/seven/ members per group were held with selected knowledgeable experienced farmers, local Development Agents, religious leaders and Lemo *woreda* administrators to know the awareness of the

community about land degradation and how the people of the study area manage the land, Comments, opinions and suggestions were compiled from different knowledgeable elders and natural resources management experts.

- ✓ **Field Observation**

Field observation was conducted in each selected three kebeles by the researcher, together with natural resource management experts, DAs and model farmers to observe severity of the land degradation, its effects on the local community and farmers' activities by the help of visual photographs and preparing of checklists.

- ✓ **Key Informants Interview**

The researcher was semi-structured interview checklists. The key informant interview were conducted from Development Agents, elders, model farmers, religious leaders and Woreda's Rural Development Office, the researcher interviewed 5(five) peoples from each sample kebele about the cause and consequence of land degradation as well as land management practices in the study area.

- ➢ **Secondary Data**

Secondary data such as socio-economic, demographic, climatic, soil management condition, land use pattern, etc were collected from governmental and non-governmental institutions. In addition to these, published books, journals, government official reports, related literatures and websites were employed.

3.2.5. Method of Data Analysis and Presentation

Statistical Package for Social Science (SPSS) version-20 software was employed to analyze data drawn from household survey. Descriptive statistics like mean, percentage, frequency distribution and inferential statistics i.e., Chi-square taste were used to analyze quantitative data. Qualitative data generated from key informant interview, focus group discussion and secondary sources were analyzed by narrative description or storytelling.

Chapter Four

4. General Characteristics of Sample Households

This chapter contains two major parts. The first part is devoted to socio-economic characteristics of the sample household heads while the second part assess land degradation problem of the study area. In the first part, emphasis is given to demographic and educational characteristics, landholding and farming system, livestock holding and land tenure security of the sample households. The second part deals with assessment of land degradation problems. Under this part, types of land degradation; soil erosion, deforestation, over grazing of range land, and gully formation, causes of land degradation; continued cultivation, population pressure, steep slope cultivation, limited use of conservation, overstocking, heavy rainfall and cutting tree for fuel and construction and consequence of land degradation, its impacts that affecting the livelihood of the local community are discussed.

4.1 Socio-economic characteristics

4.1.1. Demographic characteristics

4.1.1.1. Sex, age, marital status and family size

The sex ratio of the sample households selected in this study was proportional to the total population i.e., equal proportion of male and female sample households selected from the total male and female households in the study areas. As it is indicated in (Table 4.1) 89.1% of the respondents were male households and 10.9% were females.

Most of the land management practices require more labor force. Hence, male headed households are expected to better undertake different land management practices, as better endowed with labor. Women are often faced with more labor constraints than male farmers and male-headed households. Women also sometimes inhibited from making decisions about land management practices while their husbands are away (Benin, 2006). In addition, women are commonly busy in household activities and their prime responsibility is usually child rearing.

Age influences adoption decision since it influence the planning horizon of the farmer (Long, 2003). It was one of the demographic characteristics hypothesized to influence the retention decision of the farmers. Conservation measures such as terraces, soil bunds and fanyajuu need long term investments (Lee and Stewart, 1983). On the contrary, older farmer usually have short planning horizon (Gould, *et al*, 1989).

With regard to age structure of the respondents, as it is indicated in (Table 4.1) the majority (67.3%) of the respondents are between the age of 31 and 50 years old. About 4.2% of the respondents are below 30 years while 19.6% were between 51 and 60 years old and 8.9% were above 60 years old. And 72%, 60% and 68.7% of the respondents in Belessa, Hayise and Kode were the age in between 31 and 50 or adulthoods respectively. The mean age of the household is 45.5 years. That means on average the households are adulthood, positive implication in terms of availing and coordinating family labour. The maximum and minimum ages of the respondent are 24 and 95 years old respectively.

Considering the marital status of sampled households, 82.1% of the respondents were married. While 5.4% and 12.5% were unmarried and widowed respectively. There is no divorced household. In the study area, one can see the average size of the family. As it is indicated in (Table 4.1), the majority of the sample households have large family size. Of the total, 70.8% of the respondents have a family size of more than five. The largest family size is 19 the smallest is 2.The average family size is approximately 7. While considering sex composition of the household members, the average size males and females is 3.9 and 3.87 respectively. The statistical analysis indicates that there is no significant mean difference in terms of sex composition of household members among sample households. The household with a greater number of mouth to feed; competition arises for labor between food generating off-farm activities, like daily labor rather than investment in soil and water conservation (Bekele *et al*., 2009).

Table 4.1: Demographic characteristics of the sample households in the study areas.

Demographic characteristics of the respondents	**Study kebeles**						**Total**	
	Belessa		Hayise		Kode			
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Sex of SHHs								
Male	43	84.3	47	94	61	91.1	151	89.9
Female	8	15.7	3	6	6	8.9	17	10.1
Total	51	100	50	100	67	100	168	100
Age								
<30	1	1.96	-	-	6	9	7	4.2
31-40	16	31	4	8	27	43.3	47	28
41-50	21	41	26	52	19	28.4	66	39.3
51-60	10	19.6	13	26	10	15	33	19.6
>60	3	5.9	7	14	5	7.5	15	8.9
Total	51	100	50	100	67	100	168	100
Family size								
1-2	-	-	-	-	2	3	2	1.2
3-4	3	5.9	3	6	8	11.9	14	8.3
5-6	13	25.5	9	18	11	16.4	33	19.6
7-8	21	41.2	18	36	26	38.8	65	38.7
>9	14	27.5	20	40	20	29.9	54	32.1
Total	51	100	50	100	67	100	168	100

(*Source: Field survey, February, 2015).*

4.1.1.2. Educational Status

Educational status of a society, particularly literacy level is among the key factors determining development and growth (Todaro and Smith, 2009). Survey result indicates that; 32.7% of the sample household heads were illiterate. 25.6% of the respondents read write though they haven't attended any formal education. 20.2% attended grade 1-4. The number of people attended education is decreasing as the grade level increases. As it is indicated in (Table 4.2), the total percentage of sampled households attended grade 5-8, 9-10, and above 10 are 14.9%, 4.8% and 1.8% respectively. In this sense, included in the sample, the number of household heads that have no education and low level of education dominates the entire population and they responded that they were less in their practices of introduced soil and water conservation measures. This intern could have its own implication in relation to dissemination of new technologies of soil and water conservation practices that could be integrated with local practices.

Table 4.2: Educational Status of SHHs in the study areas.

Educational Status of SHHs	Study kebeles						Total	
	Belessa		Hayise		Kode			
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Illiterate	14	27.5	12	24	29	43.3	55	32.7
Read Write	11	21.6	17	34	15	22.4	43	25.6
1-4	13	25.5	10	20	11	16.4	34	20.2
5-8	8	15.7	7	14	10	14.9	25	14.9
9-10	4	7.8	3	6	1	1.5	8	4.8
>10	1	1.96	1	2	1	1.5	3	1.8
Total	51	100	50	100	67	100	168	100

(*Source: Field, Survey February, 2015).*

4.1.2. Land holding and Farming systems

4.1.2.1. Land Holding

Land is held privately except small communal grazing and forest lands. That means every piece of land, whether cultivated or not, belongs to a particular household. As it is indicated in (Table 4.3), all the respondents replied that they have their own farmland. However, there is a significant variation in the size of land holding among households. Of the sample households, the majority (70.5% in Belessa, 42% in Hayise and 77.9% in Kode) had land holding size of less than one hectare. About 15.7% of the respondents in Belessa, 34% in Hayise and 13.4% in Kode hold land between 1to 2 hectare and about 7.8%, 16% and 9% of the respondents in Belessa, Hayise and kode hold land between 2 to 3 hectare respectively. Only 4% in Hayise and 1.5% in Kode has more than 3 hectare. This indicates that there is acute shortage of land mainly in Belessa and Kode. This acute shortage of land deters farmers' ability to produce enough crops to feed their family throughout the year. The pattern is similar to the national level reality. According to CSA (1995), some 80% of the Ethiopian farmers in the highland (above 1500 meters) cultivate less than one hectare of farm land. Even worse, the number of households with small holdings will increase with time owing to the increasing rural population and limited land resources. Farmers with small land holding use higher discount rate compared to the

benefit of conservation treatment. This reduces the likelihood of adoption of soil and water strategies (Lee and Stewart, 1983).

4.1.2.2. Farming systems

The farmers are engaged in small scale mixed farming systems using simple farm implements and methods of production. Because of the rudimentary nature of farming they produce very small yields, and thus their farming is better described as subsistence.

Most of the household heads drive their livelihood from mixed farming (crop production and animal rearing). The numbers of respondents, (Table 4.3) who are engaging in mixed farming, are 86.3%. Insignificant number of the sampled household heads (2.4% crop production, 0.6% in animal rearing, 0.6% in petty trade and 10.1% in mixed and petty trade) is engaged in other activity for their livelihood.

Table 4.3: Land holding size & main occupation in the study areas.

Land holding size and main occupation of SHHs	**Study kebeles**						**Total**	
	Belessa		Hayise		Kode			
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Total size of farm land								
<1ha.	39	76.5	21	42	53	77.9	113	67.3
1-2ha.	8	15.7	17	34	9	13.4	34	20.2
2-3ha.	4	7.8	8	16	6	9	18	10.7
>3ha	-	-	2	4	1	1.5	3	1.8
Main occupation								
Crop production	3	5.9	-	-	1	1.5	4	2.4
Animal rearing	-	-	-	-	1	1.5	1	0.6
Mixed farming	43	84.3	45	90	57	84.1	145	86.3
Petty trade	-	-	1	2	-	-	1	0.6
Mixed & petty trade	5	9.8	4	8	8	11.9	17	10.1

Source: Field, Survey February, 2015.

The majority of the respondents (94% in Belessa, 98% in Hayise and 92.5% in kode) replied that they have no sufficient cultivated land to produce enough food production for the livelihoods of their family.

Likewise, those respondents who indicated in insufficiency of the land were asked whether they have an option of getting additional land. About 45.1% in Belessa, 40% in

Hayise and 37.3% in Kode *kebele* have no option for getting additional land. However, as the questionnaire survey result indicated 49%, 58% and 55.2% of the sample households have different options to get additional land in their respective kebeles. Accordingly, 39.2% of the respondents in Belessa share the land for cultivation with others who have relatively large land size and who have no farm implements to cultivate the land. The figure for Hayise is 54% and Kode is 38.8%. About 23.5% in Belessa, 20% in Hayise and 26.9% in Kode lease land from others for additional crop production. The rest of the respondents (9%) replied that we are forced to exert pressure on nearby on forest and grazing land to get additional land, which has great damage to the degradation of the natural environment. The way of having access to additional land by clearing forest and grazing land is small as compared to other means. This is mainly because there is no extensive land areas that are covered by forest and grazing land.

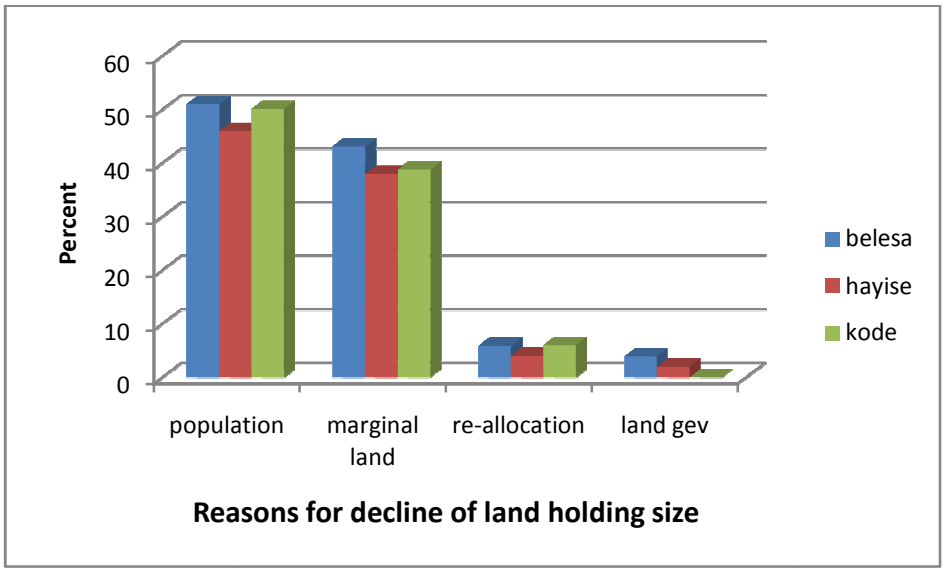
4.1.2.3. The trends of land holding size

Majority of the interviewed farmers (70.6% in Belessa, 60% in Hayise and 68.2% in Kode) replied that the size of the agricultural land was becoming smaller in the study communities. About 25.5% of the respondents in Belessa, 28% in Hayise and 30.3% in Kode reported that there is no change in the size of their farm land over time. However, only 3.9% of the respondent in Belessa, 12% in Hayise and 1.5% in Kode argued that the size of the land becoming increasing from time to time.

According to the survey result, as indicated in (Figure 4.1) majority of the respondents (51% in Belessa, 46% in Hayise and 50.1% in Kode) replied that decrease in land holdings was mainly attributed to increase in human population which results in sharing land to children (newly formed households) and 43.1% in Belessa, 38% in Hayise and 38.8% Kode replied that increase in marginal land use that leads to loss in quality, and (5.8%) by land redistribution and (1.8%) land taken away by government.

In addition to response obtained from household survey, the FGD participants have confirmed that the high population growth resulted in land fragmentation and decrease in land holding size over time. As they reported, due to absence of diversified economic system and lack of other means of acquiring land, now a day's sharing parents land become the most important way of accessing land for newly formed households.

Figure 4.1: Reasons for decline of land holding size



4.1.2.4. Constraints to crop production

Crop production is the major source of livelihoods of the local people. In the *Woreda* both annual and perennial crops are grown at different altitudinal zones. Types of crops grown are among the factors that affect land degradation. Because the type of crops grown affects the level of tillage, soil nutrient uptake or restoration and aggravate or minimize degradation. According to the information obtained from Lemo *woreda* agricultural and rural development offices, the types of crops grown in the area include Wheat, Teff, Barley, Bean, Pea, Chickpea, Sorghum, Maize, Fababean and potato.

However, there are multiple constraints to adequately grow crops. Accordingly, majority of the respondents (84.3% in Belessa, 72% in Hayise and 76.1% in Kode) replied that land shortage is the main constraints of crop production. And the respondents of (76.5% in Belessa, 66% in Hayise and 68.7% in Kode) and (56.9% in Belessa, 64% in Hayise and 79.1% in Kode) also replied that soil erosion and erratic rainfall is the main constraints of crop production respectively (Table 4.4). Significant number of the

respondents (15.5%, 44%, 25.6%, 23.8%, 19.6% and 25.6%) mentioned drought, lack of access to inputs, pest and disease, labour shortage, lack of market and access to credit where identified as main constraints of crop production respectively. Furthermore, FGD participants indicated that pest and disease where the main constraint of both annual and perennial crops production.

Table 4.4: Constraints of crop production of the sample HHs in the study areas.

Constraints of crop production	**Study kebeles**							
	Belessa		Hayise		Kode		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Erratic rainfall	29	56.9	32	64	53	79.1	114	67.9
Labour shortage	9	17.6	13	26	18	26.9	40	23.8
Lack of access to input	25	49	22	44	27	40.3	74	44
Drought	5	9.8	7	14	14	20.9	26	15.5
Land shortage	43	84.3	36	72	51	76.1	130	77.8
Soil erosion	39	76.5	33	66	46	68.7	118	70.2
Pest & disease	14	27.5	10	20	19	28.4	43	25.6
Lack of market	11	21.6	9	18	13	19.4	33	19.6
Access to credit	13	25.5	14	28	16	23.9	43	25.6

(Source: Filed survey, February, 2015).

4.1.3. Livestock Holding

Livestock is generally considered to be an asset that could be used either in the production process, or be exchanged for cash or other production asset. It is also considered as a measure of wealth and increased availability of capital to make feasible conservation investment (Norris and Batie, 1987 and Bekele, 1998).

Table 4.5 Shows the population size of the livestock in TLU.

Livestock in TLU	Frequency	%
0-1	4	2.4
1.1-1.9	9	5.4
2-2.9	27	16.1
3-3.9	46	27.4
>4	79	47
Total	165	98.2

(Source: Field survey; 2014).

Conversion factor used in to TLU was: ox/cow 1, Heifer 0.75, Calf 0.2, sheep and goats 0.13, horse 1.1, donkey 0.7 (Strack *et al*., 1991).

Survey result showed that average holding of livestock in the study area was 4.13TLU and total livestock of the sample households was 669.96TLU. The composition of livestock was that cattle accounted for 81.5%; sheep and goats 3% and horse, mules and donkeys 15.3%.

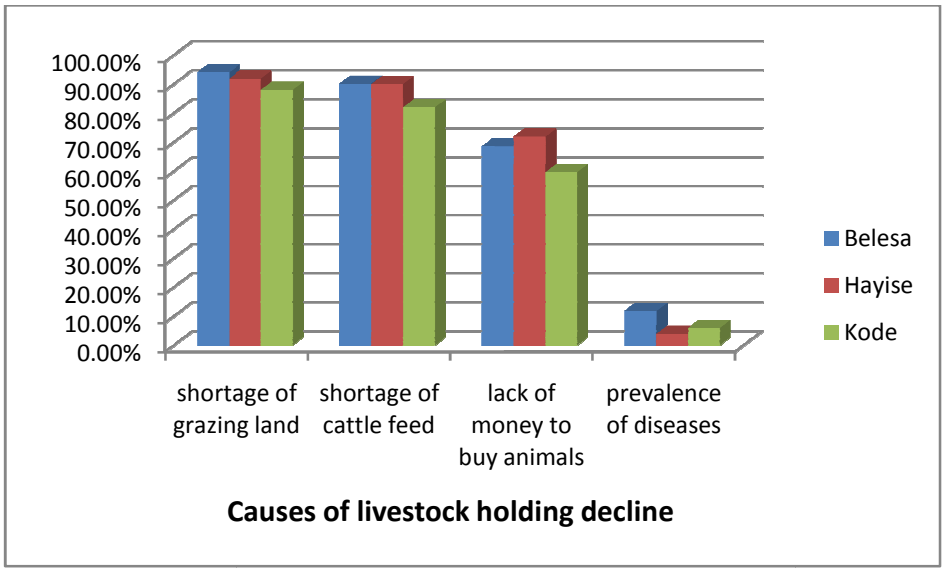
Almost all of the respondents (94% in Belessa, 100% in Hayise and 94% in Kode) have livestock's of different kinds. About 88.2%, 90% and 83.6% respondents in Belessa, Hayise and Kode respectively reported that livestock possession declined over time. Few respondents (5.9% in Belessa, 10% in Hayise and 9% in Kode) replied that number of livestock possession through time becomes increasing. However, only 1.5% in Kode confirmed that the livestock possession does not show any change.

4.1.3.1. Causes of livestock holding decline

Regarding livestock possession over time, respondents were also asked to give reasons for their livestock decline. As indicated in (Figure 4.2) 94.1% of the respondents in Belessa, 92% in Hayise, 88.1% in Kode, who claimed that livestock holding is decreasing, justified that shortage of grazing land and animal feed as major causes. About 68.6%, 72% and 59.7% of the respondents in the three respective kebeles justified that

lack of money to buy livestock are major causes for the decrease of livestock possession over time. The number of respondents who claimed the decreasing trend of livestock holding due to prevalence of diseases is 11.9%, 4% and 6% in Belessa, Hayise and Kode respectively. Moreover, FGDs participants and key informants indicated that there is a tendency of change in attitude among the society towards possessing small number of livestock population with better quality. Now a day's introduction of cattle with better quality rather than having large cattle population becomes a good practice.

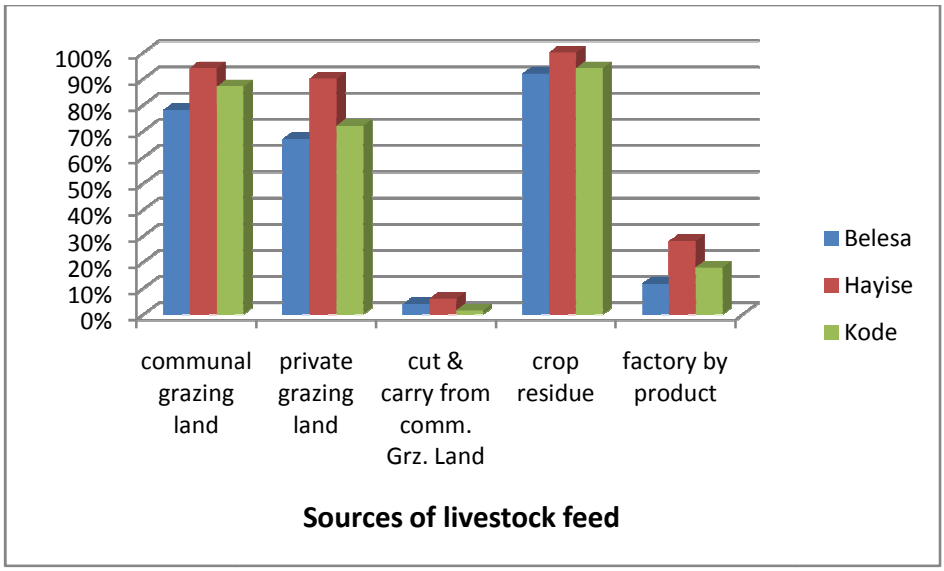
Figure 4.2: Causes of livestock holding decline



4.1.3.2. Sources of livestock feed

The respondents were asked to tell feed sources for their livestock. As indicated in (Figure 4.3) large number of respondents (92% in Belessa, 100% in Hayise and 94% in Kode respectively) use crop residue to feed their animals. About 78%, 94% and 87% of the respondents mentioned communal grazing land as a source of feed for their livestock while the percentage of respondents used their own land plot is 67%, 90% and 72% in Belessa, Hayise and Kode respectively. Only 3.9%, 6% and 1.5% of the respondents in Belessa, Hayise and Kode use cut and carry system from communal grazing land, marshy and hillside area respectively. About 11.8%, 28% and 17.9% of the respondents in Belessa, Hayise and Kode use industrial byproduct to feed their animals.

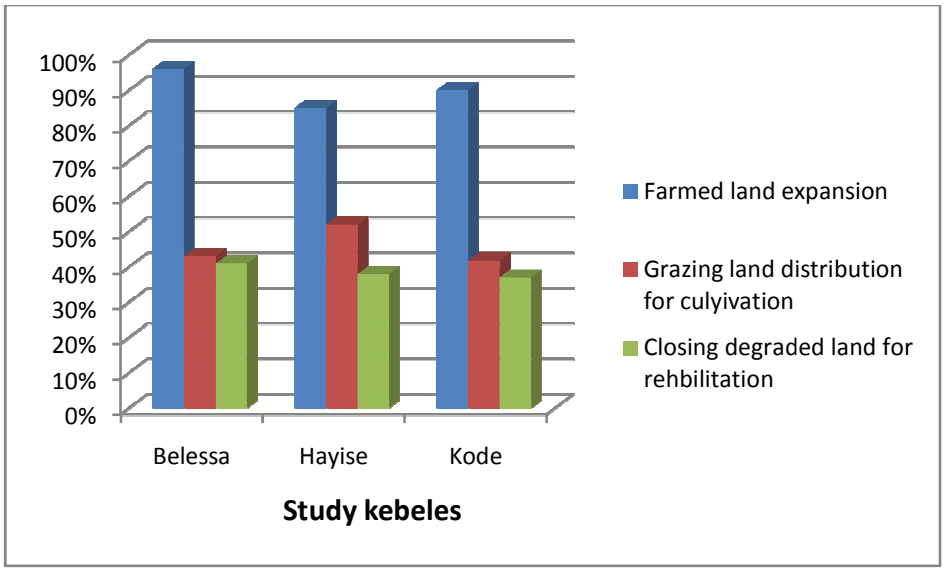
Figure 4.3: Sources of livestock feed



Almost all respondents (100% in Belessa, 98% in Hayise and 100% in Kode) argued that the size of gazing land had decreased over time. Only 2% in Hayise replied that the size of grazing land no change over time. As indicated in (Figure 4.4) respondents were also asked to give reasons for decreasing trend of grazing land size over time. About 96% of the respondents in Belessa replied that expansion of farm land is the major reason for shrinking of grazing land. The figure of the response for Hayise and Kode were 85% and 90% respectively. This indicates that the farm land expansion towards marginal forest area is the main problem in Belessa and Kode than Hayise *kebeles.*

About 41%, 38% and 37% of the respondents attributed to the distribution of grazing lands for cultivation purpose among peoples. Enclosure of degraded areas for rehabilitation purposes is also another reason for decreasing trend in grazing land.

Figure 4.4: Causes for decline of grazing land



And most of the respondents agreed that cattle were the major cause for destruction of conservation structures in the study area. This is because after the harvest of the crop most of the farmers left their livestock on the farm. The overall characteristics of the livestock feed sources and grazing land condition favor land degradation.

4.1.4. Land Tenure Security

Land tenure security has been shown to be an important factor affecting subsistence farmers' decisions to practice or not soil and water conservation measures. The general agreement is that the land users must have secured property ownership land right they cultivate to invest in SWC works in anticipation of long term benefits. In a situation where the farmers are not certain to capture the benefits of investment in soil and water conservation on their lands; they will not be willing to devote much effort to practice soil and water conservation structures. In other words, secure land ownership increases the sense of responsibility and lengthens the farmers planning horizon. Thus, they will be more concerned about the proper use and management of the land resources.

In Ethiopia, land has been under the state control since 1975 land reform. The land user (farmer) has been given only usufruct right, it is believed that this property ownership

regime has been source of insecurity for the farmers to invest on their small plots of land for long term benefits. Studies in different parts of the country have tried to show empirically that land tenure insecurity significantly influences farmers' decisions in land management practices (Kebede, 1989 *et al*.,).

Regarding the land tenure security system, questions were raised to FGDs participants and key informants. Most of the contacted groups revealed that the current land tenure system is better to them than the past regime. They stated various reasons for supporting the current land tenure which include, easy access to land through share cropping and renting; more tenure security than before due to land certification. One of the group members in Hayise says land certification is important to solve farmers, when they disagree on their plots with common boundary farmers. This discussion asserted that there is no severe problem of land tenure insecurity which affects farmers' long term investment on their land to conserve it from further degradation.

4.2. Assessment of Land Degradation

4.2.1. Types of land degradation

Land is the most important resource for agricultural activity, particularly when agricultural production system is traditional and subsistence. It is very scarce and is getting scarcer over time since the population size is increasing.

Inappropriate land use management practices; for example, steep slopes may be cultivated by landless poor people to produce their food (FAO, 1994). The main cause of land degradation in Ethiopia is soil erosion. The erosion in Ethiopian highlands, amounting to nearly one billion tons of soil lost each year is due to natural causes exacerbated by human activities, particularly overgrazing, over cultivation and deforestation. In addition, (Yohannes, 1999) reported that many environmentalists, policy makers and researchers agree that land degradation mainly caused by soil erosion has been one of the chronic problems in Ethiopia.

Land degradation is high in the study area. Almost all of the respondents (98.2%) show agreement regarding land degradation problem in the study kebeles. As indicated in

(Table 4.6), the common types of land degradation are soil erosion, deforestation, over grazing and gully formation.

About 91.7% and 87.5% of the respondents replied soil erosion and over grazing of the range lands as the main form of land degradation in their locality. 54.8% and 28.6% of the respondents attributed to deforestation and gully formation as the second main forms of land degradation respectively.

Table 4.6: Types of land degradation in the study areas.

Types of land degradation	**Study kebeles**							
	Belessa		Hayise		Kode		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Soil erosion	47	92.2	46	92	54	80.6	147	87.5
Deforestation	32	62.7	24	48	36	53.7	92	54.8
Overgrazing of range land	48	94.1	49	98	57	85	154	91.7
Gully formation	14	27.5	12	24	22	33	48	28.6

(Source: Field survey, February, 2015).

Respondents were also requested to identify erosion types in their farm land. Accordingly, 51%, 58% and 49.3% of the respondents in the three *kebeles* reported that rill erosion is the common type of soil erosion in their farm land followed by sheet erosion which has got attention by 45.1%, 42%, and 40.3% of the respondents. Gully erosion is the least one that only 18.5% of the respondents replied as the main form of water erosion in their farm land. Considerable number of the respondents (28.6%) agreed that all form of erosion is common in their respective farm land (Table 4.7).

Similarly, owing to the steep nature of the landscape, FGD participants and professionals fully agreed on the problem of land degradation. Occurrence of erosion is usually depicted without noticing in the farm land and gradually forms small rills and accumulation of silt on the grass or road side after rain. Consequently, the water ways

(rills) are becoming big gullies expanding year after year, to the stage of uncontrolled erosion pattern (Figure 4. 5, 4. 6 and 4.7). Seasonality and torrential rainfall pattern is among the major causes of land degradation.

Table 4.7: The main forms of erosion in the study areas.

Main form of erosion in cultivated land	**Study kebeles**							
	Belessa		Hayise		Kode		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Sheet erosion	23	45.1	21	42	27	40.3	71	42.3
Rill erosion	26	51	29	58	33	49.3	88	52.4
Gully erosion	10	19.6	8	16	13	19.4	31	18.5
All forms of erosion	17	33.3	11	22	20	29.9	48	28.6

Source: Field Survey, February, 2015.

Figure 4.5: Degraded land in Kode *kebele* (photo *by the researcher, February, 2015).*

Figure 4. 6: Gully rehabilitation by structural methods in Belessa kebele *(Photo by the researcher, February, 2015).*

Figure 4.7: Gully formation in Hayise kebele *(photo by the researcher; February, 2015)*

4.2.2. Causes and consequences of land degradation in the study area

There are different factors contributing for occurrence of land degradation. The findings of household survey indicated that continued cultivation, population pressure, steep slope cultivation, limited use of conservation, overstocking, heavy rainfall and cutting tree for fuel and construction are the major immediate and underlying causes of land degradation in their order of importance. According, to the information obtained from Lemo *woreda* ARDO and field observation, more than 70% of the land scape is hilly and mountainous; hence farmers are commonly forced to plough very steep slopes.

Table 4.8: The immediate and underlying causes of land degradation of the sample households in the study areas (multiple response is possible).

The causes of land degradation	Study kebeles							
	Belessa		Hayise		Kode		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Overstocking	29	56.9	20	40	18	26.9	67	39.9
Cutting tree for fuel & construction	17	33.3	16	32	19	28.4	52	31
Ploughing steep slopes	31	60.8	28	56	40	59.7	99	59
Limited use of conservation	20	39.2	27	54	30	44.8	77	45.8
Continued cultivation	38	74.5	36	72	49	73.1	123	73.2
Excessive rainfall	23	45.1	20	40	14	20.9	57	33.9
Population pressure	35	68.6	30	60	48	71.6	113	67.3

Source: Field survey, February, 2015.

Respondents were also asked to indicate the immediate and underlying causes of land degradation. Accordingly, 74.5%, 72% and 73.1% of the respondents in Belessa, Hayise and Kode have attributed to continued cultivation as the main causes for land degradation followed by population pressure which account for 68.6%, in Belessa, 60% in Hayise, and 71.6% in Kode respectively. About 59% and 33.9% of the respondents in the three *kebeles* confirmed that steep topography and heavy rainfall are the main causes of land degradation. According to the findings from the FGD in Belessa and Hayise, population growth is a triggering factor which initiates other causes of land degradation. Population pressure resulted in deforestation, expansion of farming to marginal areas and grazing land (Figure 4. 8 and 4. 9).

Figure 4. 8: Expansion of farm land down to River Gudera in Hayise and Kode *kebele (Photo by the researcher, February, 2015).*

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Figure 4. 9: Cultivation of marginal land in Hayise *kebele* (*Photo by the researcher, February, 2015***).**

In addition, they further mentioned that the attention of concerned government officials to take immediate action is less when people encroached into enclosed area in searching cultivated land and grazing area which contributes to the problem of land degradation.

Regarding the impact of land degradation the average soil loss rate for the whole country was predicated to be 12 tons per annum while the absolute total yearly, loss

was estimated at 1.5 billion tons (Muluneh, 2000). Soil erosion in 1990 has cost the nation an annual loss of grain production estimated at about 40,000 tons. The permanent in values of the country's soil resources caused by erosion in 1990 was estimated to be Birr 59 million (EPA, 1997).The Amhara RCS indicates that soil erosion is greatest on arable land, and the average annual soil loss is estimated total of about 1.1 billion tons per year. The situation is pretty much the same (Gedion, 2005).

Participants of FGDs and key informants from the three kebeles expressed that land degradation is seriously affecting the livelihood of the local community. Due to land degradation problem, the agricultural lands currently used for cultivation requires the application of more chemical fertilizers over time. And application of chemical fertilizer through time affects the organic phosphate in the soil. Unless, it is difficult to obtain yield and such degraded lands remains out of use.

Climate change is observed in the study area. All contacted groups revealed that there is change in climate condition over time. The agro-climatic zone which is observed in recent past was mostly Dega and Woina-Dega type. But now Woina-Dega climate zones as well as kolla are well observed. This indicated that land degradation affects the climate condition in the long run i.e., decreases the rainfall in amount from year to year (rainfall variability) seen in the study areas. And due to these loss of plants and animals life in the study areas. Almost all of the respondents (100%, 100% and 98.5%) in Belessa, Hayise and Kode respectively replied that it is possible to minimize land degradation. Only 1(1.5%) of the respondent in Kode kebele prefer uncertainty regarding the possibility to minimize the problem of land degradation.

Survey respondents were also requested to express the reasons for their responses. Accordingly, those respondents who confirmed that land degradation can be minimized, asserted that if there is cooperation between and/among government and the community members, it is possible to minimize land degradation. According to them different actions were proposed and implemented to minimize land degradation. Among these actions, construction of physical conservation structures was given more attention. These conservation structures include construction of check dam, terrace and ditch, cut-off drains and contour ploughing. Moreover, the importance of awareness creation among

community members were considered important means to halt land degradation. Respondents stressed the supreme importance of government effort in land management practices with the involvement of the society as a whole through awareness raising activities.

Most of the key informants and FGD participants of the three kebeles asserted that in the study woreda adequate attention has been given by the government towards the problem of land degradation. The presence of MERET donor-government joint project in the study woreda and government initiative of land resource management through public mass mobilization practices different activities on Sustainable Land Management on the watersheds of the study areas. Now a day the issue of natural resource degradation has got the attention of many stake holders. They further noted, land is the basic resources for the local community and the country as well; and unless there is strong effort from the government and community to curb the existing trend of degradation, the result would be disastrous or even irreversible.

CHAPTR FIVE

5. The responses of the local community to land degradation

In this chapter effort has been made to discuss the problem of land degradation and factors affects land management practices. The first section of the chapter deals with different land resource management practices. Under this, soil fertility improvement practices, soil and water conservation practices and trend of land management practices over time have been discussed. The second section gives due attention to socio-economic and institutional factors that affect the management practices of land resources.

5.1. Land Management Practices in Lemo Woreda

The current pressure on land is already recognized and land degradation is one of the various problems of the local people. By considering the exesisting land degradation problem, different land management and rehabilitation measures by the concerned stockholders as clearly discussed here under:

5.1.1. Soil fertility improvement practices

Individual farmer practices different land management activities mainly to increase agricultural yields and to conserve the natural environment on their farming plot. They practice both the short and long benefit oriented soil fertility management. For short term effect, farmers apply chemical fertilizer to obtain high agricultural yield. As indicated in (Table 5.1) inorganic chemical fertilizer application a prerequisite as many parts of the country is commonly experienced due to soil fertility loss by erosion.

According to survey results, (71.4%, 74% and 76.1% of the respondents in Belessa, Hayise and Kode kebeles respectively) practice crop rotation as one of the most important methods of improving soil fertility and soil conservation method on cultivated fields. It is a method through which nutrient content of the soil is improved by interchangeably cultivating different crops on the same plot of land. This method again becomes more important when leguminous crops are part of the rotation system to improve the nitrate content of the soil. According to the information obtained from FGDs

and key informants, this system is one of the widely practiced soil fertility improvement system. The rotation system mostly consists cultivation of cereals (wheat, barley, teff, maize and sorghum), legumes (mainly beans and pea), and root crops (potatoes) in the farm plot at different seasons and years.

Manure is an important input of promoting the fertility status of the soil. Its application to farm land raises soil nutrient level, increasing rate of infiltration and reduces soil erosion. About 39.2%, 44% and 35.8% of the respondents in Belessa, Hayise and kode *kebeles* respectively use manure to improve soil fertility. However, recently, manure application on farm lands has been decreasing from time to time. This is mainly due to the significant decline of the number of livestock per household. The FGD participants indicated that fragmentation of farming plots has confined the use of manure only around the homestead area than the distance farming plot. In addition, the use of cattle dung as source of fuel for cooking is another contributing factor for low application of manure for soil fertility improvement practice.

As the survey result confirmed only 13.7%, 20% and 11.9% of the respondents used fallowing to improve soil fertility in Belessa, Hayise and Kode *kebeles* respectively.

Table 5.1: Main land management practices and soil fertility improvements in the study areas.

Number of sample respondents who practice land management in the study areas	**Study kebeles**						**Total**	
	Belessa		Hayise		Kode			
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Yes	51	100	50	100	67	100	168	100
No	-	-	-	-	-	-	-	-
Main land management practice in the study areas								
Closure of grazing land	32	62.7	36	72	38	56.7	106	63.1
Mixed cropping	9	17.6	4	8	14	20.9	27	16.1
Making water way	18	35.3	15	30	21	31	54	32
Mulching	6	11.8	4	8	10	14.9	20	11.9
Tree planting	16	31.4	18	36	20	29.9	54	32.1
Rotation grazing	7	13.7	11	22	16	23.9	34	20.2
Soil fertility improvement of the farm lands								
Chemical fertilizer	51	100	49	98	66	98.5	166	98.8
Crop rotation	32	63	37	74	51	76.1	120	71.4
Manuring	20	39.2	22	44	24	35.8	66	39.3
Fallowing	7	13.7	10	20	8	11.9	25	14.9

Source: Field survey, February, 2015.

5.1.2. Soil and Water Conservation Practices

As many parts of Ethiopian highlands, farmers have a pool of indigenous knowledge with which they use and manage their land resources. They make efforts to conserve their soils against erosion by applying a range of conservation techniques.

Among soil and water conservation measures, which is widely used by farmers, in almost all households, is contour ploughing. 88.2%, 86% and 76.1% of the respondents in Belessa, Hayise and Kode respectively confirmed that they manage soil from erosion through contour ploughing. To establish the structure, the farm plots are ploughed horizontally:- following the contours so that those contour furrows are created with the help of traditional iron plough. As it was discussed with the *woreda* expert; the furrows that are formed along contours help to hold the water until it infiltrates into the soil and then in to the ground. Hence, it reduces the erosive effects of surface run off on farming plots.

Traditional ditches are extensively practiced to conserve soil and water in the area. According to survey result, about 67%, 64% and 57% in Belessa, Hayise and Kode respectively practice traditional ditches in most of their farm plots. Homestead areas are less affected by erosion because the permanent *enset* cultivation in homestead farm plots.

Findings from the survey respondents indicated that, hill side terracing and check-dams were among the most frequently used physical structures for soil and water conservation. However, it was noted from FGD participants and key informants that the terracing and check-dams were poor quality. As a result they serve only for a short period of time, until they face a heavy rain fall. Moreover, the potential positive impact of conservation attempts had also been reversed by the simultaneous devastating act of the farmers themselves for cultivation and uncontrolled animals grazing. Grass strip, stone bounds and fanya juu (in some cases) are used as another technique for soil and water conservation practices.

In the view of FGDs and key informants, biological treatment of soil and water conservation activities are being practiced in combination with the physical soil and water conservation structures. The practice was introduced to the area recently by

government and NGOs i.e. Productive Safety Net Program. According to the information obtained through observation made by the researcher, multi-purpose trees and shrubs, legumes and grasses are some of the biological methods used to conserve the land from erosion. The treatment of the land takes place in comprehensive way in all land use types such as in cultivated lands, grazing lands, forest areas and marginal lands.

Table 5. 2: Soil and water conservation practice in the study areas.

SWC practices	**Study kebeles**						**Total**	
	Belessa		Hayise		Kode			
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Contour ploughing	45	88.2	43	86	51	76.1	139	82.7
Stone bunds	11	21.6	10	20	16	23.9	37	22
Soil bunds	17	33.3	20	40	22	32.8	59	35.1
Fanyajuu	10	19.6	13	26	16	23.9	39	23.2
Terraces	38	74.5	36	72	45	69	119	71
Ditches	34	67	32	64	38	57	104	62
Grass strips	6	11.8	7	14	4	6	17	10.1

(Source: Field survey, February, 2015).

5.1.3. Gully Rehabilitation Practices

Gullies which were intermittent stream channels longer than rills are created by concentrated run off flow from the surrounding sloping land. Usually, gullies follow sheet erosion or from neglect of rills. Most of the reasons behind gully formation include deforestation, cultivation of steep slopes, lack of fallow, less vegetative cover, overgrazing and insufficient soil conservation measures.

According to the key informants and survey respondents, most of the aforementioned factors behind gully formation are testified to be existent and to be the major causes of

land degradation. In order to curb gullies, cut off drains was widely constructed along water way to control runoff. This eventually helps to reduce erosion in steep slope areas. Check dams and planting trees and grasses along water ways are additional gully rehabilitation practices (Table 5. 3).

Table 5.3: Methods of gully rehabilitation practice in the study areas.

Methods of gully treatment	**Study kebeles**						**Total**	
	Belessa		Hayise		Kode			
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Check dams	38	74.5	36	72	45	69	119	71
Cut-off drains	34	67	32	64	38	57	104	62
Planting trees legumes grasses	6	11.8	7	14	4	6	17	10.1

(Source: Field survey, February, 2015).

5.1.4. Agro-forestry practices to stabilize the structural measures

Agro-forestry is the practice of planting and management of trees/ shrubs in crop land/ pasture land to get both the economic and/ or ecological benefits. In agro-forestry systems, the tree or shrubs can be grown with crops at the same time and in the same field or in the same field at different times. Trees help to preserve the fertility of the soil through the return of organic matter and the fixation of nitrogen. They improve the soil's structure and help to maintain high infiltration rates and greater water holding capacity. As a result less runoff is generated and erosion is better controlled. Trees are also attractive to the farmer where they provide additional needs; especially fuel, fodder and fruits multipurpose trees and shrubs are thus fundamental to agro-forestry (Morgan, 1995).

For instance maize and chat can be cultivated in combination with potato, pepper, Fababean and cabbage. According to the observation made the agro-forestry practice was designed to involve planting of shrubs and trees along soil and water conservation structures, mainly to establish bunds. Edible fruits like apple; and suspania and lucinia lucosophala, which can be used for forage purpose; are used to protect soil from erosion.

Planting trees and shrubs of multi-purpose species on the soil bunds were a component of community based natural resource management activities. To practice agro-forestry and afforestation farmers establish nursery.

In addition to soil and water conservation and soil fertility maintenance, the seedling produced at the nursery were also meant for meeting the fuel and construction wood demand of the population and production of animal fodder.

Figure 5.1: Agro-forestry practices in Hayise kebele (Photo by researcher, February, 2015).

Figure 5.2: Agro-forestry practices in Belessa kebele (Photo by researcher, February, 2015).

5.1.5. Trend in land management practices

Respondents were asked to express the trend of land management practices in their localities overtime. Most of the respondents (74.4%) replied that land management practice in their village has been increasing from time to time. This indicates that the increasing awareness of community about the negative impact of land degradation. Those who (22.6%) replied the land management practice; had 'declined' over time justified for the pressure of the people and lack of alternative means of livelihoods for their existence rather than neglecting the degradation problem and consequence.

FGDs and key informants from Lemo *Woreda* ARDO expressed that trend in land management practice among the community members is increasing over time. According to them most of the people are willing to practice soil and water conservation activities either on their own farm land or together with neighbors on community land at village level. Before this time, most of the people were reluctant to cooperate and even they seek other benefits for the construction of physical structures on their farm land. But now, despite some, they are practicing these structural conservation measures and even support the act of closing degraded areas from the reach of people and other animals.

5.2. Socio-Economic and Institutional factors affecting land management practices

5.2.1. Increasing in size of population

Population growth is important factors, which determine the management of degraded areas. The increase in size of the population can influence land management practices either positively or negatively depending on the issue whether it has led to intensive or extensive agricultural practices.

As it can be understood that, 87% of the respondents replied that 'increase' in size of population in an area result decrease in the involvement of the society on land

management practices. While, 13% of the respondents indicated that with the increase in population size, the involvement of their community in land management practices increases. Respondents were also asked to give reasons for their reply. Accordingly, most farmers who replied, that there is 'decrease' in land management practices as population size increase in a given area, it exerts great pressure on land resources and hence no room for land management practices. As the participants of FGDs in the three kebeles indicated, the increase in human population results: no fallowing, expansion of cultivation to marginal forest and grazing land and extremely hilly nature of the terrain, increasing demand on forest and forest products.

The above discussion indicated that as human population size in a given geographic area increases it exerts a great pressure on available natural resource and hence affects land management practices negatively.

Those respondents who replied 'increasing' have also given their reasons. Most of them replied that as human population size increases labour supply also increase and due to this population increases positively influence the involvement in land management practices. The statistical analysis indicates that $x^2 = 23.329\ and\ p = 0.03$. The result indicates that there is significant association between population increase and land management practices

5.2.2. Motive of family members to practices in land management

Regarding the involvement and the support of the household members to land management practices, 64.7%, 72% and 65.7% of sampled household heads in Belessa, Hayise and Kode confirmed that their family members were willing to participate in any natural resource conservation activities. While considerable number of respondents i.e., 35.3%, 28% and 34.3% in Belessa, Hayise and Kode respectively replied there family members had no motivation to involve in land management practices. This is mainly due to declining trend of land productivity and involvement of the household members in off-farm activities. The statistical analysis indicates that $x^2 = 28.22\ and\ p = 0.000$. The

result indicates that there is a significant relationship between motive of family members and land management practices.

5.2.3. Cooperation of neighborhoods in land management practices

Regarding the cooperation of neighbors in land management practices; 68.6%, 76% and 65.7% of the respondents in Belessa, Hayise and Kode indicated as they cooperate among themselves to manage degraded areas such as farm plots and community lands. 29.4%, 22% and 31.3% of the respondents in Belessa, Hayise and Kode respectively did not cooperate to perform any land management practices were the following reasons:

- People give more attention for short term benefits than working for long term benefits
- The deterioration of the social tradition cooperation (in some cases). This is due to the fact that many people are trying to focus on their personal gains than social benefits.
- Where ever the productivity of land decreases, people are inclined toward off-farm activities and this in turn discourages the need for assistance from other households.

However, those respondents who indicated that the assistance gained from

other households had increased mentioned the reasons as follow:

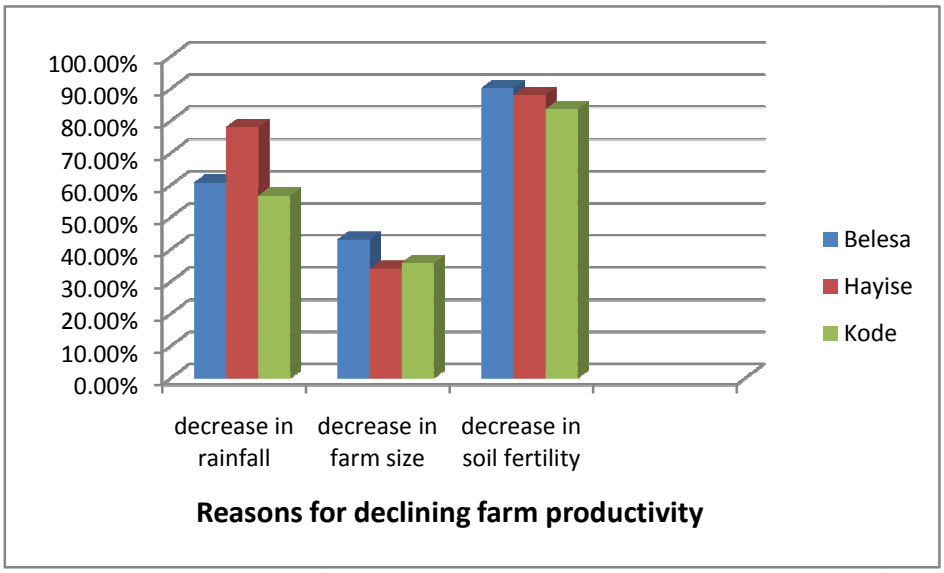
- Increase in the level of awareness among some communities to minimize problems of land degradation in cooperated manner than performing at individual level.
- A need to win challenges of life in common.

All contacted groups i.e., sample household heads, FGDs and key informants argue that there is an increase in awareness among communities regarding the problem of land degradation. As a result, there are extensive efforts made by all stakeholders to conserve natural resources and to perform land management practices. The statistical analysis indicates that $x^2 = 4.392\ and\ p = 0.734$. The result indicates that there is no significant association between cooperation of neighborhoods and land management practices.

5.2.4. Productivity of the farm land

The productivity of cultivable land can facilitate or deter the involvement of households in land management practices. The majority of the respondents (87.5%) replied that the productivity of their farmland is decreasing over time. As indicated in (Figure 5.3) this was due to decrease in soil fertility (86.9%), erratic rainfall (64.3%) and farm land fragmentation and decrease in its size (37.5%) stands 1st to 3rd in rank for the declining of farm productivity. Only 10.7% and 1.8% of the respondents agreed that the productivity of land increased and never show changes respectively. The participants of FGDs mentioned that decrease in rainfall and its irregularity and farm land size brought about by the population pressure are the two serious causes for the declining of productivity of farm lands over time. Those respondents who replied the productivity of land as increasing gave different reasons. Accordingly, better land management, benefit from agricultural technologies and uses of inorganic fertilizers are the major reasons for the increment of output of cultivated land over time. The key informants of DAs and FGDs the three study kebeles confirmed that land resource of this area is productive if it is well handled. In addition, they raised some examples of farmers who obtained high yield in the past three years due to their efforts to maintain the soil resource of their land. As it can be understood from the above discussion, the combined effect of a number of factors such as soil fertility decline, erratic rainfall condition and decrease in farm land due to population growth the major obstacles for the production of enough crops to the society and intern this has led to the decrease in the investment made by the farmers in relation to land management practices. The sample respondents that the decreasing farm productivity responded that they involve in off-farm activities to earn their income. Chi-square analysis shows that $x^2 = 26.365\ and\ p = 0.000$. the result indicates that a significant relationship between farm productivity of the sample households and land management practices.

Figure 5.3: Reasons for decreasing farm productivity



5.2.5. Involvement in off-farm activity

Involvement in off-farm activities has its own effects on land management practices. As poor farmers generally hold small land, they are more often engaged in off-farm activities such as petty trade. This can decrease their interest to invest on soil conservation activities (Ludi, 2004). 56.5% of the respondents replied that some members of their family are involved in off-farm activities, while 43.5% of the respondents replied that none of their family members has involved in this activities. These respondents, who are involved in off-farm activities, were asked to indicate the type of activities they are involved. Accordingly, 35.3%, 28% and 43.3% of the respondents' family members were engaged in petty trade in Belessa, Hayise and Kode *kebeles* respectively, while 17.6%, 36% and 9% were laborers in their respective *kebeles*. About 19.6%, 10% and 7.5% of the respondents' household members in Belessa, Hayise and Kode were engaged in government employment respectively.

The sampled households who are involved in off-farm activities were asked if the activities have any influence on land management practices. Accordingly, 40.5% respondents of those whose family members involved in off-farm activities replied that such activities either positively or negatively influence their involvement in land

management practices in their locality. 16% of the respondents indicated that these activities do not have any impact up on their involvement in any land management practices.

Respondents were also asked to indicate the reasons for their reply. Those respondents who confirmed the influence of off-farm activities on land management practices indicated that if family members spend time outside their farm activity, they cannot consider/ recognize any land degradation problems and hence gave no attention to land management practices. In addition, they cannot contribute labor supply for any land management practices in their community. In contrary, those who replied that off-farm activities have positive influence on land management practice pointed out that the following:

- Involvement in off-farm activities reduces a pressure exerted by all family members on land resource for their livelihood.
- May invest the income they earn outside their farm land on soil and water conservation practices, for instance, by buying and planting some fruits and vegetables and by employing laborers and by buying farm inputs (fertilizers).

Chi-square analysis shows that $x^2 = 31.905\ and\ p = 0.000$. The result indicates that a significant relationship between the influence of off-farm activities of the sample households and land management practices.

5.2.6. Access to extension services in improving land management practices

Any new agricultural practices in particular area need adequate mechanism in diffusing information. Lack of relevant and timely information can prevent a wide spread practices of natural resource conservation activities. Access to extension services helps farmers to gain better understanding of the potential effects of soil erosion and benefits of soil and water conservation practices as well as enhancing knowledge on the application of soil and water conservation technologies.

The respondents were asked whether they have access to any extension services related to land management practices. Accordingly, 88.1% of the respondents replied that they have access to extension services that promote land management practices. Significant number of respondents (11.9%) reported that they have no any access to extension services related to land management practices.

Those respondents who have access to extension services were asked whether they implemented it on their land or not. Accordingly, 84.3%, 72% and 74.2% respondents in Belessa, Hayise and Kode replied that they implemented soil and water conservation structures on their farm land. The services they got as a result of extension programs include: technical advice on the utilization of chemical fertilizer, improved seed and pesticides, better farming methods and soil and water conservation practices (terraces and check-dam construction, water harvesting and compost preparation). In contrary, to this during house hold survey some respondents replied that access to extension service for only model and rich farmers and some respondents replied that most of the time they advise on agricultural inputs than conservation measures. However, as they reported, the services were not enough to effectively minimize or halt natural resource degradation as compared to the magnitude of the problem.

The source of information for the respondents to carry out land management practices. According to the survey report, DAs (88.7%) are the major source of information for land management followed by traditional (their own experience) (56%) by which farmers used to carry out soil and water conservation practices. About 41.7%, 22.6% and 7.7% respondents indicated that people in the neighborhood, NGO's and mass-media respectively are source of information for land management practices in their own and communal lands.

Regarding the work of DA's as source of information, FGD participant said that the number of DA's working in a *kebele* is three and these helped them to reach the society easily to give timely advice and technical support for SWC practices. Chi-square analysis shows that $x^2 = 24.591\ and\ p = 0.001$. The result indicates that a significant relationship between extension service of the sample households and land management practices.

5. 2. 7. Efforts of concerned government agents and NGO in managing degraded land

Land management practices as issues of special concern, are within the limit of Lemo *woreda* ARDO. Due to increase in human population pressure, terrain nature of land, over cultivation, deforestation and irregular rain fall pattern, the agricultural production has been decreasing over time. In order to increase farm productivity and to conserve the resource base of the *woreda*, different physical soil and water conservation measures, soil fertility improvement, a forestation and agro-forestry practices are designed and are underway.

By NGO- MERET project and PSNP the establishment of nursery and seedling production, plantation and distribution among society. In addition, distribution of fruits and coffee seedlings in order to introduce agro-forestry practice is part of the activities. Moreover, soil and water conservation structures are practiced on individual lands to minimize soil loss and to increase productivity of farm land. With the involvement of the society and government cooperation extremely degraded areas to protect from encroachment of livestock.

A total of 4,475hectare of land has been planned to be treated with area closure over the 5 years' period. About 19,645km of terracing, 565km of check dams, 21,421km of diversion canals, 201,600trench, 220,300 micro-basins, 2,380 percolation ponds, 58,425meter cube compost preparation, 65.876(in million) seedling and tree planting, 0.6(in million) agro-forestry and 2,129 desho grass planting were designed to be treated in the five years plan. According to the planning, maintenance of the physical conservation measures has been carried out every year. The task of constructing the physical measures and production of seedling plantation were equally divided among the 5 years.

According to the report indicated in (Table 5.4), about 1,562km area closure and 6,324km terracing was done in the first two years of the plan.

Table 5.4: The five years plan (2003–2007E.C) for area closure, construction physical soil and water conservation, soil fertility improvement, afforestation and Agro-forestry components.

Activities and plan		**Unit**	**Achievement in the first two years**	
Activities	Plan	Unit	2003	2004
Area closure	4,475	hec.	742	820
Terracing	19,645	Km.	2,904	3,420
Check-dam	565	Km.	87	93
Diversion canals	21,421	Km.	747	842
Trench	201,600	No.	123,335	61,054
Micro-basins	220,300	No.	5,500	52,317
Percolation ponds	2,380	No.	460	502
Compost preparation	58,425	Meter cu.	12,520	15037
Seedling and tree planting	65.876	In million	5.7	3.315
Agro-forestry tree planting	0.6	In million	6.4	8.2 8.2
Desho grass planting	2,129	No.	240	256

(Source: Lemo woreda ARDO 2015).

As it is indicated in (Table 5.4), none of the plans has been accomplished in its actual implementation schedule. This indicates that there are challenges that encountered land management practices in the study *woreda*. However, there are examples of practices accomplished by productive safety net program (PSNP).

Regarding the challenges, the findings of key informants and FGDs are summarized as follows:

- The use of natural resources base only on fulfilling the immediate needs of the society rather than considering the long term effect. This limits SWC measures.
- The planning and introduction of SWC practices have been done without involving the local community which creates resistance among some group of people to accept the introduced new structures.
- Poor supervision of soil fertility improvement and soil and water conservation works performed by farmers and assisted by DAs, lack of reward or incentives to motivate these practices and lack of technical support are some of the problems observed among government officials.
- There is strong desire among people for the implementation of SWC on their farm lands through PSNP beneficiaries without their involvement. When farmers are told to construct terraces on their farm land, they reply that those beneficiaries of the PSNP should construct any SWC structures in their farm land.
- Land shortage occurred as a result of high population growth which limits the land management practices at a wider range.

To conclude, the chapter provides brief description about different land management practices and challenges which encounter the practice of the activities. The result of the discussion indicates that application of chemical fertilizer and crop rotation are the important way farmers use to improve soil fertility to maximize agricultural products. On the other hand, contour ploughing, ditches and hill side terracing are the main activities of the people used to conserve soil and water resources. In areas were gully developed, people use check-dams and cut-off drains to rehabilitate and to check further formation. However, there are challenges which determine land management practices. Decreasing productivity of the land, involvement of family members in off-farm activities, the increase population, inadequate cooperation of neighbor people to take collective measures and lack of full cooperation of government and lack of full cooperation of NGO's in land management practices are major challenges that determine changes in land management practices.

CHAPTER SIX

6. Conclusion and Recommendation

6.1. Conclusion

This study has attempted to examine the challenges of land degradation and its management practices in Lemo *woreda.* The finding of the study indicated that the livelihood of the farmers in the study area depends on subsistence agriculture. The major economic activity for all sampled households is based on farming (86.3%). The average size of farm land owned by farmers is less than one hectare which limits the amount of production in the study area.

On the other hand, the findings indicate that the study *woreda* has serious land degradation problems as observed in other part on highland Ethiopia. This problem appeared to be one of the major challenges for crop production.

The livelihood of the community is affected by these land degradation problems. The Productive lands become less productive and subsequently left uncultivated. About (39.9%) of the sampled households agreed that leaving lands due to loss of quality is the main causes of decreasing trend in land holding.

Regarding response to land degradation problem, there have been a range of land management practices underway by local communities, government and non-government organizations. The survey results and personal observation indicates that there are a marked change occurred on the land resource as the result of land management practices. However, as compared to the magnitude of the problem, these land management and rehabilitation practices are not enough to curb land degradation problem. There are also challenges that affect land management Practices.

The study revealed that different socio-economic and institutional factors affects land management practices. Among the socio-economic factors increase in human population is the major challenge. With the increased population there is subsequent increase in the

size of cultivated area which in turn resulted in the shrinking of grazing lands and expansion of the cultivation into areas formerly considered as marginal and extremely fragile. Continuous search for new land cultivable land also challenges the construction and maintenance of soil and water conservation practices and closing extremely degraded area for rehabilitation.

Regarding the involvement of family members and neighborhood in land management practices, the finding of the study revealed that slightly more than half percent of the population have willingness and cooperation to involve in land management practices. This indicates the increase of awareness of the community about the negative impact of land degradation. But the population which accounts nearly half percent did not show any willing to involve in land management and rehabilitation works. The reasons identified during the survey, exhaustion of the fertility of land and subsequent reduction in farm yields, deterioration of social values of helping each other and subsequent focus on personal gains, and decrease in productivity of land which discourage the need for additional labor from outside are the major one.

Economically, the decreased productivity of farm land and involvement in off-farm activities pushes away people from participating in land management practices. In addition, people who engaged in off-farm activities require large number of labor. Thus, from this, it can be concluded that the economic factors have played their own role in land management practices.

Regarding the institutional support related factors, though efforts being made were reported by the government and non-government officials in the study area, none of the activities are enough to halt the problem of land degradation. From this, it is possible to conclude that adequate integration of the government officials with local communities during planning and introduction of different soil and water conservation activities and the intention of government to fulfill the immediate needs of the people are some of the problems observed.

6.2. Recommendations

Based on the finding of the research, the following actions that improving land management practices and solving at least minimizing problems of land degradation are recommended.

- In association with the increased population pressure a number of adverse effects on the environmental conservation of the study area and land management practices have been identified. Easing population pressure on natural resource needs due attention. This can be achieved by resettlement program, continuous training and awareness creation on family planning, technological improvements in agriculture and development of other sectors of the economy to minimize burdens on natural resource.
- In making intervention in land management practices, there should be active participation of local people primarily farmers. This helps to integrate indigenous land management practices with the new ones and enhance easy adoption and sustainable use of effective introduced practices. In addition, it is also essential to provide benefits to the local communities from enclosed area in sustainable manner which, in turn, increased the sense of one's resource.
- To improve the productivity of the farm land focus should be given to intensive technique of agricultural system that promote the use of various soil fertility improvement and conservation practices to boost production from small plot of land. In addition, Women should be encouraged to put manures in farm fields rather than using it for fulfilling fuel wood demand.
- Land management practices can be further promoted if they are carried out in conjunction with other developmental activities like provision of family planning education and empowering Women.
- The need for a flexible extension program is necessary to broaden the concept of land management practices.
- It would be most timely and appropriate at the federal level to produce guidelines that would take in to account the priorities of regional and local

level to enclose and manage several degraded area from further degradation.

- Finally, relation with development agents and training on conservation measures surely increase the interest and knowledge of the farmers in practicing land management. However, as to the result of this study, farmers' have very limited and irregular contact with Das. Most of DAs reside in town that is far from the residence of farmers they assigned to assist. As a solution of these problems, farmers training centers (FTCs) were built in each *kebeles* but they are not fully functional. Hence, it is recommendable that concerned government bodies should use FTC for training of farmers on the implementation, dissemination, use and management of new technologies.

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Household Survey Questionnaires

Part I. General Information

1. Name of the Enumerator……
2. Date of the Enumeration……..
3. Enumeration Kebele……

Part II. Personal Information

1. Sex of the respondent a, male b, female

2. Age of the respondent……..

3. Marital Status of the respondent a, single b, married c, divorced d, widowed

4. Educational status of the respondent a, illiterate b, read and write c, 1-4 d, 5-8 d, 9-10 f, >10
5. Family size Male…….Female…….Total……..

Part III. Economic Activities

6. What is your major economic activity? a, crop production b, animal rearing c, mixed farming d, petty trade e, mixed farming and petty trade f, others (specify)----------
7. Do you have your own farm land? a, yes b, no
8. If your answer is 'yes', what is the estimated total size of your farmland? a, less than 1 ha b, 1-2 ha c, 3-4 ha d, above 4ha
9. How do you see your current landholding to support the household? a. insufficient b. sufficient c. excess
10. If your answer is 'insufficient' do you have any option of having additional land? a, yes b, no
11. If your answer is 'yes', what are the options? a. share cropping b, lease/contract land c, clearing forest and grazing land d, others(specify)----------
12. How is the trend in your landholding size? a, increasing b, decreasing c, no change

d, other (specify)----------

13. If your answer is 'increasing' what are the reasons behind the increment?

(Multiple answers are possible) a, encroachment into forest area

b, land reallocation c, cultivation of marginal land d, others (specify)------

14. If your answer to Q No.7 above is 'decreasing', what are the root causes?

(Multiple answers are possible) a, increase in human population

b, increase in marginal land due to loss quality c, land redistribution

d, land taken away by government e, others (specify) ----------

15. What are the constraints to crop production in your area?

(Multiple answers are possible) a, Erratic rainfall b, labour shortage

c, less access to input d, drought e. Land shortage f. Soil erosion

g. pest and disease h. others (specify)----------

16. Do you have your own livestock at present? a, yes b, no

17. If your answer is 'yes', what is the type and number of domestic animals you have?

Livestock type	**Number**
Cattle Ox	
Cow	
Heifer	
Calf	
Goat	
Sheep	
Equine Horse	
Mules	
Donkey	
Others	

18. What is the trend of your livestock holding? a, increasing b, decreasing c, no change

19. If your answer is 'decreasing', what are the reasons (Multiple answers are possible) a, Shortage of grazing land b, Lack of money to buy animals c, Prevalence of livestock disease d, Others (specify)----------

20. If your answer is 'increasing', what are the reasons?

_____

_____

21. How do you feed your livestock? a, free grazing on communal grazing land b, own grazing land c, cut and carry from communal pasture land d, crop residue e, others (specify)----------

22. How do you see the size of grazing land overtime? a, increasing b. decreasing c, remain the same

23. If your answer is 'decreasing', what are the reasons? (Multiple answers are Possible) a, expansion of farm land b, grazing land distribution among people c, area closure d, other(specify)----------

24. If your answer is 'increasing', what are the reasons? _____

_____

Part IV Land Degradation

25. Is there land degradation in your area? a, yes b, no

26. What were the major forms of land degradation in your area? (Multiple answers are possible) a, soil erosion by water b, soil erosion by wind c, deforestation d, overgrazing of rangeland e, Gully formation f, others (specify)----------

27. Which type of erosion by running water is more common in your farm land? a, sheet erosion b, rill erosion c, gully erosion d, all form of erosion e, others(specify)----------

28. What were immediate and underlying root causes of land degradation? (Multiple Answers are possible) a, overstocking b, cutting trees for fuel and construction c, ploughing steep slopes d, limited use of conservation structures e, continued cultivation/no fallowing f, heavy rainfall

g, steep topography h, population pressure I, others----------

29. Is it possible to halt/minimize land degradation problems? a, yes b, no c, I don't now

30. If your answer is 'yes', how?----------

31. If your answer is 'no', why?----------

Part v Land Management Practices

32. Is there land management practices in your area? a, yes b, no

33. If your answer is 'yes', what are the main land management practices? a, closure of grazing land b, terracing c, mixed cropping d, organic manure/composting e, crop rotation f, making water way g, mulching h, tree planting i, rotation grazing j, contour plowing k, fallowing

34. Which conservation measures listed in questation no.32 do you think are more effective in managing degraded lands? Why?----------

35. What mechanisms did you used to maintain soil fertility in your farmland? a, chemical fertilizer b, crop rotation c, manuring d, fallowing

36. What were the SWC structures you had used in your area? a. contour ploughing b. Stone bunds c. soil bunds d, fanyajuu e, terraces f. cut of drain e, forage strips g. others (specify)----------

37. What mechanisms did you use for gully treatment? a, check-dam b, cut off drains c. planting trees legumes and grasses d. others (specify)----------

38. How do you see land management practices over time? a, increasing b, decreasing c, no change d, unknown

39. If your answer is 'increasing'/'decreasing', what are the reasons?----------

40. How is your participation in land management practice over time? a, high b, medium c, low d, I didn't participated

41. What are the reasons for your answer?----------

42. With the increasing in the size of population how do you see the involvement of society in land management practices? a. increasing b, decreasing

43. If your answer is ‘increasing’, what are the reasons?----------

44. If your answer is ‘decreasing’, what are the reasons?----------

45. Are your household members willing/have motive to involve in land management practices? a, yes b, no

46. If your answer is no what is the reason?----------

47. How do you see the assistance gained from other households for land management practices? a, increasing b, decreasing c, remain the same

48. How do you see the productivity of the farm land overtime?

a. increasing b. decreasing c. no change d. I don’t know

49. If your answer is ‘decreasing’, what are the reasons? (Multiple answers Possible)

a. decrease in rainfall b. decrease in farm size c, decrease in soil fertility

d. others(specify)----------

50. If your answer ‘increasing’, what are the reasons? a. access to new land

b. better land management c. benefit from agricultural extension technologies

d. adequate rainfall e. others(specify)----------

51.does any member of your family involve in off-farm activities? a, Yes b, No

52. If your answer is yes, in what type of work are they involved?

a, handicraft b, labourer c, petty trading d, government employer e, others (specify)……

53. Do you see any influence of off-farm activities on land management practices?

a, Yes b, No

54. If your answer is ‘yes ‘in what way they could influence the practices?

_____

_____

55. List any socio- economic factors that hinders you from participating in Land Management practices----------

56. Have you access to any extension programs to improve resource conservation practices in your area? a, Yes b. No

57. If your answer is ‘yes’, have you applied any in the recent past? a. Yes b. No

58. If your answer is ‘yes’, what did you get?

List its benefits……

List its weakness……..

59. If your answer is ‘no’, what is the reason?.....

60. Where do you get information about land management? a. traditionally b. from neighbors c. from DAs d. from NGOs e. from mass media f, if any (specify)----------

61. Is there any effort made by *Woreda* Agriculture and Rural Development office to promote local Conservation practices? a. Yes b. No

62. If your answer is ‘yes’, mention those efforts?…….

63. Is there intervention by NGOs to manage degraded lands in your area? a, yes b, no

64. If your answer is ‘yes’, what are their contribution to manage degraded land?.....

65. List down any policy related factors that you think are obstacles to the land management practice in your area?----------

66. What measures do you suggest for the sustainability of land management practices in your area?----------

Questionnaires for key informant’s interview

1. What rights do farmers currently have on their land holding?
2. Do you think that this right affects farmers land management activities?
3. If there is a problem of land degradation, what are the indicators?
4. What are the contributing factors for land degradation?
5. What is the trend of productivity of land through time? Give justification for your response----------
6. What is the trend of livestock holding by the farmers in the area? Give reasons for your response----------
7. Describe the major feed sources for livestock by order of importance?
8. What is the trend of these livestock feed? Give reasons for your response?

9. How did you see land management practice carried out in your area in the past?
10. What is the situation of the practice nowadays?----------
11. What interventions are there by government and NGOs in the area with regard to land management practice?----------
12. What are the constraints to the sustainability of land management practices in your area?----------
13. What measures do you suggest for the management of degraded land in effective manner?----------

Checklist for Focus Group Discussion

1. What are the major economic activities of the community?
2. What challenges are there in undertaki se economic activities?
3. What is the trend of households' landholding size overtime?
4. What are the contributing factors if there is any change?
5. How do you describe the productivity of land overtime?
6. If there are changes, what are the contributing factors?
7. What mechanisms are used by the farmers to improve the productivity of land?
8. What are the major livestock feed in the area?
9. What is the trend in the availability of livestock feed?
10. If there is change, what are the major causes?
11. What is the trend in livestock holding by the community in the area?
12. What challenges are there in livestock production? If there are challenges, what are the causes?
13. How do you describe the status of land degradation in your *kebele*?
14. If there are problems of land degradation, what are the indicators for the problems?
15. What are the causes for land degradation?
16. How did you see land management practice carried out in your area in the past?
17. How is the practice nowadays?
18. What problems being encounters in relation to land management practices?
19. What should be done to promote and sustain natural resource conservation in effective manner in your area? ----------

20. Do you think that the current land tenure system (land holding) is good to you?

21. What is the reason for your response?----------

22. Do you think that current land tenure security affects long term investment on your farm plot? Why? ----------

23. Do you see any influence of off-farm activities on land management practices?

    a, yes b, no

24. If your answer is yes in what way they could influence the practice?----------
    ----

25. What do you think about the benefits obtained from land management practices?--------
    ----

26. Is there improvement in natural resource management in your area? a, yes b, no

27. If your answer is 'yes', list down the changes observed?----------

Declaration

I the undersigned declare that this thesis is my genuine work and that all sources of materials used for the thesis have been duly acknowledged and I also declare that this thesis has been never presented to any other institution anywhere for the award of any academic degree.

Name----------

Signature----------