



DILLA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

**PERCEPTION OF FARMERS TOWARDS SOIL EROSION AND
CONSERVATION MEASURES IN ENEMAY WOREDA, EAST
GOJJAM, ETHIOPIA**

BY:

WALTENGUS AYANEH

ADVISOR:- ABIYOT LEGESSE (PhD)

SEPTEMBER, 2021

DILLA, ETHIOPIA

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DECLARATION

WALTENGUS AYANEH, hereby declare that the thesis entitled: perception of farmers towards soil erosion and conservation measures in EnemayWoreda, East Gojjam, Ethiopia, is the outcome of my own effort and study, that all sources of the materials used for the study have been accordingly acknowledged. I had produced it independently except for the guidance and suggestion of research advisors. This study is original work and it had not been presented for the award of any other Degree, Diploma, follow ship or other similar titles of any other University or Institution.

WALTENGUS AYANEH

Name

Signature

Date

THESIS APPROVAL

This is to certify that we have examined and approved the thesis prepared by Waltengus Ayaneh Entitled: Perception of farmers towards soil erosion and conservation measures in Enemay Woreda, East Gojjam Ethiopia. Therefore, recommend its submission in partial fulfillment for the requirements for the Degree of Master of Arts in Geography and Environmental Studies, as it complies with the regulations of the university and meets the standard set with respect to originality and quality.

Advisor ----- **Sign** ----- **Date** -----

APPROVAL SHEET

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Name and Signature of Examining Board:

Chairperson	Signature	Date
Internal Examiner	Signature	Date
External Examiner	Signature	Date

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LIST OF ACRONYMS

DA	Development Agents
EHRIS.....	Ethiopian Highlands Reclamation Study
FCD.....	Focus group Discussion
SPSS.....	Statistical packages for social science
SWC.....	Soil and water conservation
UNEP	United Nations Environment Program

ABSTRACT

In Ethiopia, soil erosion is one of the major causes of land degradation which resulted low agricultural productivity. The study examines on farmers' perception towards the problems of soil erosion and their conservation knowledge in EnemayWoreda. Hence, the objective of this research was to examine farmers' perception on soil erosion and their adoption of soil conservation measures in the study area. With the use of structured questionnaire and interview, a total of 132 farmers were surveyed for the study. For many farmers, absence of fertile topsoil and stoniness of soil were main indicators to soil erosion on their land. Others recognize by observing poor crop and grass growth of the soil. They also perceived well the causes of soil erosion in their lands as slope steepness of cultivation fields, ceaseless cultivation and absence of fallowing with many time preparations of soil for cropping; still other causes have great roles. Severity of soil erosion in the study area explained as severe, moderate, minor soil erosion and a few cultivation fields had no erosion risk. Consequently, farmers well understood the results of severe soil erosion on their farms and recognized as loss of topsoil, reduction of yield over time, loss of vegetation cover and grasses, change in soil color, requiring high input and management, formation of uncross-able gullies, lack of farm land and grazing field, and out migration. The major soil conservation methods implemented by farmers in the study area were terracing, tree planting, contour plowing and leaving crop residue. This research finding also concludes that almost all interviewed farmers perceived the main problems associated with the use of soil conservations methods in EnemayWoreda were mainly includes; served as a shelter for pests and rats, difficult to tillage, need much labor, need incentives to implement, difficult to implement and reduce farm size. . In order to effectively plan for soil conservation measures application and introduce new techniques there is a need of participate local farmers and modifying educational/training programs which were provided for farmers by considering the existing knowledge and practices.

Keywords: Perception of Farmers, Soil erosion, soil Conservation Practices, causes and effects of soil erosion in EnemayWoreda

CHAPTER ONE

1. INTRODUCTION

1.1. Background of the study

Soil is an important resource, which needs much attention in its use and management. It is the soil which nourishes and provides with required needs for the nature. The whole creation depends on the soil which is the ultimate foundation of our existence (Desta et al., 2017; Mekuria et al., 2009; Tesfahunegn, 2019).

Today, depletion of natural resources is the major problem facing the world. World Resource Institute of the United Nations Environment Program (UNEP) estimated that millions hectare of land are degraded and completely disappeared with their original biotic functions and 1.2 billion hectares (10%) of the earth's vegetative surface are moderately degraded of which about one fourth is found in Africa and Asia and the rest three-fourth in North America. Undoubtedly, environmental degradation (soil erosion and climate change) has direct effects on agricultural productivity and food security (Bewket, 2003; Biratu & Asmamaw, 2016; S. Daba, 2003; Desta et al., 2017).

However, soil erosion is recognized as one of the most serious, common and widely spread and well known environmental problems faced by human society, associated with agricultural land use and intensive use of soils throughout the world. Soil erosion, and the other related forms of land degradation, now constitutes an extensive and serious problem in many parts of the world, particularly in the developing countries (Assefa & Hans-Rudolf, 2016; Nigussie et al., 2017). In fact, soil erosion is now one of the most widespread environmental problems that are occurring globally. In spite of the importance that the subject has been given by national and international organizations, the problem has been increasing in recent years (Tefera & Sterk, 2010).

According to Ethiopian Highlands Reclamation Study (EHRS), showed that almost 50 % of the highlands of Ethiopia are significantly eroded, 25% seriously eroded, while 4% had reached a point of no economic return (1984). It was estimated that 12,000 tones total crop production per annum in 1985 (FAO, 1986) Similarly the Ethiopian highlands lose about 1.9-3.5 billion tons of top soil every year.

Soil erosion rates as high as 42 Mg ha⁻¹ year⁻¹ have been reported on cultivated lands across the country (Bewket&Sterk, 2003; Tesfaye et al., 2014b; Haregeweyn et al., 2015), and recent estimates by Hurni et al. (2015) indicated rates of 20 Mg ha⁻¹ year⁻¹ on currently cultivated lands and 33 Mg ha⁻¹year⁻¹ on formerly cultivated degraded lands. Similarly, soil erosion has been a serious problem in the Upper Blue Nile Basin. Gelagay&Minale (2016) stated a soil erosion rate of 47 Mg ha⁻¹ year⁻¹ in the Koga watershed, and Bewket&Teferi (2009) reported a rate of 93 Mg ha⁻¹ year⁻¹ in the Chemoga watershed

The use of soil conservation practices may be conceptualized as a decision-making model with four components. First, physical characteristics of the land (include degree of slope, slope length, and soil susceptibility to erosion) that define potential for soil erosion. Second are the personal attributes of the farmer which may translate into a disposition to recognize and control erosion(Mekuria et al., 2009; Moges & Taye, 2017). Important attributes may include age, education, profitability orientation, risk aversion, etc. The third component can be described as the economic profile of the farm enterprise. This profile may serve to facilitate action stemming from one's disposition to control erosion or may produce constraints to actual implementation. Finally, the decision to adopt may be influenced by public institutions which may intervene to alter a farmer's disposition toward soil erosion control and/or to offset economic or technical management constraints to practice use (Belay 2014; Tesfahunegn et al., 2016). The limited success of those efforts highlights the need to better understand the factors that encourage or discourage the adoption and sustainable use of introduced conservation measures(Belay & Bewket, 2013; Walie, 2015).

Although, several types of researches have been conducted on on-farm soil erosion in Ethiopia generally, and in the study region in particular, but most of them have been focused on the quantitative assessment of the magnitude of soil erosion. Very few studies focused attention on the qualitative assessment of soil erosion using farmers' perception of soil erosion and their conservation measures. Some experts believe that due to the gradual spread nature of pervasiveness of soil erosion, farmers may be ignorant of its seriousness and reluctant to response(Adimassu et al., 2014; Kiros-Meles and Abang, 2008; Wolka et al., 2013)While, many issues and decisions on on-farm soil erosion and its effects cannot be addressed solely through technical expertise because they need not only biophysical examination but also, perceptions and soil conservation understanding(Akinnagbe and Umukoro, 2011; Demissie, 2015).

More or less soil erosion is the common problem of Ethiopia, and traditional conservation practices took place for some decades in many parts of the country. Even though, in some places like in East Gojjam particularly in Enemay still now soil erosion is a serious problem which the farmers of the area are suffering and reaches at a severe rates; even some farmers of that village are losing their farm lands due to erosion. Stand on this, the researcher is interested on the assessment of the farmers' perception on soil erosion and their adoption of soil conservation measures towards on it.

1.2. Statement of the Problem

The prevalence of soil erosion is a major problem in Ethiopian agriculture. Many tones of top and fertile soil are lost from fields every year. According to(USAID, 2010) the average annual rate of soil loss in Ethiopia is estimated to be 12 tons per hectare per year with losses as high as 300 tons per hectare per year. Human-related activities such as deforestation, overgrazing, intensive cultivation, soil mismanagement, cultivation of steep slopes, and urbanization with land use and management, topography, climate and social, economic and political conditions influence and accelerate the soil erosion hazard(Daba,2018; Demissie, 2015; Mather, 1982)

The highlands of Ethiopia in general and the Amhara region in particular experience severe soil erosion mainly due to steep terrain, poor surface cover, continuous cultivation on sloppy areas, and degradation of grazing lands due to human and livestock pressure. In many parts of the region, erosion leaves stones and bare-rock on the surface of landscapes as it has removed almost all fertile top soil in many places (Meseret, 2014; Wolka et al., 2013).Many of the areas of greatest soil erosion concern in Ethiopia's highlands are located in the Amhara region. The reason for the selection of for this study is because there has been serious problem on soil and water conservation related with perception of farmers as well as no adequate research so far conducted on perception of farmers towards soil erosion and conservation measures in the area.

Household head distance of the farm plot from home, slope of the farm plots, total livestock, farm land size, land to labor ratio, age of the household head, education level of the holding capacity, are affecting adoption of soil conservation practices. In addition they also reveal that several socio-economic, bio-physical, policy and institutional related constraints affecting farmers' perceptions to apply various soil conservation measures in Ethiopian.

In line with these farmers in EnemayWoreda, they perceived soil erosion as a problem constraining crop production.

Decision on the significance and the type of SWC measures are not made by farmer concerned and there is little and rare attempt to made to include farmer experiences and knowledge (Abebe & Sewnet, 2014; Hoang et al., 2003). Many conservation practices in Ethiopia was carried out in the form of food for work without provide any opportunity for discussion and local participation in conservation planning (Akinngbe & Umukoro, 2011). This program was not successful to achieve its objective. After phase-out of this programs some farmers become unwilling to participate and maintain those already established project even they remove the structure from the field(Miheretu, 2014; Walie, 2015)

Even though so many review of relevant literature indicates to the fact, several empirical studies conducted on perception of farmers on soil erosion and conservation practices, their level of soil conservation practices perceived by Ethiopian farmers on their farm lands.

However, almost all of them have been showing issues of adoption in relation to improved soil conservation technologies. Available and previous evidence shows that studies on the determinants of adoption of soil conservation measures are few and far between them and totally none exist in the study area. Therefore, this study will be conducted in view of bridging this gap.

Enemayworeda is well known in agricultural production in the Blue Nile basin targeted by the government. However, it is very vulnerable to soil erosion due to its undulating topography, steep slopes and high rainfall. The alarming rate of soil erosion in this region calls urgent attention to this problem. However, there is scanty knowledge study related with assessing the perception of farmers on soil erosion in this area. To fill the knowledge gap, therefore, the study focused on examining the impact land use land cover change on soil erosion in the study area so as to alleviate soil erosion.

1.3. Objectives of the Study

1.3.1. General objective

The general objective of this study is to:

Assess farmers' perception on soil erosion and their adoption of soil conservation measures in EnemayWoreda.

1.3.2. Specific objectives of the study

More specifically, this study attempt to:

- ❖ Assess the perception of the farmers on the causes, levels and consequences of soil erosion.
- ❖ Examine farmers' perception and level of training on adopting soil conservation measures, and
- ❖ Identify factors that influence farmers' decision on adopting of soil conservation measures.

1.4. Research Questions

Understanding farmers' perception of soil erosion and its impact is a very necessary position in promoting soil conservation measures. Therefore, this study will address the following research questions:-

- What is the perception of farmers on the causes, levels and consequences of soil erosion?
- What is the relation between farmers' perception and level of training on adopting soil conservation measures?
- What factors influence farmers' adoption of soil conservation practices?

1.5. Significances of the study

The results of this study will have contributions in identifying implemented soil conservation practices by farmers and their effectiveness in controlling soil erosion. It also provide information on the existing location specific knowledge related to soil conservation practices, indicate the factors that need urgent intervention, and identify directions and information that need further research works. It can be a good opportunity to the administrative zone in general, and the district in particular, to have an organized document that can serve as guideline in the future planning. In addition, it can indicate directions and supply information for further research and development efforts for nongovernmental organizations whose main concern is programs in soil and water conservation.

The results of this study could provide a significant contribution to the scientific community. Moreover, the result from the perception of farmers on soil erosion can identify and give priority intervention of vulnerable areas, so that planners and decision-makers can choose favorable locations for future development schemes. The community who are found in the study woreda particularly will be the beneficiary from the study result. Therefore, the information from this research will helps the soil conservation stakeholders and policy

makers, in promoting the soil conservation measures to all needy areas for better achievement. Moreover, it will help as a reference for other studies in the area with similar or other themes of study.

1.6. Delimitation of the study

Since it is not possible to cover the whole aspects of the study area with the available time and resources, it is advisable to limit the study size and the scope of the problem to a manageable size. Hence, the study focused on Enemay Woreda Amhara, Ethiopia. It will try to see the perception of farmers towards soil erosion and conservation measures. The time boundary of the study is from February 2021 to July 2021.

1.7. Limitation of the study

Limitation of Study challenges in obtaining previously recorded secondary data from the woreda and kebele agricultural sector; particularly data on land allocation for residential and total number of displaced households who obtained compensation by years has been a major challenge during data collection time. During interview, obtaining farmers and DA with sufficient know-how and experience was a difficult task. Even, those who interviewed were reluctant to give relevant information due to the serious land administration problems in the area during data collection time. Finally the researcher could be able to cope up the problem.

1.8. Organization of the study

This study will be organized into five chapters. The first chapter provides with an overview and the issues which attempts to address and achieve at the end of study. This is following with related literature reviews in which the previous researches and thought related to farmers' perception on soil erosion and the use of soil conservation measures will be reviewed. The third chapter will describe the methodology used to collect relevant data and how collected data will analyze. The fourth chapter will presents the results of the study. Finally, chapter five will gives conclusion and possible recommendation based on the results of the study.

CHAPTER TWO

2. REVIEW OF RELATED LITERATURES

2.1. Theoretical framework

2.1.1 Definition of Soil erosion

The definition of soil erosion given by the EU Commission of Land Management and Natural Hazards as the “wearing away of the land surface by physical forces such as rainfall, flowing water, wind, ice, temperature change, gravity or other natural or anthropogenic agents that abrade, detach and remove soil or geological material from one point on the earth's surface to be deposited elsewhere”(Eu, 2007).

Soil erosion as defined by(Alkharabsheh, et.al., 2013; Dregne, 1992), from the geomorphological point of view, is a form of soil degradation or soil transformation into sediments usually caused by wind and water. As stated by (R. Lal, 2002), it is a three-phase process consisting of the detachment of individual particles from the soil mass, their transport by erosive agents such as running water, wind, ice, gravity under the influence of a defined force, and finally its deposition when sufficient energy is no longer available to transport the particles. Thus, resulting in either a geologic (natural erosion) or an accelerated, (man and animal-induced) erosion felted as on-site and /or off-site impacts. While, from the human point of view, as defined by (Pimentel, 2006), it is a gradual decline in soil productivity quantitatively or qualitatively caused through its abused by human action. The gradual reduction, according to them may be through the physical removal of soil or decline in soil fertility without actual loss of soil or a combination of both. Soil erosion is one of the processes of soil degradation, which reduces the productive capacity of agricultural lands and lead to desertification.

2.1.2 Soil Erosion in the World

Globally, about 80% of the current degradation of agricultural land is caused by soil erosion (Federation & Research, 2004). Soil erosion as "soil cancer" is a much complex process and its various direct and indirect social and environmental impacts are an increasing threat for the human existence on the earth's surface. However such and related phenomenon with decreased soil fertility cause the destruction of natural ecosystems like pastures, forest and agricultural ecosystems and soil erosion rate is a key index for the assessment of land

management strategies and sustainability of development programs of the countries (Akinngbe & Umukoro, 2011; M. H. Daba, 2018).

Much of the world has been facing increasingly serious soil erosion of various degrees caused by both natural and human factors as well as its consequent environmental deterioration. The loss of soil through land degradation processes particularly by erosion is one of the most serious environmental problems (Vávra & Rikoon, 2019; Wolka et al., 2013). While topsoil takes centuries to develop, the world's growing human population has actively depleted this resource over decades.

At the global level, between 30% - 50% of the world's arable land has been significantly affected by soil loss (Walie, 2015). The problem of soil erosion is difficult particularly in East Africa because of mountainous nature of the region, high population densities, fragile soil, high amount of rainfall and limited capital to invest in soil conservation measures. Severe erosion has been documented throughout the area (Genene & Abiy, 2014).

2.1.3. Soil Erosion in Ethiopia

Ethiopia has a total surface area of 112 million hectares of which 60 million hectares is estimated to be agriculturally productive. From the total estimated agriculturally productive lands, about 27 million hectares of the country are significantly eroded, 14 million hectares are seriously eroded and 2 million hectares of the land have reached the point of non-returnable, with an estimated total loss of two billion m³ of fertile top soil per year (Woldeamlak & Stroosnijder, 2003). Even though the people of Ethiopia have been depending on small-scale agricultural products depletion of the soil resources is very high. And also one of the most severely eroded countries in the world. The average annual rate of soil loss in Ethiopia is estimated to be 12 tons/hectare/year, and it can be even higher on steep slopes with soil loss rates greater than 300 tons/hectare/year or 250 mm/year, where vegetation cover is limited (Desta et al., 2017).

Soil erosion hazards, due to unsustainable and non-manageable practices of land use in Ethiopia is not a new phenomenon. However, the problem first received official attention after the devastating famine in 1973/74 (Bewket & Sterk, 2002). According to Kauffman et al., (2014) about 50% of the land area in the highlands was significantly eroded, 25% was

seriously eroded, 5% had reached the point of non-returnable and only the remaining 20% was considered to be free from serious erosion risks in the country.

In Ethiopia the annual rate of soil loss in the country is higher than the annual rate of soil formation rate. Estimation of soil erosion in the highlands of Ethiopia, according to (Mather, 1982), 2 million hectares of lands have been severely degraded and hence annually, the country loses over 1.5 billion tons of topsoil from these highlands by erosion (Demeke, 2003). This indicates that soil erosion is a very serious threat to food security of people and requires urgent management intervention (Meseret, 2014).

The principal environmental problem in Ethiopia is land degradation, in the form of soil erosion, gully formation, soil fertility loss and severe soil moisture stress, which is partly the result of loss in soil depth and organic matter. Amhara region contains many of the areas of greatest land degradation concern in Ethiopia's highlands. But the region is known not only for the severity of land degradation, but also, since the last few years, different efforts taking resulted many places in the region redress these problems including construction of stone terraces and soil bunds, area enclosure and afforestation. So far different activities have been conducted in the region; little quantitative information is available on the level of the problem.

2.1.4. Causes of Soil Erosion

Erosion occurs when soil is exposed to different physical agents like water or wind energy. These processes are influenced by the decisive factors which include the climate, the relief, the nature of the surface, and the activity of human being.

According to (Kiome & Stocking, 1995a) erosion can be either geological natural erosion, a steady and slow process of nature which is non-destructive therefore which is not detrimental to man's well-being and is wholly beyond his control; or it can be human induced that is caused by disturbance of nature's balance by human activities like large scale cutting of forests, leveling and cultivation. There is no particular soil erosion cause which can be singled out and assumed as the main cause of soil erosion. The process has many underlying factors, some induced by nature and some by humans (Miheretu, 2014).

Excessive numbers of livestock on a given area of land can cause significant soil erosion problems due to overgrazing and poaching of the soil which can lead to high rates of soil exposure, capping and increased overland flow (Demissie, 2015). Accelerated soil erosion, in

excess of natural geological rates, is caused by anthropogenic activity. According to (R. Lal, 2007) anthropogenic activities involving deforestation, overgrazing, intensive cultivation, soil mismanagement, cultivation of steep slopes, and urbanization accelerate the soil erosion hazard. Land use and management, topography, climate, and social, economic, and political conditions influence soil erosion. In developing countries, soil erosion is directly linked to poverty level. Resource-poor farmers lack means to establish conservation practices. Subsistence agriculture forces farmers to use extractive practices on small size farm (0.5–2 ha) year after year for food production, delaying or completely excluding the adoption of conservation practices that reduce soil erosion risks (Rattan, 2007).

2.1.5. Consequence of Soil Erosion

Soil erosion is one of the biggest global environmental problems resulting in both on-site and off-site effects. Soil erosion has accelerated in most parts of the world, especially in developing countries, due to different socio-economic and demographic factors and limited resources (Kiros-Meles & Abang, 2008). Soil erosion which manifests itself in the form of gullies, rills and sheet wash is an immensely complicated process involving the interaction of many biological, social, economic, environmental and political factors. It varies in its occurrence both spatially and temporally. The ultimate result of soil erosion is that it reduces crop yields and ruins agriculture, though the exact extent of soil erosion and land degradation is not known (Schneider et al., 2010).

Soil erosion is the main form of land degradation, caused by the interacting effects of factors, such as biophysical characteristics and socio-economic aspects. Degradation resulting from soil erosion and nutrient depletion is one of the most challenging environmental problems in Ethiopia. The Ethiopian highlands have been experiencing declining soil fertility and severe soil erosion due to intensive farming on steep and fragile land (R. Lal, 2007).

The impact of soil erosion is complex leading to reduction in soil depth and moisture storage capacity together with soil-nutrient losses, and ultimately results in reduced agricultural production and productivity (R. Lal, 2007). In addition, soil erosion is a threat not only to agriculture but also to the economy, as the country's economy depends on agriculture.

Soil erosion creates severe limitations to sustainable agricultural land use, as it reduces on farm soil productivity and causes food insecurity (Nyssen et al., 2006). Erosion results in the degradation of a soil's productivity in a number of ways: it reduces the efficiency of plant

nutrient use, damages seedlings, decreases plants' rooting depth, reduces the soil's water holding capacity, decreases its permeability, increases runoff, and reduces its infiltration rate (Critchley & Netshikovhela, 1998). In addition the loss of nutrients alone resulting from soil erosion has an estimated cost of \$20 billion a year.

Soil erosion is one of the most important environmental problems among various forms of land degradation that poses serious challenge to the food security of the population and future development prospects of Ethiopia (Nigussie et al., 2017). The problem of soil erosion has been a problem ever since land was first cultivated. The consequence of soil erosion occurs both on- site and off-site. In Ethiopia, the on-site impacts of soil erosion are most frequently studied, typically by estimating the productivity losses as economic cost of soil erosion. Off-site problems result from sedimentation downstream, which reduces the capacity of rivers and retention ponds, enhances the risk of flooding and muddy flood shortens the design life of reservoirs. Sediment is also a pollutant in its own right and, through the agro-chemicals adsorbed to it, can increase the levels of nitrogen and phosphorus in water bodies and result in eutrophication (Schneider et al., 2010; Tefera & Sterk, 2010).

2.1.6. Farmers' Perception on Soil Erosion in Ethiopia

Farming in Ethiopia is the oldest practice through various farming systems and cultural contexts, and farmers' varieties play a significant role in the agricultural productivity as a whole. Even though it is the oldest activity, the highest portion of the country's genetic resource wealth essential for food and agriculture is still being conserved and improved on small-scale farmers' fields, and farmers' practices in these regards are essential to meet their livelihood needs (Schneider et al., 2010; Tefera & Sterk, 2010)

Perception of farmers' on land degradation by erosion is a significant social factor that is also important in deciding options for controlling soil losses. Understanding and increasing farmers' knowledge and their perception and factors that influence their land management practices have a paramount importance for promoting sustainable land management (Genene & Abiy, 2014). Understanding farmers' perception of soil erosion and its impact is important in promoting soil and water conservation technologies (Adimassu et al., 2014).

In considering farmers' perception on soil erosion, it is necessary to evaluate whether they distinguish between indicators of erosion and fertility loss. For instance, studies conducted in different areas have shown that farmers have knowledge of soil conservation measures (Setegn et.al., 2009). The question to be asked is: 'if farmers have knowledge of soil erosion,

why not apply conservation?’ Identifying where implementation problems may arise is also very important. As study made by (Setegn et.al., 2009) indicates farmers perceived soil erosion as a problem constraining crop production.

Some farmers perceive the effect of soil erosion when it reaches some critical level, which is very difficult to reverse the degradation at the subsistence farmer level. In other cases, farmers will not be interested to invest in conservation and bear associated risks if they do not perceive significant threat posed on productivity due to soil erosion (Zegeye et al., 2010). According to (Tesfahunegn et al., 2016) mentioned that demographic and social-economic back ground of the farmers have a significant effect on perception on degree of soil erosion and their response to varies conservation strategies. Similarly, studies showed that, farmers with higher educational levels are expected to be better in perception and response to soil erosion problems (Demissie Walie, 2015).

2.1.7. Farmers’ Perception towards Adoption of Soil Conservation in Ethiopia

Soil erosion is a dangerous and slow process therefore farmers need to perceive its severity and the associated yield loss before they can consider implementing soil and water conservation (SWC) practices (The FAO, 1984).

Perception of soil erosion as a hazard to agricultural production and sustainable environment is the most important determinant of effort at adoption of conservation measures. Theoretically, those farmers who perceive soil erosion as a problem having negative impacts on productivity and who expect positive returns from conservation are likely to decide in favor of adopting available conservation technologies (Leh et al., 2013; Mather, 1982). On the other hand, when farmers do not acknowledge soil erosion as a problem, they will not expect benefits from controlling erosion and it is highly likely that they will decide against adopting any conservation technologies.

There are several factors that should be determine the cost of making terraces made by hand depends on the method of construction, the slope of the land, the type and size of terrace, the spacing of terraces and ease or difficulty of digging. Maintenance costs consist mainly of repairing terrace embankments. In areas with a land scarcity, farmers may consider the lower production resulting from not using land occupied by conservation measures as a conservation cost (S. Daba, 2003).

In Ethiopia, different efforts were taken towards soil conservation since the 1970s and 1980s. Since then the government of Ethiopia and non-government organizations (NGOs) invested a huge amount of money has been taken to introduce soil and water conservation measures particularly in the areas where the problem of soil erosion is threatening and food deficit is widespread in the country. The measures of soil conservation were includes physical measures and undertaken through campaign using Food-for-Work(FFW) as an instrument to motivate farmers to putting up the conservation structures both on communal holdings as well as on their own plots (Schneider et al., 2010; Tesfahunegn et al., 2016). However, the efforts put towards the promotion of the conservation technologies have not success in achieving the expected objectives. This is mainly attributed to a wider range of technical, socio-economic, and policy constraints that make the recommended technologies inappropriate to local conditions.

The limited success of those efforts highlights the need to better understand the factors that encourage or discourage the adoption and sustainable use of introduced conservation measures. Despite intensive soil and water conservation activities since more than two decades ago, adoption of the interventions in Ethiopia is considerably rather low. This fact is frequently attributed, among other things, to the top-down approach in extension activities, standard mainly structural soil and water conservation technologies, lack of awareness of land degradation by the land users, and land security issues (Muhati, & Olaka, 2018). There are several possible reasons for the failure of past conservation intervention to meet users' expectations. First, the introduction of the measures did not consider local conservation and farming practices and in many cases did not fit in with traditional methods. Second, since interventions normally include such activities as reforestation, terrace construction, etc., they are generally characterized by high initial costs that poor farmers could not afford and by benefits that only become apparent in the long run. Finally, the extensive and uniform application of similar soil and water conservation (SWC) measures disregarded local agro-ecological and socio-economic variations.

2.1.8. Factors Affecting the Use of Soil Conservation Practices

Adoption of structural soil conservation technologies is affected by various factors, usually categorized into; farm specific characteristics, technology specific attributes, and farmer's socio-economic characteristics. Examples of such variables that have been found to influence technology adoption include: farm size, farmer's age, education, social networks (e.g. membership of association), dependency ratio, gender, access to agricultural advice and

information, land tenure security, soil fertility, soil type, income, input availability, access to markets, risk aversion behavior, technology awareness, farming experience, adequacy of farm tools, technical and economic feasibility of using the technology, agro-ecological conditions, access to credit and presence of enabling policies (Borrelli et al., 2017).

Some of these factors increase adoption; others reduce adoption; while others have mixed effects. USAID et al. (2010) indicated that various factors that influence on-farm adoption of soil conservation practices, including socio-demographic characteristics of farm operators and physical features of the farm. Physical and environmental characteristics such as farm size, slope length, degree of slope, and soil erodability also affect the adoption of conservation practices. According to Amsalu & de Graaff (2006) farmers rather frequently reject newly introduced SWC technologies even when they are aware that adoption of the measures protects and improves productivity of their lands.

The newly introduced SWC technologies need to be evaluated not only for their technical efficacy but also for the chances of their sustainable usage and utilization by the land users. Reasons for the limited success stories of soil conservation measures are related to the extension approach. The direction of the technology transfer in the Ethiopian agricultural extension system is considered linear, from the expert to the farmer (Schneider et al., 2010). In this approach, experts are considered as knowledge producers and farmers as adopters of that knowledge, which lead to overlooking the farmers' indigenous knowledge on soil conservation. Through this approach, the chance of reaching consensus and understanding by all actors has been a difficult challenge and extension messages were simply transmitted from the experts to the farmers just as messages at churches or mosques during religious holidays or other social gatherings.

The need to promote soil and water conservation was induced by both economic and physical factors that became a common experience of the farmers. By (Kiome & Stocking, 1995b; Setegn et al., 2009) have investigated specific factors affecting the adoption of soil conservation practices as: 1) physical factors, 2) economic factors, 3) personal factors, 4) type of farm, 5) type and form of information, and 6) the availability of an economically and technically feasible solution.

2.1.9 Conceptual Frame Work

The perception of farmers' on soil erosion and their conservation knowledge are being influenced by their level of physical, demographic and socio-economic characteristics. The conceptual framework of the factors, which consist of three key concepts of variables, is shown in figure 1. The dependent variable which includes the framework for this study are farmer perception on soil erosion and their conservation methods. The physical characteristics of the land which includes slope, aspect, vegetation cover, rainfall and erosion susceptibility and the demographic characteristics include household head, age, sex, household size, literacy and marital status. Literacy level of the household head, farm size, and assesses information about farmers are important socio-economic factors included in this model. Both demographic, physical characteristics and socio-economic factors are the independent variables, which are expected to have farmers' perception and there conservation knowledge to soil erosion.

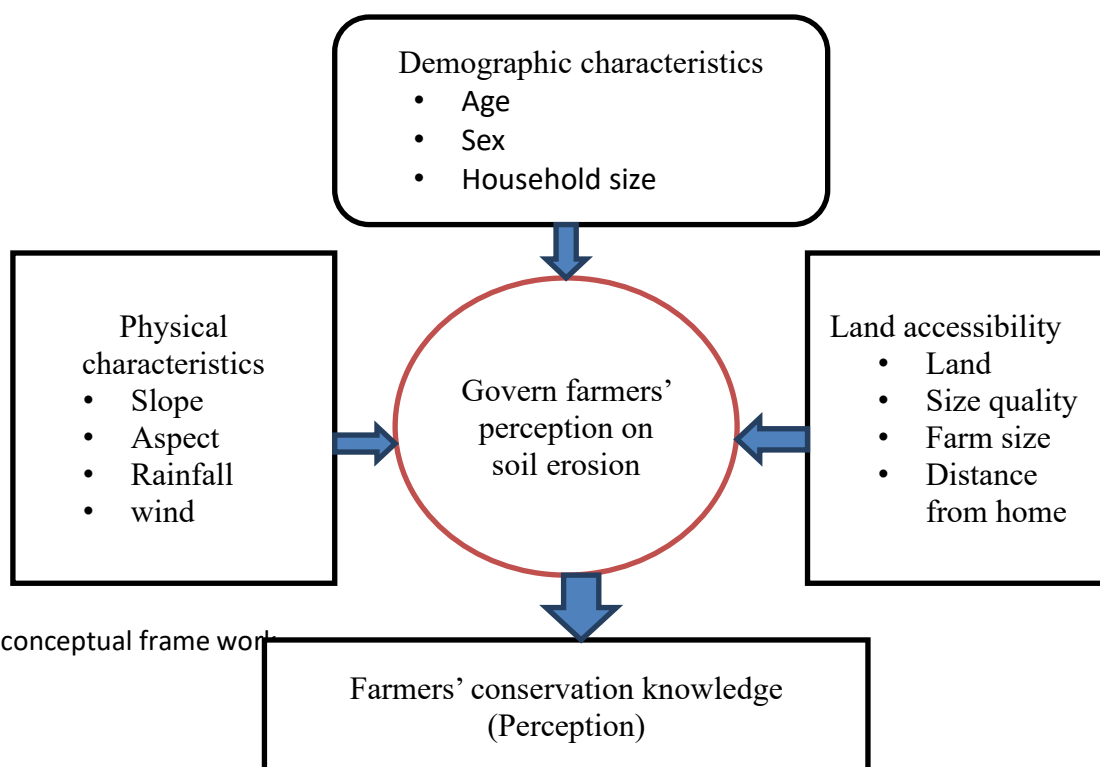


Figure 1: conceptual frame work

CHAPTER THREE

3. METHODS AND MATERIALS

3.1. Description of the study area

3.1.1. Location and size

EnemayWoreda is one of the 18 woredas of East Gojjam Zone in Amhara National Region State. Bichena is its main town and it is situated at 265 km northwest of the capital city of Ethiopia, Addis Ababa. The Woreda is situated between $10^{\circ} 16' 29'' - 10^{\circ} 41' 23''$ N latitude and $38^{\circ} 01' 29'' - 38^{\circ} 20' 33''$ E longitude and interims of relative location it is bordered by DejenWoreda in the South, DebayTilatginWoreda in the West, Enarj-EnawgaWoreda in North and ShebelBerentaWoreda in the East. And also it has 25 rural kebeles.

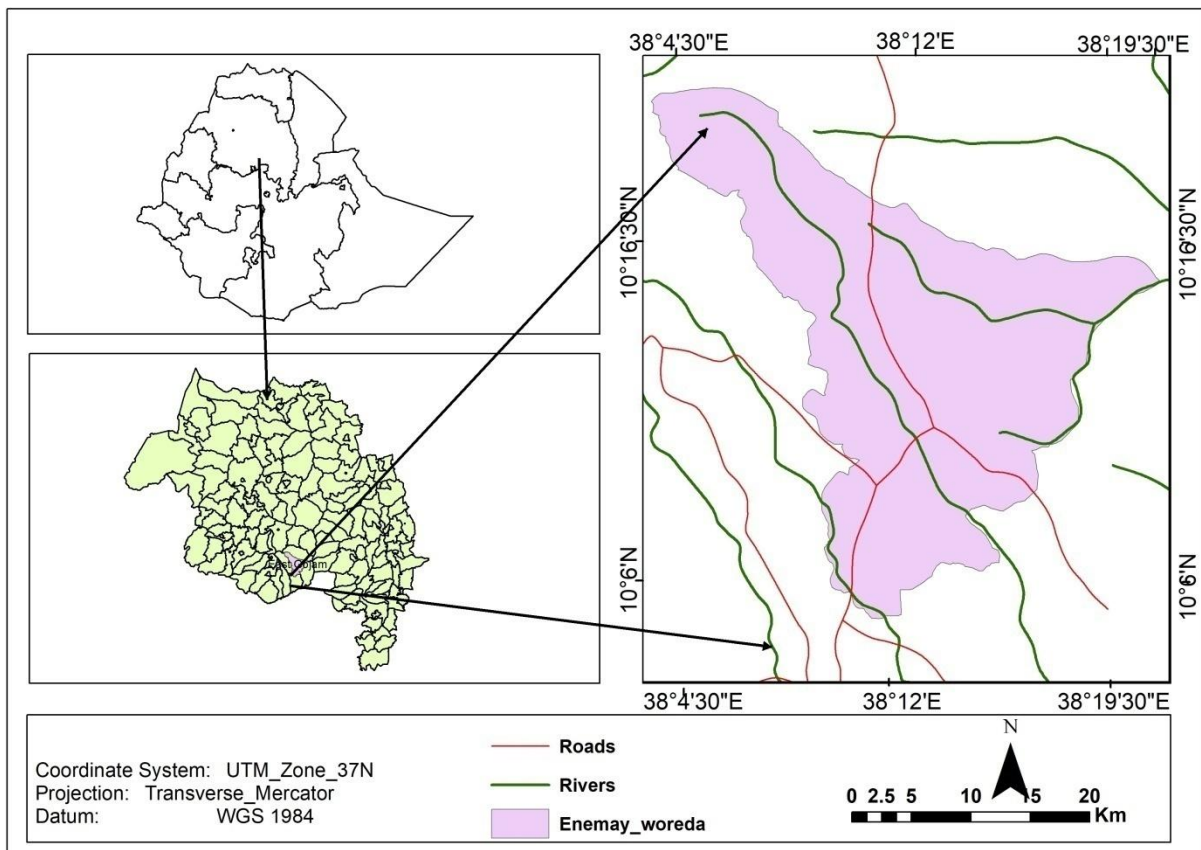


Figure 2: Location Map of the study area

3.1.2. Topography

Its topography is ranged between 2200 to 2430 meters above sea level (m.a.s.l) and it contains different types of vegetation used for varieties of socioeconomic significant purposes through the lives of the area's residents. Economically the localities are depends on

mixed farming system (Enemayworeda Bureau of Agriculture and Rural Development Office, 2021).

3.1.3. Geology and soil types

The regional geology of the study area is dominated by the tertiary volcanic rock and quaternary basalts. Enemayworeda is formed by several geological formations. The largest formation is Lumame basalt. The second largest geological formation in the woreda is Yejube basalt. The major soil types in the study woreda are EutricVertisols and EutricLeptosols. Another soil types are HaplicLuvisols, Eutric Camisoles, and RendzicLeptosols. Eutricvertisols, and EutricLeptosols can be found in the middle and lower course of the watershed. Generally, the soil types of the study area are characterized with shallow, moderate to deep and very deep in depth and sandy clay texture characteristics (FAO, 1986).

3.1.4. Climate and Agro-ecological zones

The annual average temperature and rainfall of the Woreda is ranges between 18 °c to 28 °C and 815 mm to 1486 mm, respectively. On the basis of altitudinal variation, the woreda has been categorized into three traditional climatic zones i.e., *Kolla*(Tropical =5%), *Woinadega*(Sub-tropical =88%) and *Dega*(Temprate =7%) having elevation 1000-1500m, 1500-2500m and 2500-3000m above sea level, respectively

3.1.5. Vegetations

Elsewhere, deforestation is the main cause of soil erosion. In the study area due to unprotected forest removal practices, soil erosion is intense especially during just at the beginning of rainy seasons. As a result, the land cover change with in the past 20 years was very rapid and alarming.

3.1.6 Socio-economic characteristics

3.1.6.1. Population

Based on the 2007 national census conducted by the Central Statistical Agency of Ethiopia (CSA), this woreda has a total population of 165,292, of whom 82,175 are men and 83,117 women; 18,872 or 11.42% are urban inhabitants. The majority of the inhabitants practiced Ethiopian Orthodox Christianity, with 92.05% reporting that as their religion, while 7.78% of the population said they were Muslim. The 1994 national census reported a total population for this woreda of 120,914 in 24,130 households, of whom 60,022 were men and 60,892 were women; 14,160 or 11.71% of its population were urban dwellers. The largest ethnic group reported in Enemay was the Amhara (99.83%). The majority of the inhabitants

practiced Ethiopian Orthodox Christianity, with 89.55% reporting that as their religion, while 10.33% were Muslim; this was the largest concentration of Muslims in MisraqGojjam, either in numbers or percentage.

3.1.6.2. Farming System

According to the Woreda's Agricultural Office data, the average annual cropland holding is about 0.58 hectares per household. However, this size is diminishing from time to time. The farmers are losing their lands to degradation, particularly gullies. The other important thing is that parents share their land with their sons when they get married. It is socially obligatory that the parents give plots of land on which their children establish house and also where they can grow something for subsistence. This fragmentation of land has been decreasing the quality of land and paved the way to land degradation and nutrient depletion.

In the study area, the land is mainly used for crop production, settlements, homestead gardening, tree plantation and livestock grazing. Significant part of the study area is degraded and, therefore it is unused. A very small part is used for conservation purposes. These include areas where the community has enclosed former forest lands to allow natural regeneration of trees and grasses, and where certain individuals have taken the initiative to plant trees in gullies and have enclosed them.

According to the Enemayworeda Agricultural and Rural Development Office data, the current land use pattern in the area is as follows: The woreda covers 75,005 hectares of land. Of which, 51,652 hectares (67.72%) is used for agriculture; 13,583 hectares (17.81%) for settlement and construction; 5464 hectares (7.16%) for grazing; and 3,045 hectares (4%) is covered with forest. 4,448 hectares (5.83%) is fertile while unutilized; and the rest 905 hectares (1.20 %) is totally unproductive (EnemayWoreda Agricultural Office, 2021).

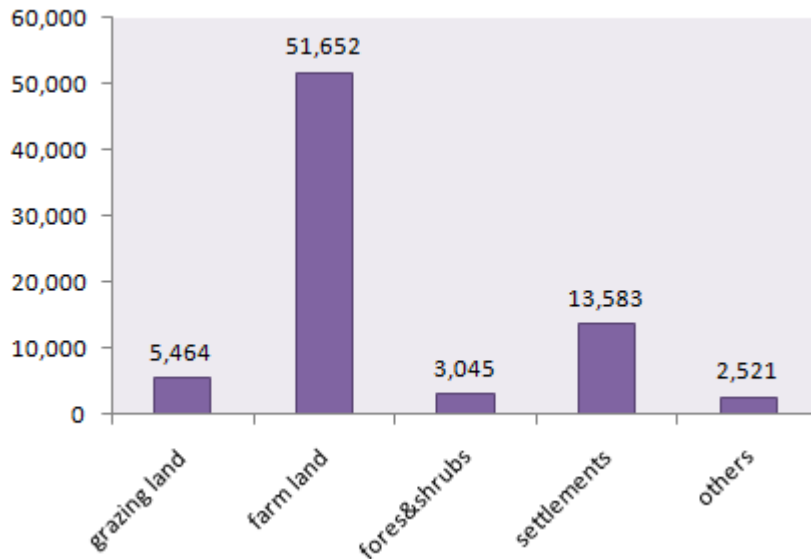


Figure 3: Land use of Enemayworeda

3.2. Research Methodology and Design

3.2.1. Research design

The study was conducted in Enemayworeda where farmers are reluctant to implementing different ways of soil and water conservation methods. Therefore the main objective of this study is to assess knowledge, attitude and practice of people towards soil erosion; the target population of this study will be selected from residents of Amhara regional state, East Gojjam zone of EnemayWoreda. Thus, all village households, village leaders, development agents, social workers, government officials in the area will be the universe of the study from which samples have to be draw.

In general this study was seen as a descriptive cross-sectional study with a central task of improving perception of farmers towards soil conservation measures in selected rural kebeles of the study area. The study used a mixed approach with a central premise of; the use of quantitative and qualitative approaches in combination provides a better understanding of research problems than either approach alone (Creswell & Clark, 2018). Hence, the mixed approach that is used in this research employs strategies of inquiry that involve collection of qualitative and quantitative data simultaneously to best understand the research problem under investigation. The study was guided by the principles of multiple sources and subsequent crosschecking of information as well as by applying various data collection instruments.

In selecting the population, a number of issues were taken into account including accessibility and its proximity to the Woreda town. In other word purposive sampling method was used.

Thus, from the twenty five villages in Enemayworeda, based on the availability of different ecology zones, three villages, namely *Sekela*, *Yekegan* and *Yekebhana*, Were selected from *kolla*, *woinaDega* and *Dega*climatic zones respectively. From each village, ten percent of the households were randomly selected for data collection purposes. To include the local leader’s opinion, one village leader from each sample villages was interviewed. One development agent or social worker from each sample village was questioned. In addition, two officials from the District Agriculture and Rural Development Office in the area were interviewed. A total of one hundred thirty two respondents were reached for the purpose of this study.

In the analysis part of this study descriptive statistics was used. To check the existing of statistically significant relationship of the independent variables and dependent variables chi square test shall be employed. Finally, based on the result of the findings appropriate conclusions and recommendations were made.

Table 1: Characteristics of sample households in the EnemayWoreda

Characteristics		Villages		
		<i>SEKELA</i>	<i>YEKEGAN</i>	<i>YEKEBEHANA</i>
Total number of households		410	380	529
Sample households		41	38	53
Agro-climate		Tropical	sub-tropical	Temperate
Main crops*		TF, BN, SR,	TF, BN, WT, P, LT	WT, BR, BN
Main SWC measures**		ST/B, WW, CP	ST/B, DD, WW, CP	DD, GS, CP

* TF = *teff*, BN = beans, BR = barley, SR = sorghum, WT = wheat, P = peas, LT = lentils.

**ST/B = stone terraces/bunds, WW = waterways, DD = drainage ditches, GS = grass strips, CP = contour plowing.

3.3. Sampling Procedure

It is necessary to take a part of the population from which information is drawn to represent the entire population in the selected Wereda. The samples for this study were taken from the households of EnemayWereda. The Wereda have 27549 numbers of households and 165292 number of population (Central Statistical Agency of Ethiopia, 2007)

The sampling technique employed in this study area was stratified, purposive and simple random sampling techniques. Based on the information obtained from *Enemayworeda* agricultural and rural development office and preliminary field survey the Woreda have three agro-ecological zones. Then in the first stage the rural administration *kebele* of the wereda shall be stratified into three strata based on their agro-ecological zones i.e., *kolla*(Tropical), *Woindega*(sub-tropical) and *Dega*(temperate). Then, the researcher was selected one kebele from each agro-ecological zone purposively due to their accessibility to the main road and for representing different agro ecology zones. The selected villages include *Sekela*, *Yekegan* and *Yekebhana* from tropical, sub-tropical and temperate agro ecology zones respectively. The selected villages have a total household of 410(*Sekela*), 380(*Yekegan*) and 529(*Yekbhana*). To allow for adequate representation, 10% of households from each sub-village were randomly selected for inclusion in the sample. Total samples of 132 households were selected for interviews. A random sampling procedure was employed in selecting the sample households from lists of household heads (HH) that will make for each of these villages. Sampling is a common practice in research. The random sample of 10% of the villages and households selected for this study is considered to be representative enough for statistical analysis (Creswell & Clark, 2018).

3.4. Variables of the study

A farmer’s decision about SWC practices can be conceived of having two components: whether to use SWC practices and, if so, how many practices to use on how much land. Both of these components are assumed to be influenced by a number of factors that are related to a farmer’s objectives and constraints. The dependent and independent variables employed in this analysis are listed below. The independent variables are hypothesized to influence the use of soil and water conservation measures positively, negatively, or both positively and negatively.

Table 2: Classification of independent variable

No	Variable group	Individual variables
1	HH demography	Age, Education, Gender, family size...
2	Socio-economic	Farm size (area of cultivated, grass, land), ratio of total land to labor, livestock farming, off- farming income.

3	Institutional	Visited by DA (Extension service), Technical support, Training, security of land and market distance.....
4	Biophysical	Slope, level of soil fertility, type of soil erosion, distance of each plot from home.

3.5. Data source and method of collection

All the necessary data required for the study was obtained from both primary and secondary sources. Primary sources of data include personal observation of the researcher and questionnaires with selected sample residence of EnemayWereda. A secondary source of data is data that help to review the overall perception of farmers towards soil erosion and its conservation measures. Relevant documents concerning soil erosion was the major sources of secondary data.

Combination of the following data collection tools were employed to gather relevant information about the perception of farmers towards soil erosion and conservation measures in the study area. All the data were collected between November 2020- march 2021.

3.5.1. Field Observation and Informal Interviews

Field observation was conducted throughout the whole process of the research in order to ensure the validity of information obtained. It was aimed of understanding the local condition of the community in terms of their culture, farm practices and traditional way of resources utilization and application of conservation measures, etc. It was also done with the purpose of getting guidance for development of the formal question and to get additional information in related to soil erosion severity, existing soil conservation measures, yield conditions, soil color, topography and land use and land cover. In this regard, the three sampled rural kebeles were observed purposefully.

On the other hand informal interviews were carried out with farmers are aimed to obtaining information for developing to produce structured questionnaires which is the core instrument for collected information and was conducted in an informal and easy manner.

3.5.2. Questionnaires

This is the most important and largely used instrument for data collection tool in this research. Based on information acquired from informal discussion with farmers and field observation, and from literatures reading; structured questionnaire were developed and employed on 132 farm house holds randomly selected.

The survey was conducted using a structured survey questionnaire to obtain farmers' perception towards the problems of soil erosion and their conservation knowledge. Two enumerators were selected (one is high school teacher and the other is development agent (DA) for structured interviews. Prior to implementing the survey, the questionnaire was used to train enumerators and tested for their clarity.

The questionnaire was comprised of both open-ended questions and questions with codified answers, and was administered after pre-testing. The questions pertained to four main topics: (1) respondents in household characteristics, (2) land and landholding characteristics of respondent, (3) cause and effect of erosion, and (4) perception of respondent to soil conservation practices.

During the field survey, especially on the main topics of the questioner (cause and effect of erosion) the respondents were asked ranking and yes or no item questions regarding their perception to soil erosion. The first questions were about the causes and consequences of soil erosion. These questions involved 8 possible ranking choices and the respondents were asked to rank from the highest to the lowest level based on their perception towards each. These ranking questioners were used to analyze causes, extent and consequences of erosion in the study area. The second question on the cause and consequences of soil erosion was involved eight possible item of yes or no question and the respondents were asked to answer the question based on their perception towards each question. The yes or No questioners item were used to identify some of the factors that determined farmers' perception on the cause and consequences soil erosion.

3.5.3. Interview

An interview is collection of data through verbal interaction between individuals (Lang et al. 1991). The researcher prepared semi- structured interview guides. The last level of the informal interview was conducted with village extension workers. The interviews were intended to gather information about the type of soil conservation and fertility practice, farming practices, extent of using market inputs such as fertilizers, improved seeds, and the type of extension services rendered and also to establish if there is a gap in communication between farmers and extension workers.

3.5.4. Focus Group Discussions (FGD)

Additional information was obtained through community group discussions. Focus group discussion was conducted in all three kebeles with 24 selected farmers. In each sample kebeles, discussion groups were comprised of eight people, both males and females of differing ages. Eight farmers in a group were formulated in FGD. The approach Consider respondents age due to the farmers have adequate experience to provide good answers.

3.6. Methods of Data Analysis and Presentation

The survey was generated both qualitative and quantitative data, the first task is therefore to summaries, categories and code all qualitative responses into numeric values and then enter them in SPSS statistical program. The findings of the study were presented in tables, figures and charts. Some structured household survey data were analyzed using percentages, multiple response (frequency and cross tabulation), and descriptive statistics (frequency and cross tabulation) using the Statistical Package for Social Sciences (SPSS) for Windows 24.

Information obtained from focus group discussion and informal interviews with different elderly people in the kebeles and extension officer were mostly in form of verbal/narrative information. This information is more qualitative in nature and will be used to support the coded qualitative and quantitative data analysis.

CHAPTER FOUR

4. RESULTS AND DISCUSSION

4.1. Household Characteristics of the Respondents

From the total 132 respondents 78.79% (104) and 21.21% (28) were male and female respectively. According to the field survey the age-sex composition of the sample population is presented in table (3). Accordingly, respondent bellow age 41 constituted 39.3% of the total and above 40 the remaining 60.7%.

Table 3: Age-sex composition of sample households

Age group	Sex of respondents					
	Male		Female		Total	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
20-30	4	3	4	3	8	6
31-40	40	30.3	4	3	44	33.3
41-50	28	21.2	8	6.1	36	27.3
>50	24	18.2	20	15.2	44	33.4
Total	96	72.7	36	27.2	132	100

Source: Field Survey, 2021.

According to the field survey the distribution of the household by number of person is mainly dominated by household with 4-6 members. The household head with less than or equal to three (3) members make up 15.2%. Household with 4-6 members constituted 63.6% and household with 7 and above constituted the remaining 21.2%. Changes in the distribution of marital status have an important impact on the size and structure of families household. According to the field survey, 84.8% of the respondents were married, 9.1% were widowed and the reaming 6.1% were single. The level of literacy in the study area was low. Among the literacy category about 21.2% of the respondents were illiterate, 42.2% of the respondents could read and write. Only 36.7% of the total had any formal education, either at elementary or/and secondary level.

Table 4: Educational levels of sample household head

Educational level	Frequency	Percent
Illiterate	28	21.2
Adult literacy	56	42.4
Attend elementary education	24	18.2
Attend secondary education	12	9.1
Attend grade ten and above	12	9.1
Total	132	100

Source: Field Survey 2021.

4.2. Farmers' Perception on Erosion Problems, indicators and causes

4.2.1. Land size, soil fertility and land productivity

The availability of land and its size often affects farming practice and influences soil erosion process. Even though there had been large land size of agriculture in the study area, most of the agriculture land is fragmented and distributed to their child as they get married which resulted to the smallest land holding of the people and majority of the land in the area is not sufficient for small holder subsistence. As a result of it those farmers are used over and over their plots resulted in soil fertility and productivity yield reduction. This fragmentation of land paved the way to land degradation and discourage farmers not to participate in soil and water conservation in their farmland and to migrate in to near towns for season (mostly after harvesting their crops) for searching in non-farm activities. Farmers' response also revealed the existing land shortage. Out of 132 interviewed farmers, 87.5 percent of the household reported that the land they cultivate is insufficient to support their house hold and they are not imposition to inherit land from their parents when they get married the household land holding have decrease. Again 76.5 percent of sample households have less than 1 hectare of land

Farmers measurement and better solution for this cultivable land scarcity to be involving in non-farm activities such as daily laborers (39.5%) ,increasing the existing land productive by using modern technologies includes improved seed (48.5%), migration to other area (urban area) (12 %). None of the farmers suggested expanding cultivable land by cleaning forest and common land. This is agreeing with the finding of (Kibemo, 2011).

Farmers in the study area have a great knowledge of soil fertility they are cultivating. Farmers in the study area often perceive soil fertility associated with crop yield. About 84 percent of the farmer reported that their yield increases with the position of flat cultivated land, 12

percent of the respondent farmer chooses moderately stepping slope for high yield and 4 percent of the farmers preferred gentle undulating slope for high yield while none of the respondent preferred mountainous and large sloppy cultivated land. This is due to fear of high rainfall erodability and difficulty of cultivation of higher sloppy and mountainous areas.

According to the field survey 80% of the farmers reported decline of the productivity of their land. 16% and 4% of the respondent perceived they productivity of their land is improving and constant respectively. As the farmers indicated the main factors attributed for the decline of the productivity of their land were over cultivation 45.5%, remove of soil by erosion 72.7%, absence of fallowing 22.4% and 39.4% high cost of fertilizer mentioned as the causes for decline of their land productivity. This observation agrees with the findings of Aklilu et al., (2006 a) at Beressa watershed, central highlands of Ethiopia.

Table 5: Farmer’s perception on causes of productivity decline

Causes for productivity decline	Responses		
	Frequency	%	Percent of causes
Absence of fallowing	24	10.3	18.2
High coast of chemical fertilizer	52	22.4	39.4
Removal of RF soil by erosion	96	41.4	72.7
Over cultivation	60	25.9	45.5
Total	232	100	175.3

Source: Field survey, (2021).

4.2.2. Indicator, Causes, Extent and Consequences of Erosion

During the field survey, the respondents were asked to ranking regarding their perception to soil erosion. The first questions were about the cause of soil erosion and the second one was about consequence of soil erosion. Both questions were involved 8 possible ranking choices and the respondents were asked to rank from the highest to the lowest level based on their perception towards each.

Soil erosion was perceived by the farmers in the study area as a great hindering factor of their farming productivity. Farmers described existence of soil erosion on their land as Very slight, slight, moderate, severe, and very severe based on Haregeweyn et al. (2017) presented in (Table6)

The survey showed that 96.9% of the respondent farmers reported erosion problem on their farm land. The farmers rated the degree of soil erosion problem as Sever (18.2%), moderate (54.5%) and slight (24.2%). While (3.1%) of the respondent reported very slight erosion. This

is more than or comparable to the findings of other studies made in different part of the country. For instance, the study made in Hadiya Zone of SNNPR (Habtamu, 2006) indicated that about 74% of farmers interviewed perceived soil erosion problem on their cultivation field (Belay, 1992). Also other study in Beressa watershed indicated that among the interviewed farmers reported that erosion problems on their farmland 72% in Debele, 76% in Wushawushign, and 67% in Faji (Aklilu, 2006a).

Table 6: Farmers' expression of soil erosion by degree of severity (Haregeweyn et al. 2017)

Soil erosion severity level	Frequency	%
Very Severe	-	-
Severe	24	18.2
Moderate	72	54.5
Slight	32	24.2
Very slight	4	3.1
Total	132	100

Source: Field survey, (2021).

As mentioned by the majority of the farmer (Table 7) the dominant form of erosion in the study area was sheet and gully types. From the farmers who reported erosion problem, 39.4% mentioned the prevalence of sheet erosion, 36.4% mentioned the prevalence of gully erosion. The two forms of soil erosion together accounted for 75.8% of the total reported prevalence of erosion forms, while rill form of erosion is mentioned by 24.2% of the respondent farmers. However, the majority of the farmers reported that the extent of erosion problem as moderate and minor. From the field observation in Yekegan, Sekela and Yekebehanavillages' sheet forms of erosion caused considerable damage to the farmland. Especially in Yekegan village due to its slope that is plain land form farmers may have limited understanding of the severity of sheet erosion and this could influence their perception on sheet erosion negatively.

Table 7: Dominant forms of erosion in the study area

Forms of soil erosion	Frequency	Percent
Sheet	52	39.4
Rill	32	24.2
Gully	48	36.4
Total	132	100

Source: Field survey, (2021).

Among interviewed farmers, 36.3% and 21.2% farmers mentioned the causes for soil erosion as slope steepness of cultivated land and absence of soil conservation measures respectively (Table 8). This is clearly in agreement with the finding of Kibemo (2011) study on farmer perception on soil erosion in Sora district slope steepness mention as the main cause for soil erosion. Moreover, intensity of rainfall and deforestation mentioned as causes of soil erosion by 15.2% and 12.1% of the respondent farmers respectively. None of the farmers of the study area did not recognize terms of land preparation for cropping as causes for soil erosion in their farm land.

Out of the total possible causes of soil erosion farmers in the study area mentioned slope steepness (36.3%), absence of soil conservation measures (21.2%) and intensity of rainfall (15.2%) ranked from one up to three as the causes of soil erosion in higher percentage than the rest possible causes. In terms of sample villages, farmers of Yekebhana reported 18.2%, 9.2% and 5% that slope steepness of the cultivation land, absence of soil conservation measures and intensity of rainfall respectively as the causes of soil erosion in higher percentage. Even if this kebele is more a flat plain land, absences of forests are plying a major role in erosion process. In the remaining two sample villages of the study area, slope steepness of the cultivation land (10.1%), absence of soil conservation measures (10.5) and intensity of rainfall (6%) indicated by farmers of Yekegan, and by farmers of Sekela, absence of soil conservation measures (10.5%) and slope steepness (8%) and intensity of rainfall (4.2%) were mentioned as the causes of soil erosion one up to three.

Table 8: Respondent by their perception for the causes of soil erosion

Respondents' perception to the Causes of soil erosion	Frequency	Percent
Slope steepness of cultivated land	48	36.3
Ceaseless cultivation and absence of fallowing	8	6.1
Types of soil and erodibility	8	6.1
Intensity of rainfall	20	15.2
Absence and delay of soil conservation measures	28	21.2
Deforestation	16	12.1
Overgrazing	4	3
Terms of land preparation for cropping	-	-
Total	132	100

Source: field survey, (2021).

(Table 9) indicates that the number and percentage distribution of respondent who perceived the main indicators of soil erosion on their land. About 30.3 percent, 18.2 percent, 12.1 percent of the respondents were mentioned absence of fertile topsoil, Poor crop and grass growth, and rill and gully development and slope steepness as indicator of soil erosion on their farm land. And also about 12.1 percent of the respondents were mentioned root exposure and slope steepness each accounted as indicator of soil erosion. Observing the color of soil and accumulation of sediments near to valleys mentioned as indicators of soil erosion each by 6.1% of the respondent farmers. While the remaining 3% of the respondent mention stoniness of the soil as indicators of soil erosion.

Table 9: Perception of respondent for the indicators of soil erosion

Erosion indicators	Frequency	Percent
Rills and Gully development	16.	12.1
Observing the color of soil	8	6.1
Accumulation of sediments near to valleys	8	6.1
Stoniness of soil	4	3.0
Slope Steepness	16	12.1
Absence of fertile topsoil	40	30.3
Root exposure	16	12.1
Poor crop and grass growth	24	18.2
Total	132	100

Source: field survey, (2021).

Generally out of the total respondent about 48.5% reported that the main indicators of soil erosion were absence of fertile topsoil and poor crop & grass growth. In the area of the study villages farmers were perceived decreasing the productivity of their yield as the main indicate of soil erosion on their land.

Almost 57.5% of interviewed farmers mentioned the effect of soil erosion on their farm land is loss of top soil, about 33.3% and 24.2% of interviewed farmer mentioned the effects of soil erosion is formation of gullies and yield reduction over time respectively. In addition farmers reported that loss of vegetation cover and grass 9.1%, require high input and management (2.3%), change in soil color (3%),desertification and out migration (12.1%) and lack of farm land and grazing field (0.8%) as the effects of soil erosion by interviewed farmers in the study area, (see table 4.8) out of the first three reported effects of soil erosion loss of top soil

were indicated by almost farmers of Yekbehana (19.9%), Yekegan (11.4%) and Sekela (9.1%) from the total 57.5%.

Table 10: Perception of respondents for the consequence of soil erosion

Consequences	Frequency	%
Loss of topsoil	44	33.3
Reduction in yield over time	20	15.2
Development of gullies	32	24.2
Loss of vegetation cover and grasses	12	9.1
Change in soil color	4	3
Require high input and management	3	2.387
Lack of farm land and grazing field	1	0.8
Desertification, and out migration	16	12.1
Total	132	100

Source: Field survey, (2021).

4.3. Factors that influence farmers' perception towards the problem of soil erosion

This sections has examined farmers perception to the impact of back ground characteristics such as demographic and socio economic conditions towards on soil erosion. These characteristics include in this study were the respondents sex, age, household size, educational (literacy) level and farm size of the house hold.

The chi-square of independent was made to know whether or not there was a significance association between the independent variables (perception to the cause and consequence of soil erosion) and a set of explanatory variables with a significant level (P- Value). When P-value is < 0.05 at, there is a significant association between each of independent variable with dependent variable.

4.3.1. Relationship between Respondents Age and perception about causes and consequence of soil erosion.

Table (11) show that among young farmers 77%, 61.5%, 59.6%, ,57.7%,51.9% and 38.5% were reported that they are perceived soil erosion caused by intensity of rain fall, Absence and delay of soil and water conservation measure, overgrazing, deforestation, slope steepness of the cultivation land, and terms of land preparation for cropping respectively . On the other hand old age group (> 40) farmers who accounted for 58.8% (deforestation and desertification), 52.5 %(overgrazing), 50 %(Slope steepness of the cultivation land and 45%

(intensity of rainfall) mentioned as the causes of soil erosion in higher percentage than the young age farmers. Generally, Chi square test indicate that a significant association was found between age of the respondents and perception in related to the causes of soil erosion in four major causes of soil erosion (slope steepness of cultivated land, types of soil and its erodability, intensity of rainfall and absence & delay of soil and water conservation measures) with ($X^2= 9.568$ at $p=0.002$, $X^2=28.401$ at $p=0.000$, $X^2= 13.148$ at $p=0.000$ and $X^28.108$ at $p=0.004$).

Table 11: Respondents' age and perception towards the causes of soil erosion

Causes of soil erosion	Age categories								P-Value	
	20-40		>40		X ²	P-Value				
	Yes	No	Yes	No						
N	%	N	%	N	%	N	%			
Slope steepness of the cultivation land	40	51.9	12	48.1	40	50	40	50	9.568	0.002**
Ceaseless cultivation and absences of fallowing	24	30.8	28	69.2	29	36	51	64	1.286	0.257
Types of soil and its erodibility.	44	59.6	8	40.4	30	37.5	50	62.5	28.401	0.000**
Intensity of rainfall	40	77	12	23	36	45	44	55	13.148	0.000**
Absence and delay of soil and water conservation measures	32	61.5	20	38.5	29	36.2	51	63.8	8.108	0.004**
Deforestation and desertification	30	57.7	22	42.3	47	58.8	33	41.2	0.015	0.904
Overgrazing	31	59.6	21	40.4	42	52.5	38	47.5	0.645	0.422
Terms of land preparation for Cropping	20	38.5	32	61.5	22	27.5	58	72.5	1.745	0.186

Sources: Field survey, (2021). ** Statistically significant.

According to the field survey old age group (>40) farmers seems better in their understanding than young age (20-40) farmers in 6 possible consequence of soil erosion. Table (12) show that among old age farmers which accounted 73.8% of them reported that (reduction in Yield over time), 68.8% (Reproduction of gullies), 80% (loss of vegetation cover and grasses), and 48.8 % (change in soil color), 70% lack of farm land and grazing and 67.5 % (desertification and out migration) perceived that as consequence of soil erosion in better percentage than their counter parts. On other hand young age group (20-40) farmers are better in perceiving

loss of top soil, and require high input and managements. Generally, Chi square test indicate that a significant association was found between age of the respondents and perception in related to the consequences of soil erosion in four major consequences of soil erosion (loss of top soil, loss of vegetation cover and grasses, lack of farmland and grazing and desertification and outmigration) with $\chi^2=14.423$ at $p =0.000$, $\chi^2=19.720$ at $p =0.000$, $\chi^2=8.709$ at $p =0.003$ and $\chi^2=27.084$ at $p =0.000$ respectively.

Table 12: Respondents in their age and perception towards the consequence of soil erosion

No	Effects of soil erosion	Age categories								X ²	P-Value
		20-40				>40					
		Yes		No		Yes		No			
N	%	N	%	N	%	N	%				
1	Loss of top soil	47	90.4	5	9.6	48	60	32	40	14.423	0.000**
2	Reduction in Yield over time	36	69.2	16	30.8	59	73.8	21	26.2	0.319	0.572
3	Reproduction of gullies	27	52	25	48	35	68.8	25	31.2	3.782	0.051
4	Loss of Vegetation cover and Grasses	22	42.3	30	57.7	64	80	16	20	19.720	0.000**
5	Change in soil Color.	24	46.2	28	53.8	39	48.8	41	51.2	0.085	0.770
6	Require high input and Management.	43	82.7	9	17.3	58	72.5	22	27.5	1.822	0.177
7	Lack of farm land and grazing	23	44.2	29	55.8	56	70	24	30	8.709	0.003**
8	Desertification and out migration.	11	21.2	41	78.8	54	67.5	26	32.5	27.084	0.000**

Sources: Field survey, (2021). ** Statistically significant.

4.3.2. Relationship between respondents' sex and perception about the causes and Consequence of soil erosion.

Table (13) shows that among male farmers absence and delay of soil and water conservation measure 100%, over grazing 100% (deforestation and desertification), 91.7 % and slope steepness of the cultivated land 70.8 were found better in percentage perceived as a causes of soil erosion than a female farmers. The female farmers were better perceiving the causes of

soil erosion in higher percentage in intensity of rain fall 94.4%, terms of land preparation fallowing (60%), types of soil and erodibility (40%), deforestation and desertification (73.3%) and overgrazing (30%) than their counter parts.

Generally, Chi square test indicate that a significant association was found between sex of the respondents and perception in related to the causes of soil erosion in types of soil and its erodibility, intensity of rainfall, absence of SWC, overgrazing and terms of land preparation for cropping ($X^2=4.393$ at $p=0.036$, $X^2= 8.142$ at $p=0.004$, $X^2=74.275$ at $p=0.000$, $X^2=18.000$ at $p=0.000$ and $X^2=27.710$ at $p<0.05$). See (Table 13).

Table 13: Respondents in their sex and perception towards the causes of soil erosion

No	Causes of soil erosion	Sex categories								X^2	p-value
		Male				Female					
		Yes		No		Yes		No			
		N	%	N	%	N	%	N	%		
1	Slope steepness of the cultivation land	68	70.8	28	29.2	24	66.7	12	33.3	0.215	0.643
2	Ceaseless cultivation and absences of fallowing	59	61.4	37	38.6	15	41.7	21	58.3	4.163	0.643
3	Types of soil and its erodibility.	62	64.5	24	35.5	16	44.4	20	55.6	4.393	0.036**
4	Intensity of rainfall	61	63.5	25	36.5	34	94.4	2	5.6	8.142	0.004**
5	Absence and delay of soil and water conservation measure	96	100	0	-	13	36.1	23	63.9	74.275	0.000**
6	Deforestation and Desertification	88	91.7	8	8.3	28	77.8	8	22.2	4.741	0.29
7	Overgrazing.	94	100	2	-	27	75	9	25	18.000	0.000**
8	Terms of land preparation for cropping	18	18.8	78	81.2	24	66.7	12	33.3	27.710	0.000**

Sources: Field survey, (2021). ** Statistically significant.

Table 14: Respondents in their sex and perception towards the consequence of soil erosion

Effects of soil erosion	Sex categories								X ²	p-value
	Male				Female					
	Yes		No		Yes		No			
	N	%	N	%	N	%	N	%		
1. Loss of top soil	91	94.8	5	5.2	23	63.9	13	36.1	21.231	0.000**
2. Reduction in Yield over time	88	91.7	8	8.3	28	77.8	8	22.2	14.741	0.029**
3. Reproduction of gullies	85	88.5	11	11.5	25	69.4	11	30.6	6.875	0.009**
4. Loss of Vegetation cover and grasses	83	86.5	13	13.5	24	66.7	12	33.3	6.680	0.010**
5. Change in soil Color	52	54.2	44	45.8	12	33.3	24	66.7	4.550	0.033**
6. Require high input and management.	67	69.8	29	30.2	27	75	9	25	0.346	0.556
7. Lack of farm land and grazing	78	81.5	18	18.7	28	77.8	8	22.2	0.200	0.655
8. Desertification and out migration.	70	73	26	27	2	58.3	15	41.	2.600	0.107
					1		7			

Sources: Field survey, (2021). ** Statistically significant.

(Table 14) indicated that male farmers were found better in perception in seven possible consequence of soil erosion than their counter parts. Generally, Chi square test indicate that a significant association was found between sex of the respondents and perception in related to the effects of soil erosion in five possible effects of soil erosion (X²= 21.231 at P=0.000, X²=14.741 at p=0.029, X²=6.875 at p=0.009, X²=6.680 at p=0.010 and X² =4.550 at p=0.033,loss of top soil, reduction in yield over time, reproduction of gully, loss of vegetation cover & grasses and change in soil color).

4.3.3. Relationship between respondents' Literacy status /Education level and perception about the causes and consequence of soil erosion.

The literacy status of farmers is useful to know their perception about the current soil erosion problem. The data presented in Table (15) indicated that literate farmers were found better in perception in four possible causes of soil erosion than in their counter parts ceaseless cultivation and absence of fallowing (56.8%), absence and delay of soil conservation measure(91%), 83% deforestation and desertification), 43% (terms of land preparation).

Generally, Chi square test indicate that a significant association was found between literacy states of the respondents and perception in related to the causes of soil erosion only in one possible causes of soil erosion ($X^2 = 4.366$ at $P=0.037$) intensity of rainfall .This clearly provides support for the findings of Shibru (2010) who stated that education is one factor which appears to have an influence on local people's perception towards the causes of soil erosion. He found that the educated farmers perceived deforestation as causes of soil erosion than illiterate farmers in his study area.

Table 15: Respondents in their literacy status and perception towards the causes of soil erosion

Causes of soil erosion	Education level of the house hold head								X^2	p-value
	Literate				Illiterate					
	Yes		No		Yes		No			
	N	%	N	%	N	%	N	%		
1. Slope steepness of the cultivation land	59	61.1	36	37.9	29	78.4	8	21.6	3.173	0.075
2. Ceaseless cultivation and absences of fallowing	54	56.8	41	43.2	16	43.2	21	56.8	1.977	0.160
3. Types of soil and its erodibility.	71	74.7	24	25.3	29	78.4	8	21.6	0.192	0.661
4. Intensity of rainfall	59	62.1	36	37.9	30	81.1	7	18.9	4.366	0.037**
5. Absence and delay of soil and water conservation Measure	91	95.8	4	4.2	52	86.5	5	13.5	3.627	0.057
6. Deforestation and Desertification	83	87.4	12	12.6	29	78.4	8	21.6	1.674	0.196
7. Overgrazing.	87	91.6	8	8.4	33	89.2	4	10.8	0.184	0.668
8. Terms of land preparation for cropping	43	45.3	52	54.7	16	43.2	21	56.8	0.044	0.834

Sources: Field survey, (2021). ** Statistically significant.

The literacy status of farmers also influences their perception about the consequence of soil erosion. The literate farmers were found better in perceiving five possible consequences of soil erosion in higher percentage than their counter parts. These include reduction of yield over time, reproduction of gullies, loss of vegetation cover and grasses, change in soil color and Lack of farm land and grazing (See Table 16).

Table 16: Respondents in their literacy status and perception towards the consequence of soil erosion

Effects of soil erosion	Education level of the house hold head								X ²	p-value
	Literate				Illiterate					
	Yes		No		Yes		No			
	N	%	N	%	N	%	N	%		
1. Loss of top soil	82	86.3	13	13.7	32	86.5	5	13.5	0.001	0.980
2. Reduction inYield over time.	79	83.2	16	16.8	29	78.4	8	21.6	0.409	0.523
3. Reproduction of gullies.	83	87.4	12	12.6	30	81.1	7	18.9	0.854	0.355
4. Loss ofVegetationcover and grasses	78	82.1	17	17.9	27	73	10	27	1.365	0.243
5. Change in soilColor.	50	52.6	45	47.4	11	29.7	26	70.3	5.619	0.018**
6. Require high input and management.	67	70.5	28	29.5	28	75.7	9	24.3	0.095	0.927
7. Lack of farmland and grazing	84	88.4	11	11.6	24	64.9	13	35.1	9.933	0.002**
8. Desertification and out migration.	70	73.	25	26.	32	86.5	5	15.5	2.485	0.115
		7		3						

Sources: Field survey, (2021). ** Statistically significant.

Generally, Chi square test indicate that a significant association was found between literacy status of the respondents and perception in related to the effects of soil erosion in only two

possible effects of soil erosion ($X^2 = 5.619$ at $P=0.018$, $X^2 = 9.933$ at $p=0.002$ change in soil color and lack of farm land and grazing respectively).

4.3.4. Relationship between respondents' house hold size and perception about the causes of soil erosion.

According to the field survey the distribution of the house hold by number of person is mainly dominated by house hold with up to seven members'. The data presented in Table (17) show that nearly 83.1% of the respondent had at least six house hold members. The remaining respondent had more than six members. Among the respondent of household which have greater than six members had better perception in higher percentage than their counter parts in five possible causes of soil erosion.

Generally, Chi square test indicate that a significant association was found between house hold size of the respondents and perception in related to the causes of soil erosion in three possible causes of soil erosion with ($X^2 = 17.307$ at $P=0.000$, $X^2 = 5.157$ at $P=0.023$ and $X^2 = 5.530$ at $P=0.019$ Ceaseless cultivation and absences of fallowing, absences and delay of soil conservation and measure and Overgrazing).

Table 17: Respondents in their size of household and perception towards the causes of soil erosion

Causes of soil erosion	Size of house hold								X^2	p-value
	Up to 6 members				More than 6 members					
	Yes		No		Yes		No			
N	%	N	%	N	%	N	%			
1. Slope steepness of the cultivation land	24	75	8	25	68	68	32	32	62.05	0.453
2. Ceaseless cultivation and absences of fallowing	7	21.9	25	78.1	64	64	36	36	17.307	0.000*
3. Types of soil and its erodibility.	20	62.5	12	37.5	76	76	24	24	2.228	0.136
4. Intensity of rainfall.	28	87.5	4	12.5	72	72	28	28	3.171	0.075
5. Absence and delay of SWC	27	84.5	5	15.6	96	96	4	4	5.157	0.023*
6. Deforestation and desertification	28	87.5	4	12.5	91	91	9	9	0.334	0.563
7. Overgrazing.	23	71.9	9	28.1	89	89	11	11	5.530	0.019*
8. Terms of land preparation for cropping	8	25	24	75	32	32	68	68	0.562	0.453

Sources: Field survey, (2021). ** Statistically significant.

(Table 18) showed that among the respondent households with the size of greater than six members were found better in perceiving on eight the total possible consequences of soil erosion in higher percentage than their counter parts. The result revealed that size of household has great influence on causes of soil erosion in a particular study woreda.

Generally, Chi square test indicate that a significant association was found between house hold size of the respondents and perception in related to the effects of soil erosion in six possible consequence soil erosion with($X^2=16.410$ at $p=0.000$, $X^2=28.982$ at $p=0.000$, $X^2=7.798$ at $p=0.005$, $X^2=22.206$ at $p=0.000$, $X^2=6.468$ at $p=0.011$ and $X^2=10.630$ at $p=0.001$, loss of top soil, reduction in yield over time, reproduction of gullies, loss of vegetation and grasses lack farm land and grazing and desertification and out migration).

Table 18: Respondents in their house holds size and perception towards the consequence of soil erosion.

Effects of soil erosion	Size of house hold								X^2	p-value
	Up to six members				More than six members					
	Yes		No		Yes		No			
	N	%	N	%	N	%	N	%		
1. Loss of top soil	20	62.5	12	37.5	92	92	8	8	16.410	0.000**
2. Reduction in Yield over time.	19	59.4	13	40.6	96	96	4	4	28.982	0.000**
3. Reproduction of gullies.	24	75	8	25	93	93	7	7	7.798	0.005**
4. Loss of Vegetation cover and grasses	21	65.6	11	34.4	96	96	4	4	22.206	0.000**
5. Change in soil Color.	12	37.5	20	62.5	52	52	48	48	2.041	0.153
6. Require high input and management.	24	75	8	25	88	88	12	12	3.187	0.074
7. Lack of farmland and grazing	22	68.8	10	31.2	88	88	12	12	6.468	0.011**
8. Desertification and out migration.	18	56.3	14	43.8	84	84	16	16	10.630	0.001**

Sources: Field survey, (2021). ** Statistically significant.

4.3.5. Relationship between respondents' farm size and their perception about the Causes of Soil erosion.

According to the field survey, about 76.8 of the respondent has less than or equal to one hectare of land and only 23.2% had more than 1 hectare of land. The data presented in table 19 showed that among the farmers who have less than 1 hectare of land found better in perceiving in five possible causes of soil erosion and reported that 55.7% (ceaseless cultivation absence of fallowing), 41%(types of soil erodibility), 71.4% (slope steepness of the cultivation land), 71.4 % ceaseless cultivation and absences of fallowing, 81% (types of soil and its erodibility),76.2% (intensity of rain fall) and 95.2%(absence and delay of soil and water conservation measure) as the causes of soil erosion in higher percentage than the farmers who has more than one hectars of land.Generally, Chi square test indicate that a significant association was found between farm land size of the respondents and their perception in related to the effects of soil erosion in only in three possible causes of soil erosion ($X^2=26.557$ at $P=0.000$, $X^2 = 7.879$ $P=0.005$, $X^2= 5.238$ at $P=0.022$, ceaseless cultivation &absence of fallowing, types of soil and its erodibility, deforestation and desertification respectively

Table 19: Respondents in their farm size and perception towards the causes of soil erosion

Causes of soil erosion	Size of house hold								X ²	p-value
	Up to one hectare				More than one hectare					
	Yes		No		Yes		No			
	N	%	N	%	N	%	N	%		
1. Slope steepness of thecultivation land	60	71.4	24	28.6	28	58.3	20	41.7	2.357	0.125
2. Ceaselesscultivation andabsences of fallowing	60	71.4	24	28.6	12	25	36	75	26.557	0.000**
3. Types of soil and itserodibility.	68	81	16	19	28	58.3	20	41.7	7.879	0.005**
4. Intensity of rainfall.	64	76.2	20	23.8	36	75	12	25	0.024	0.878
5. Absence anddelay of soil andwater conservationmeasure	80	95.2	4	4.8	44	91.7	4	8.3	0.684	0.408
6. Deforestation and desertification	80	95.2	4	4.8	40	83.3	8	16.7	5.238	0.022**
7. Overgrazing.	76	90.5	8	9.5	44	91.7	4	8.3	0.052	0.819
8. Terms of land preparationfor cropping	28	33.3	56	66.7	12	25	36	75	1.004	0.316

Sources: Field survey, (2021). ** Statistically significant.

Table 20 indicated that among the farmers who have less than or equal to 1 hectare of land perceived the consequence of soil erosion as loss top soil (95.2%), reduction yield over time

(90.5%) loss of vegetation cover and grass (85.7%), change in soil color(61.9), require high input and management (72.6%), lack of farm land and grazing (85.7%) and desertification and out migration (80.9%) in higher percentage than farmers who had more than 1 hectare of land. They also found better in perception in seven of possible effects of soil erosion in higher percentage than their counter parts. According to the result one can conclude that the Careless cultivation and absences of fallowing as well as soil types become the main causes of soil erosion regarding on farm size in the household levels.

Generally, Chi square test indicate that a significant association was found between farm land size of the respondents and perception in related to the effects of soil erosion in only in three possible effects of soil erosion ($X^2=11.745$ at $P=0.001$, $X^2= 5.691$ at $P=0.017$, $X^2= 9.983$ at $P=0.002$, loss top soil, reduction yield over time, change in soil color respectively. See (Table20)

Table 20: Respondents in their farm size and perception towards the consequences of soil erosion

No	Effects of soil erosion	Size of house hold								X ²	p-value
		Up to one hectare				More than one hectare					
		Yes		No		Yes		No			
		F	%	F	%	F	%	F	%		
1	Loss of top soil	80	95.2	4	4.8	36	75	12	25	11.745	0.001**
2	Reduction in Yield over time.	76	90.5	8	9.5	36	75	12	25	5.691	0.017**
3	Reproduction of gullies.	72	85.7	12	14.3	44	91.7	14	8.3	1.016	0.313
4	Loss of Vegetation cover and grasses	72	85.7	12	14.3	40	83.3	8	16.7	0.135	0.714
5	Change in soil color	52	61.9	32	38.1	16	33.3	32	66.7	9.983	0.002**
6	Require high input and Management.	64	76.2	20	23.8	32	66.7	16	33.3	1.397	0.237
7	Lack of farm land and Grazing	72	85.7	12	14.3	36	75	12	25	2.357	0.125
8	Desertification and out Migration.	68	80.9	16	19.1	36	75	12	25	0.648	0.421

Sources: Field survey, (2021). ** Statistically significant.

Generally p-value less than alpha ($p < 0.05$), we conclude that there is statically significant the relationship between independent and dependent variables. And also when p-value greater than alpha the chi-square analysis showed that no significant association between the independent and dependent variables.

The Chi square test indicate that a significant association was found between age of the respondents and perception in related to the causes of soil erosion in four causes of soil erosion (slope steepness of the cultivated land, type (nature) of the soil, intensity of rainfall and absence of SWC methods $X^2 = 9.568$ at $p < 0.05$, $X^2 = 28.401$ at $p < 0.05$, $X^2 = 13.148$ at $p < 0.05$ and $X^2 = 8.108$ at $p < 0.05$). According to the filed survey old age group (> 40) farmers seems better in their perception than young age farmers (20- 40) in six possible consequence of soil erosion. A significant association was found between age and their perception in related to the 8 possible consequences of soil erosion on four possible consequences of soil erosion (with $X^2 = 14.423$ at $p = 0.000$, $X^2 = 19.720$ at $p = 0.000$, $X^2 = 8.709$ at $p = 0.003$ and $X^2 = 27.084$ at $p = 0.000$ respectively). The female farmers were better perceiving the causes of soil erosion in higher percentage in slope steepness of the cultivated land (53.3%), ceaseless cultivation and absences of fallowing (60%), types of soil and erodibility (40%), deforestation and desertification (73.3%) and overgrazing (30%) than their counter parts. However, Chi square test indicate that a significant association was found between sex of the respondents and perception in related to the causes of soil erosion in types of soil, absence of SWC, overgrazing and terms of land preparation for cropping ($X^2 = 4.393$ at $p = 0.036$ $X^2 = 8.142$ at $p = 0.004$, $X^2 = 74.275$ at $p = 0.000$, $X^2 = 18.000$ at $p = 0.000$ respectively). In addition male farmers were found better in perception in seven possible consequence of soil erosion than their counter parts.

Generally, Chi square test indicate that a significant association was found between sex of the respondents and perception in related to the effects of soil erosion in five possible effects of soil erosion ($X^2 = 21.231$ at $P = 0.000$, $X^2 = 14.741$ at $p = 0.029$, $X^2 = 6.875$ at $p = 0.009$, $X^2 = 6.680$ at $p = 0.010$ and $X^2 = 4.550$ at $p = 0.033$ loss of top soil, reduction in yield over time, reproduction of gully, loss of vegetation cover and change in soil color respectively).

The result of the study indicated that literate farmers were found better in perception in four possible causes of soil erosion in higher percentage than in their counter parts. These include continuous cultivation and absence of fallowing (56.8%), absence and delay of soil conservation measure (95.8%), 87.4 % (deforestation and desertification), overgrazing (91.6) and 45.3 % (terms of land preparation). However, Chi square test indicate that a significant association was found between literacy states of the respondents and perception in related to

the causes of soil erosion in only in one possible causes of soil erosion ($X^2 = 4.366$ at $P=0.037$ with intensity of rainfall). The literate farmers were found better in perceiving five possible consequences of soil erosion in higher percentage than the counter parts .These include(83.2%) reduction in yield over time, (87.4%)reproduction of gullies,(82.1%) loss of vegetation cover and grasses,(52.6%)change in soil color and (88.4%)lack of farm & grazing lands. However, Chi square test indicate that a significant association was found between literacy states of the respondents and perception in related to the effects of soil erosion in only two possible effects of soil erosion change in soil color and lack of ($X^2 = 5.619$ at $P=0.018$, $X^2 =9.933$ at $p=0.002$ farm land respectively).

Nearly 75.8 percent of the respondents' farmers had six and above house hold members and had better perception in higher percentage than their counter parts in six possible causes of soil erosion. Generally, Chi square test indicate that a significant association was found between house hold size of the respondents and perception in related to the causes of soil erosion in three possible causes of soil erosion($X^2 = 17.307$ at $P=0.000$, $X^2= 5.157$ at $P=0.023$ and $X^2=5.530$ at $P=0.019$ ceaseless cultivation, absences and delay of soil conservation and measure and overgrazing). The results of this study show that among the respondents house hold with the size of greater than six members were found better in perceiving on eight possible consequences of soil erosion in higher percentage than their counter parts. They reported loss of top soil (92%), reduction in yield over time (96%), reproduction of gullies (93), loss of vegetation cover and grass (96%), change in soil color (52%),require higher input and management(88%) lack of farm and grazing land (88%) and desertification& out migration(84). However , Chi square test indicate that a significant association was found between house hold size of the respondents and perception in related to the effects of soil erosion in only six possible effects of soil erosion $X^2=16.410$ at $p=0.000$, $X^2=28.982$ at $p=0.000$, $X^2=7.798$ at $p=0.005$, $X^2=22.206$ at $p=0.000$, $X^2=6.468$ at $p=0.011$ and $X^2=10.630$ at $p=0.001$ loss of top soil, reduction of yield over time reproduction of gullies, loss of vegetation, lack of farm land and grazing, and desertification respectively.

Farmers who have less than or equal to 1 hectare of land have been perceived the consequence of soil erosion as loss top soil (95.2%), reduction of yield over time (90.5%) loss of vegetation cover and grass (85.7%), change in soil color (61.9%), desertification and out migration (80.9%), require high input & management(76.2%) and lack of farmland and grazing land (60.7%) in higher percentage than farmers who had more than 1 hectare of land. They also found better in perception in seven of possible effects of soil erosion in higher percentage than their counter parts. Generally, Chi square test indicate that a significant

association was found between farm land size of the respondents and perception in related to the effects of soil erosion in only three possible effects of soil erosion ($X^2=11.745$ at $P=0.001$, $X^2= 5.691$ at $P=0.017$, $X^2= 9.983$ at $P=0.002$ loss of top soil, reduction yield over time and change in soil respectively).

4.4. Training on soil erosion and conservation practices

According to the field survey and discussion with farmers, they have knowledge on causes, extents and consequences of soil erosion on their living with different level. Farmers who had no access to training gained experience from their neighbors and traditionally from their elders. Farmers adjacent to each other can acquire experience in either strength or weakness of specific soil conservation measures from nearby farmers and neighboring kebeles. According to the field survey and discussion with farmers, they have knowledge on causes, extents and consequences of soil erosion on their living with different level. Farmers who had no access to training gained experience. About 82.6% of the surveyed farmers got training on soil conservation applications and from these 70.5% have got only a limited training and only 12.1 % have received adequate training (Table 21). About 17.4% of the surveyed farmers did not get training.

Farmers require training on soil and water conservation, crop production and yield maximization, yield storage system, enhancing soil fertility and land tenure and land use. The construction soil conservation structure requires relatively frequent training and support. In the study area there were construction of structural soil conservation particularly bunding (soil and stone) in steep slope area, stone terrace and cheeks dam along in gullies developed area with the participation farmers and DAs.

Table 21: Respondents in their getting training on soil and water conservation practices.

Training on soil and water conservation	Frequency	Percent
Always	16	12.1
Some times	93	70.5
Never	23	17.4
Total	132	100

Source, Field Survey (2021).

Table 22 indicated that with the application of conservation measure and its changes observe in the study area about 25.3% of the respondents mentioned that they could prevent soil erosion after they apply conservation measures on their farm lands .Hence due to application

of water and soil conservation measures land cover condition in the study area were improved. Among the total respondents 31.6% reported such changes. Many farmers mentioned referred the changes observed in their farm lands after soil water and conservation measure was taken. These includes 23.7 % (increase soil fertility) and 19.4 % (increase in land productivity) are the changes they observe as the result of conservation measure.

Table 22: Percentage distribution of changes because of conservation practices.

Changes	Frequency	Percent	Percent of Case
Increased soil fertility	72	23.7	54.5
Increased in land cover	96	31.6	72.7
Increased in land productivity	59	19.4	44.7
Prevented soil erosion	77	25.3	58.3
Total	304	100	230

Sources: Field survey, (2021).

Farmers' willingness to use soil and water conservation (SWC) practices is largely determined by their knowledge of the problem of soil erosion. The results of field survey showed that almost all of the farmers in the study areas recognized soil erosion problems, and were of the opinion that conservation was necessary. Out of the total respondent 97.1% believe that erosion can be controlled if necessary conservation measures are applied. The measures mentioned include stone terraces, drainage ditches, bunding, contour plowing, vegetative and crop cover, strip-cropping and tree planting (Table 23). Check dams, terracing / bunding and tree planting constituted the most important local conservation measures.

Table 23: percentage distribution of types of practiced conservation methods.

Conservation methods	Responses		
	N	%	Percent of causes
Cultivation along the contour	88	25.4	66.6
Terracing	87	25.1	65.9
Strip-cropping along the contour	27	7.8	20.5
Drainage ditches	30	8.7	22.7
Leaving crop residue and covering the land	36	10.4	27.3
Controlling gullies	37	10.7	28
Tree planting	41	11.8	31
Total	346	100	262

Sources: Field survey, (2021).

On steep eroded bare lands stone terraces are most used structures in study area (65.9%). According to the EnemayWoreda office of agriculture Yekebhana, Yekegan and Sekela sample villages, 18 km, 23 km and 27 km stone terraces were constructed respectively. As it is stated by key informants during focus group discussion the stone terraces are considered effective in erosion control in slope areas, although it is labor-intensive, hosts rodents, and returns investment only gradually.

Trees are planted along the contour sometimes together with other conservation practices. This type of conservation method is applied by 31% of the respondents in order to reduce runoff and conserve the soil and water round the root of the plants. Trees help to preserve fertility of the soil through the return of organic matter and the fixation of nitrogen. They improve 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 (Akililu, 2006 a). In certain study areas, lands are closed off to livestock to protect it from grazing and planted with trees for regeneration.

Drainage ditches are one of the widely used soil and water conservation practices in the study area and also known as traditional ditches. Locally farmers in the study area, call the drainage ditches "boye" ("feses"). These are micro channels constructed on cultivated farms to drain off excess water and control soil erosion. Out of total respondents, 22.7% applied indigenous drainage ditches. These are low cost measures in which construction is part of the normal ploughing activity.

Leaving crop residues on the field after harvest is another traditional practice used by the farmers in the area. The survey results showed that only 27.3% of the farmers implemented this type of measure to improve the fertility of soil and there by protect soil from erosion.

Strip cropping refers to the practice of growing crops in alternate strips of row crops or forage/grass. This cropping system is an effective practice to reducing soil erosion because it breaks sloping landscapes in wide segments with diverse vegetative cover which intercepts runoff and promotes water infiltration, thereby reducing runoff and soil erosion. In the study area from the sample farmers 20.5 % applied this method.

Contour ploughing is a practice of tilling the land along the contours of the slope in order to reduce the runoff on a steep sloping land. Cultivation along the contour is the practice of tilling, planting, and performing all agricultural operations following the contour lines of the field slope. In the study area of all the sample hose holds 66.6 % applied this structure and carried out using the ox-drawn plough. Hence, it is part of the normal farming activity; it needs no extra labor and time for construction.

4.5. Respondents' Information Sources on soil and water conservation practices.

(Table 24), shows the information sources of the respondents on soil and water conservation practices. The result shows that DAs and extension agents were indicated by the respondents' as a most significant source of information. About 84.8% of the respondents used DAs and extension agents as a source. While 9.1% of the respondents indicated they are traditional sources and 6.1% neighbors use as sources of information on soil and water conservation practice.

Table 24: Respondents in their information sources about soil and water conservation practices.

Sources of Information	Frequency	Percent
Traditionally	12	9.1
From neighbors	8	6.1
DAs and extension experts	112	84.8
Total	132	100

Source Field Survey (2021).

4.6. Farmers' Contact with Development Agents (DAs)

Access for information and contact with DA has a role on the practice of soil conservation measures and to adopt new technology. Having good relation with DA helps farmers in reducing hazard associated with soil erosion and conservation strategy by providing information. Among respondent farmers, 90.2% have contact with development agents. Of these farmers, 20.5%, 57.6% and 12.1% had contact with DAs limited, good and very good respectively table. However, 9.8% of farmers have no contact with development agents and other soil conservation experts.

Table 25: Percentage distribution of respondents in their degree of contacts with DAs.

Degree of contact with Das	Frequency	Percent
Very good	16	12.1
Good	76	57.6
Limited	27	20.5
None	13	9.8
Total	132	100

Source, Field survey (2021).

The major problem that faces farmers on the practice of constructing soil or stone bunds on plots that is flat and not susceptible to erosion. The farmers in the study area criticized this

result in related to water logging problem on their agricultural field. Also they complain about stone terraces saying that it is conducive for the growth of rodents particularly rats that are very dangerous for agricultural production. They also strongly mentioned it is difficulty when they make oxen plowing. In addition to this farmers indicated that conservation structures can take part of their available cultivated land.

Table 26: SWC and its associated problems perceived by farmers.

SW conservation related problems	Soil bunds			Drainage diversion			Covering gullies with grass		
	freq.	Perce.	%(cases	freq.	Perce.	%(cases	freq.	Perce.	%(cases
Sources of rodents	55	18.3	41.7	4	2.1	3	68	22.2	51.5
Scarcity of land	57	19.1	43.2	40	20.5	30.3	32	10.5	24.2
Difficulty during plough	64	21.3	48.5	24	12.3	18.2	64	20.9	48.5
Needs large labor	48	16	36.4	60	30.8	45.5	44	14.4	33.3
Difficult to perform	24	8	18.2	32	16.4	24.2	60	19.6	45.5
Needs large capital	52	17.3	39.4	35	17.9	26.5	38	12.4	28.8
Total cases	300	100	227.4	195	100	147.7	306	100	231.8

Source, Own surveys (2021).

(Table 26), illustrates that the problem related to SW conservation methods faced on the study area were soil bunds (48.5 %), drainage diversion (45.5 %) and covering gullies with grass (51.5%), as difficulty for oxen ploughing , needs large labor force and sources of rodents respectively.

4.7. Findings from key informants, interview and observation

Farmers who had been tried to implement conservation measures in their plots were interviewed to determine how they had measured the effectiveness of SWC technologies. Accordingly, they had already observed better growth and development of crops, particularly along the structures where fertile sediments were trapped. They also evaluated that the amount of sediment trapped by the structure was very high and would have been lost from the field had that conservation structure not been built. Furthermore, during group discussion, participants who treated their lands by conservation structures gave witness to the group that the technology they have been using improved their land productivity and obtained more yield than before. Therefore, farmers were able to differentiate indicators of “acceptance” such as knowledge about introduced SWC technologies, its effectiveness in arresting soil

erosion as well as its potential to improve land productivity. On the other hand, acceptance of the technologies as effective measures against soil erosion and as having potential to improve land productivity cannot warrant its adoption at the farm level. While acceptance depends more on the design characteristics of technologies as related specifically to its effectiveness in arresting soil loss, farm level adoption of the technologies depends also on several socioeconomic and institutional factors

CHAPTER FIVE

5. SUMMARY OF MAJOR FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

5.1. Summary of major findings

Primarily the objective of this study was to examine farmers' perception on soil erosion and soil conservation measures. In order to achieve the objectives of the study, it incorporated investigations on the causes, consequences and levels of soil erosion and farmers perception on the problem of soil erosion and decision making towards soil conservation measures. And also to identify major factors that affect their decision on soil and water conservation measures. And the study have a great advantages on understanding, identifying and implementing the negative factors towards soil erosion problems to the local land users(farmers) as well as in formulating environmental policies and strategies at the national levels.

To generate the objective of the study, descriptive statistical research method of both qualitative and quantitative techniques was designed and in order to have well coverage of the investigation both purposive and random sampling technique was adopted to select 132 household heads from the total 1,319 household heads of the study area. In addition three individual DA experts for interviews were also incorporated. To obtain relevant and various forms of data concerning the current status of the problems of the study area, both open and close ended questionnaires were prepared to the households and semi-structured interview was conducted with key informants. To cross-check data on both sides, careful field observation was operated and some documented data were collected from different offices of the woreda.

Finally, the data gathered from different corners were analyzed based on the adopted quantitative and qualitative methods of descriptive statistical techniques by using the percentiles and frequencies which helped with the statistical package for social sciences (SPSS) software (v.24) and interpreted in theoretical concepts in combination with related to literatures; finally for better understanding of the study it presented by tables, graphs and figures to draw comparative image on the mind of readers.

To come up with the major findings of the study: -

- ❖ Farmers recognized a various forms of erosion indicators existing over the land scope and adversely affect their soil. These indicators include accumulation of sediments, rill and gully formation, root exposure, poor crop and grass growth, slope steepness,

stones of soil and color change. As a farmer noted absence of fertile top soil is a vital indicator of soil erosion and followed by poor crop and grass growth.

- ❖ Soil erosion was the predominant problem in the study area which was mostly due to heavy rainfall. As a result of sheet and gully erosion are the prevailing features in their cultivable fields. The degree of soil erosion in the area is perceived to be severe. According to farmer's response, soil erosion mainly caused due to the presence of steepness topography, intensity of rainfall, the absence of SW conservation and deforestation with 36.3%, 15.2%, 21.2% and 12.1% respectively. Consequently these actions was exacerbated by poor soil and water conservation practice on farming lands of respondents, lack of ground cover with and excessive cultivation and absence of fallowing were the prominent once.
- ❖ Due to the seriousness of soil erosion problem in the study area, it resulted in reduction in yield; land becomes out of cultivation, loss of top soil and requires high input and managements. And to overcome the problem, farmers were implementing soil conservation measures. For instance stone terracing, soil bund, crop cover and rotations.
- ❖ However, the implemented techniques were not efficient and these are determined by a number of constraints. From the focus group discussion they have been indicated that, the major factors which affect the ability of farmers practice was hindered by the presence of the difficulty of topography which is steep, lack of technical support and lack of money to perform SWC methods.
- ❖ In the study area farmers use a range of methods for soil erosion control. Among them, contour ploughing, terracing, tree planting, and constitute the most widely used techniques and mentioned by 66.6%, 65.9% and 31% of the respondent farmers. Others conservation measures practices in the study area includes strip cropping 20.5%, drainage diversion 22.7%, leaving crop residue 27.3% and controlling gullies 28% mentioned by the respondents farmers.
- ❖ DAs have been mentioned by all of the respondents as source of information in soil and water conservation practices. About 84.8% of the respondents used DAs and extension agents as a source of information for soil and water conservation practices. From traditionally and neighbors as sources were mentioned by only 9.1% and 15.2% of the respondents, respectively. Majority of farmers in the study area have contacts with DAs and have good interaction with DAs.

5.2. Conclusion

In a nut shell, farmers 'perception towards the problem of soil erosion have been influenced by different factors. The most important and considered factors in this study include age ,sex, literacy status, house hold size and land size of the respondents. The major finding of this study with respect to perception of farmers on the problems soil erosion and its conservation are stated.

In the present study the perception of the farmers on the causes, levels and consequences of soil erosion was assessed. Based on the objectives of the study aforementioned in the first chapter, farmers' perception and level of training on adopting soil conservation measures was examined. The study was able to identify factors that influence farmers' decision on adopting of soil conservation measures. In line with the objectives the concussions are made as follows:

- It had been found that farmers have a general awareness about the problem of soil erosion and its indicators. They also believed that soil erosion can be controlled through implementing soil conservation activities. However, farmers' participation and decision to participate in soil conservation activities are affected by household size, land source, access to extension service received, age of the head of the household and the degree of engagement in off-farm activities.
- Likewise, farmers who were willing to adopt new soil conservation technologies were more likely to participate in soil conservation activities with interest. It affects their decision by increasing personal confidence and willingness to take the possible risks associated with the impact of conservation structures.
- Young age farmers have been found better perceiving in higher percentage than the old age farmers in five possible causes of soil erosion. The literate farmers were found better in perception in four possible causes of soil erosion in higher percentage than in their counter parts such as continuous cultivation and absence of fallowing, absence and delay of soil conservation measure, deforestation and desertification as well as overgrazing.
- All in all, farmers are fully depend on their farmland and resulted in the possible consequences of soil erosion such as reduction in yield over time, reproduction of gullies, loss of vegetation cover and grasses, change in soil color and lack of farm & grazing lands.

- Though there is an unstructured prior knowledge, there are farmers who have not systematic and proper knowledge how to conserve soil in their farmland and the surrounding environment.

5.3. Recommendations

Based on the results of the findings of the study, the following recommendations are forwarded:

- The nature and extent of soil erosion problem was rising, therefore, special emphasis should be placed on it in order to address the soil erosion challenges and limited adoption practices.
- Factors such as socio-economical, institutional and natural constraints have to be examined in order to understand their role either in promoting or impeding the adoption of soil conservation innovations.
- It is essential to involve local farmers and utilize their forwarded about the soil resources and the soil erosion in order to effectively plan for soil conservation measures application and introducing new techniques.
- Local administrative leaders and farmers should design laws that govern them to protect soil erosion and deforestation and to use and maintain the constructed conservation structure.
- Creating of an alternative energy and income source and employment opportunities to farmers may partly reduce farmers' complete dependents of resources of soil and forest.
- The training programs which were provided for farmers should be modified considering the existing knowledge and practices in a particular area and DAs must create harmony and cooperative working environment with farmers.

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APPENDEX I
DILLAUNIVERSITY
COLLEGE OF SOCIAL SCIENCES DEPARTMENT OF GEOGRAPHY
AND ENVIRONMENTAL STUDIES OPEN ENDED AND CLOSE ENDED QUESTIONNAIRE FOR HOUSEHOLD SURVEY

Household survey questionnaire

A Questionnaire to be completed by Farmers of Enemay Woreda

Dear respondents,

This questionnaire is meant to gather information for a study on farmers' Perception towards the problem of soil erosion and their conservation knowledge. I hope that the research out comes contribute to the improvement of soil erosion problem and conservation practices. You are kindly requested to give answers freely and openly. Any information you give is to be kept confidential. Thus, your cooperation is very necessary to achieve the desired goal of the study.

N.B.1. The response you give will not have any negative impact on you.

2. No need of writing your name on the questionnaire.

3. Please respond in free mind and express your opinion.

Thank you for your cooperation In advance

Yours faithfully Waltengus Ayaneh

Part-I: Respondents Household Characteristics

Part one – Background information of the respondents

Please give the required information by choosing the number.

1.1 Names of rural kebeles _____

1.2 Age of household head: _____

1.3 Sex of household head: 1. Male 2. Female

1.4 Size of household: _____

1.5 Marital status of household head:

 1 Single 2. Married 3. Widowed

1.6 What is educational level of household head?

- | | |
|----------------------------------------|----------------------------------|
| 1. Can't read and write (illiterate) | 4. Attended secondary level |
| 2. Can read and write (Adult literacy) | |
| 3. Attended elementary level. | 5. Attended above grade 10 or 12 |

1.7 How do you get your income?

- | | |
|----------------------------------|-----------------------------------------------------|
| 1. Farming alone | 3. Trading |
| 2. Farming and livestock rearing | |
| 4. All | 5. please mention if there is other means of income |
-

Part- II: Land and Landholding Characteristics of Respondent

2. Land size and landholding

2.1 Do you own land? 1. Yes 2. No

2.2 If yes, how many hectares do you own? _____

2.3 How did you get the land you have currently? (More than one choice is possible)

- | | |
|---------------------------|---------------------------|
| 1. through renting | 3. Inherited from parents |
| 2. Through share cropping | 4. Allocated by Kebele |

2.4 How do you perceive the fertility of your land?

- | | | | |
|--------------|-------------|--------------|----------------|
| 1. Improving | 2. Constant | 3. Declining | 4. Do not know |
|--------------|-------------|--------------|----------------|

2.5 If the fertility of your land is declining what is the indicator?

2.6 If the fertility of your land is declining, what could be the cause?

2.7 How do you perceive the productivity of your land?

- | | | | |
|---------------|---------------|--------------|----------------|
| 1. Increasing | 2. Decreasing | 3. No Change | 4. Do not know |
|---------------|---------------|--------------|----------------|

2.8 If the yield from your land is decreasing, what could be the reason behind? (More than one answer is allowed)

- | | |
|--------------------------------------|-------------------------|
| 1. Absence of fallowing | 4. Rainfall fluctuation |
| 2. High cost of chemical fertilizer. | 5. over cultivation |
| 3. Removal of soil by erosion | 6. Other |

reason _____.

2.9 How do you describe the slope of your land?

1. Flat 2. Gently undulating 3. Moderately steeping 4. Steeply sloping

2.10 Do you perceive that the slope has an impact on productivity of your land?

1. Certainly 2. Never 3. Uncertain

2.11 Which land do you perceive is more productive?

1. Flat 2. Gently undulating 3. Moderately sloping 4. Steeply sloping

2.12 How do you think that current landholding to support the household?

1. Insufficient 2. Sufficient 3. Excess

2.13 What do you do if the land scarcity is a problem?

1. Going to resettlement area
2. Migration to other areas (urban area)
3. Involving in non-farm activities
4. Increasing the productivity of land using modern technologies
5. Increasing farm land through clearing forest and common land
6. Other option specify _____

Part-III: Soil Erosion

3. Questionnaires on Indicators, causes, severity and consequences of soil erosion

3. 1 Do you know what soil erosion is? 1. Yes 2. No

3.2 If you yes what are the indicators of soil erosion in your land?

NO	Indicators	Orders/ranks
1	Rills and Gully Development	
2	Observing the color of the soil	
3	Accumulation of dump near to valleys	
4	Stoniness of the soil	
5	Slope steepness	
6	Absence of fertile topsoil	
7	Root exposure	
8	Poor crop and grass growth	

3.3 What condition brings soil erosion in your land? (Put in order from most to least important)

No	Causes of soil erosion	Rank(1,2...8)
1	Slope steepness of the cultivation land	
2	Ceaseless cultivation and absence of fallowing	
3	Types of soil and erodibility	
4	Intensity of rainfall	
5	Absence and delay of SCM	
6	Deforestation and desertification	
7	Overgrazing	
8	Terms of land preparation for cropping	

3.4 What is the effect of soil erosion on your land?

No	Effects of soil erosion	Rank(1,2,...8)
1	Loss of topsoil	
2	Reduction in yield over time	
3	Reproduction of gullies	
4	Loss of vegetation cover and grasses	
5	Change in soil color	
6	Require high input and management	
7	Lack of farmland and grazing field	
8	Desertification and outmigration	

3.5 What condition brings soil erosion in your land?

No	Perception on the causes of soil erosion	Responses	
		Yes	No
1	Slope steepness of the cultivation land		
2	Ceaseless cultivation and absence of fallowing		
3	Types of soil and erodibility		
4	Intensity of rainfall		
5	Absence and delay of SCM		
6	Deforestation desertification		
7	Overgrazing		
8	Terms of land preparation for cropping		

3.6 What is the effect of soil erosion on your land?

No	Farmers perception on effects of soil erosion	Responses	
		Yes	No
1	Loss of topsoil		
2	Reduction in yield overtime		
3	Reproduction of gullies		
4	Loss of vegetation cover and grasses		
5	Change in soil color		
6	Require high input and management		
7	Lack of farmland and grazing field		
8	Desertification and outmigration		

3.7 How do you describe the degree of soil erosion in your farmland?

1. Severe
2. Moderate
3. Minor
4. No erosion risk

3.8 Which type of erosion is severe in your land? (More than one is allowed)

1. Sheet erosion
2. Rill erosion
3. Gully erosion

3.9 Have you taken any of the following measures because of erosion?

1. Abandoned your cultivated land?
2. Expanded to marginal land?
3. Have taken off-farm employment?
4. Other (specify) -----

3.10 Do you believe that erosion can be controlled?

1. Yes
2. No

Part-IV: Soil Conservation

4. Soil conservation knowledge and practices

4.1. Do you know the existence of improved soil and water conservation structures?

1) Yes

2) No

4.2. If yes, which type do you know?

1) Stone bunds

4) Water way

2) Soil bund

5) Planting of d/t tree

3) Cutoff drain

6) others specify-----

4.3) which of the following types of soil and water conservation measures are efficient to reduce the problem of soil erosion?

1) Stone bund

4) Water way

2) Soil bund

5) Planting of d/t trees

3) Cut off drain

6) NA

4.4) Have you participated in community conservation activities this year?

1) Yes,

2) No

4.5) Did you undertake the maintenance work by your own?

1) Yes

2) No

4.6) if no, what were the reasons for not doing?

1) I have shortage of labor

2) Lack of skill and knowledge

3) Conservation structures were built without my knowledge and willingness

4) I expect the land will be transferred to other farmers

5) There was no need for maintenance

6) Others specify? _____

4.7 Do you believe that investment in soil and water conservation practices is profitable in the long

run?

1) Yes

2) No

4.8. Do you perceive that the yield be increasing with soil conservation practices?

1. Yes

2. Never

3. Do not know

4.9. If your answer for question '4.10' is 'Yes', have you been practicing soil conservation?

1. Ye 2. No 3. Do not know

4.10. If your answer for question '4.11' is 'No', what is the reason behind?

4.11. If your answer for question '4.11' is 'Yes', what kinds of soil conservation methods do you apply? (More than one answer is allowed)

- | | |
|-------------------------------------|--------------------------|
| 1. Cultivation along the contour | 6. Grassed waterways |
| 2. Terracing | 7. Tree planting |
| 3. Strip-cropping along the contour | 8. Check dams |
| 4. Bunding | 9. Other (specify) ----- |

5. Vegetative and crop cover

4.12. Have you observed changes as a result of the practiced activities?

1. Yes 2. No

4.13. If yes, what are the changes (mark all that apply)

1. Increase in soil fertility
2. Increase in land cover
3. Increase in land productivity
4. Prevent soil erosion
5. Others (specify) -----

4. 4. Do you get training on soil and water conservation technologies?

1. Always 2. Sometimes 3. Never 4. Do not know

4. 17 where did you get information on soil and water conservation practices?

- | | |
|-------------------------|-----------------------------------------------------|
| 1. Traditionally | 4. From other non-governmental organizations (NGOs) |
| 2. From neighbors | 5. Other sources specify----- |
| 3. From DAs and experts | |

4. 18. Do you have contact with DAs?

1. Yes 2. No 3. Do not know

4.19. How do you describe the contact you have with soil and water conservation experts (DAs)?

1. None 3. Good

2. Limited

4 .Very good

4.20. What are the problems related to each soil and water conservation structures?

(Hint, choose from 1-6)

No	Problem	Soil bund	Cut off drain	Waterway plantation
1	Sources of rodents			
2	Reduce farmland			
3	Difficult to turn oxen			
4	Labor intensive			
5	Difficult to implement			
6	Costly			

APPENDIEX – II
DILLAUNIVERSITY
COLLEGE OF SOCIAL SCIENCE AND HUMANITIES
DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL
STUDIES
A QUESTIONNAIRE ON THE FOCUS GROUPS

Guiding question for focus group discussion

This discussion will handled by the researcher

1. Do you think that the rural communities perceive the existence of problems of soil erosion in your area?
2. If yes how do you know their perception?
3. What is the level of rural community perception of soil erosion problem and their conservation knowledge?
 - Is there gender variations?
 - Is there work status variations?
 - Is there age Variations?
 - Is there house hold size Variations?
 - Is there educational variations?
 - Is there farm size variations?
4. What do you think are the possible causes of soil erosion in your area?
5. What do you think are the major consequence of soil erosion in your area?
6. Do you think that the individual or the communities are actively responding to these environmental problems?
7. Are there any governmental or nongovernmental organizations which are working on environmentalissues?

If yes, what are their contributions to the rural community?
8. In your opinion, what are the major constraints to implement soil and water conservation activities in your area?

APPENDIEX – III
DILLAUNIVERSITY
COLLEGE OF SOCIAL SCIENCE AND HUMANITIES
DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL
STUDIE INTERVIEW QUESTIONS WITH THE SELECTED
AGRICULTURAL EXPERTS OF THE WOREDA

Questionnaires for the Enemayworeda Agricultural experts

1. What is the average current landholding capacity of the households?
2. Have you observed soil erosion in the area and forms of erosion?
3. How do you describe the degree of soil erosion in the area?
4. What do you think about the major cause of erosion?
5. What are the effects of soil erosion in this area?
6. What are the soil and water conservation measures introduced to this area?
7. How long they have practiced since its introduction?
8. When were they frequently undertaken?
9. What is the role (participation) of the farmers in adopting anti erosion process?
10. What are the major limitations to apply soil conservation measures on the farm land?
11. What factors those affecting the practice of soil conservation measures in the area?

APPENDIEX – IV
DILLAUNIVERSITY
COLLEGE OF SOCIAL SCIENCE AND HUMANITIES
DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL STUDIES

Check list

No	Activities	Yes (√)	No (X)
1	Type of soil erosion		
	Rain fall erosion		
	Wind erosion		
2	Visible or existed form of erosion		
	Sheet erosion		
	Rill erosion		
	Gully erosion		
	If other		
3	The most dominant/prevailing form of erosion		
	Sheet erosion		
	Rill erosion		
	Gully erosion		
	Sheet erosion and Rill erosion		
	Rill erosion and Gully erosion		
4	Conditions or levels of soil erosion		
	Very severe		
	Sever		
	Medium		
	Low		
5	Expected Cause of soil erosion in the area		
	Natural causes:		
	Run off		
	Steepness in topography		
	Erodible soil		
	Human causes:		
	Over population		
	Overgrazing		
	Improper farming activities		
	Continuous cultivate Improper farming activities		

6	Physical indicators of the effects of soil erosion		
	Accumulated sand duns		
	Stoniness of the area		
	Sheet erosion in the area		
	Rills in the farm		
	Dissection of farm plot size		
	Gulley formation		
	If any		
7	Economic activities of the area		
	Agriculture based economy		
	Irrigation based economy		
8	Soil type of the area		
	Clay		
	Sand		
	Silt		
9	Color of the cultivated field		
	Brown		
	Black		
	Gray		
	Reddish		
	Sandy		
	If other		
10	Cultivated crop types of the area		
	Maize		
	Millet		
	Sorghum		
	Teff		
	Wheat		
	Barley		
	If other		
11	Types of animals reared in the area		
	Cattle		
	Goats		
	Sheep		
	Donkeys		
	Horses		
	If other		
12	General physical appearance of the area		
	Plain		
	Hilly		
	Mountainous		
	Other		

13	Adopted method of soil conservation measure		
	stone terracing		
	Soil bund		
	Tree planting		
	Check dams		
	Grass strip		
	Cut off drain		
	Contouring		
	Mulching		
	If other		
14	Level of adopting soil conservation measure		
	Always		
	Some times		
	Never use		
15	General coverage of the area		
	Forested area		
	Crop field area		
	Bare and exposed to erosion		
	If other		
16	Expected factors affecting soil conservation activities in the area		
	Small Family size (active labor force)		
	Difficultness in topography of the area		
	Overcrowded by population		
	Overcrowded by livestock		
	If other		