ADDIS ABABA UNIVERSITY SCHOOL OF GRADUATE STUDIES COLLEGE OF SOCIAL SCIENCES

SOIL MANAGEMENT PRACTICES AND CHALLENGES IN EGERE SEBRA MARIAM KEBELE, ENEBSE SAR MIDIR WOREDA OF EAST GOJJAM ZONE, ETHIOPIA

BY AMELEWORK ASMARE

ADVISOR DR. K.N.SINGH

JUNE, 2014

ADDIS ABABA

SOIL MANAGEMENT PRACTICES AND CHALLENGES IN EGERE SEBRA MARIAM KEBELE, ENEBSE SAR MIDIR WOREDA OF EAST GOJJAM ZONE, ETHIOPIA

BY Amelework Asmare

ADVISOR DR. K.N.SINGH

A THESIS SUBMITTED TO ADDIS ABABA UNIVERSITY TO THE SCHOOL OF

GRADUATE STUDIES, IN THE PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE DEGREE OF MASTERS OF ARTS IN GEOGRAPHY AND ENVIRONMENTAL STUDIES, SPECIALIZED IN LAND RESOURCE MANAGEMENT.

JUNE 2014

Addis Ababa University

School of Graduate Studies

Geography and Environmental Studies

Soil Management Practices and Challenges in Egeresebra Mariam Kebele, Enebse Sar Midir Woreda of East Gojjam Zone, Ethiopia

BY Amelework Asmare Muse

Approved by Examining Board	Signature
1.	----------
2.	----------
3.	----------

ACKNOWLEDGEMENTS

First and foremost, I thank the Almighty God and St. Merry. The successful achievement of every work requires well-built and insight advice. I, therefore, wish to express my appreciation to my advisor Dr. K. N. Singh for his commitment and diligently helps in conducting this study. My work would have not come to this end had it not been for vigorous assistance and availability whenever I needed him.

My utmost gratitude goes also to my mother Abaynesh who is always caring me and my baby boy ze Michael Abere. I also thank my father for his financial and moral support. I would like to extend my earnest appreciation to my husband Abere for his support in every aspect. Farmers of EgerSebra Maiam kebele deserve special thanks. My sincere thank goes to my sister YeshiAlem Taddele who helped a lot at the time of data collection. Special thanks to my brother Biruk Asmare for typing the thesis and downloading materials by scarifying his precious time. I also thank my sister Meskerem for everything she has done in helping me. I also acknowledge Ato Tibebu Aklock and Abye Wogderes who have helped a lot to make the map.

Finally, my indebtedness goes to those who helped me in one way or another for the accomplishment of this thesis.

Amelework Asmare

June 2014

Table of Contents

List of Tables page

List of Figures Page

Acronyms

a.s.l	above sea level
Al	Aluminum
DA	Developmental Agent
DAP	Di ammonium Phosphate
ESGPIP	Ethiopian Sheep and Goat Productivity Improvement Program
FAO	Food and Agricultural Organization
FGD	Focus Group Discussion
ha	hectare
HEA	Household Economic Assessment
IFPRI	International Food Policy Research Institute
ISFM	Integrated Soil Fertility Management
PACA	pesticide Action Network Europe
PSNP	Productive Safety Net Project
RELMA	Regional Land Management Unit

Abstracts

Soil degradation is one of the serious factors that prone people to food insecurity by decreasing agricultural productivity, especially for those whose livelihood is dependent on agriculture. This study has attempted to identify major challenges farmers faced while managing their soils. The main objectives of the study were assessing the perception of farmers towards their soil, identifying the most common indigenous and modern soil management practices and detect major challenges farmers faced in relation to soil management. The necessary data was collected from sample households, concerned officials and DAs through questionnaires, interviews and focus group discussions. From the collected it was revealed that soil degradation was a menace to the farmers, natural vegetation was destroyed and agricultural production decreased from time to time. Famers were well aware about soil degradation and its severity and knew that soil degradation was a threat to their agricultural activities. To cope up with these situations, farmers had used different soil management techniques. To protect soil from erosion, terraces had been built. To maintain soil fertility they had used compost and crop rotation. The major challenges concerning soil management methods were resistance of farmers towards using chemical fertilizers, lack of awareness about perennials, high frequency of tillage and unavailability of DAs were some of the challenges. These findings implied that though different efforts had been made to soil management, some challenges were observed that adversely affect the sustainability of soil management. Therefore, to overcome these challenges additional soil management methods have to be implemented.

Chapter One

INTRODUCTION

1.1 Background of the Study

Soil is one of the most fundamental and basic resources in which humans cannot live without it. The significance of the soil to human beings sometimes not understood until it risked agricultural production (Humberto and Rattan, 2008). According to FAO (1994), a good soil is characterized by its ability to provide sufficient nutrient for the plant. Its texture and compaction is easy for air and water penetration and conducive for microorganisms in which they decompose organic matter and release nutrients for the plant. The ways soils are managed have its own positive or negative impacts on its fertility. If soils are used improperly the soil will be degraded due to erosion, compaction, salinization, depletion of nutrients and acidification. If the soils are utilized properly, physical loss of soil can be minimized. Some of the good management methods of soils are use of cover crops, using different soil conservation methods, application of organic matter, and careful use of chemical fertilizers (Peter et al, 2000). Humberto and Rattan (2008), stated that the extent to which soils are managed determines the sustainability of land use, adequacy of the food supply, the quality of air and water resource and the existence of human beings

In Ethiopia, the economy of 85% of the population is dependent on agriculture but the productivity of this sector is deteriorating due to unsustainable land management practices both in the areas of arable land as well as pastoral farming. Different factors have contributed to unsustainable land managements in Ethiopia such as steady growth of population, deforestation at an estimated rate of 62,000 ha per year, which mostly changed in to crop land and hence vegetation cover has reduced and accelerates soil erosion and methods of production of cereals contribute to soil loss. Not only these, animal dung and crop residues, which are the sources of manures, are used for fuel (Leonard, 2003).

Soil fertility problem in Ethiopia is also related to the removal of top soil, acidity of soils which affects 40% of the country, depletion of organic matter due to high consumption of manure for fuel purpose, reduction in macro and micro nutrients of a soil, depletion of soil physical

properties and salinity (IFPRI, 2010). Land resource degradation is considered to be one of the major threats to food security and natural resource conservation in the Amhara regional state Tilahun (2003).

1.2 Statement of the Problem

Alemayehu (2007) stated that Ethiopia is a country where soil degradation is prevalent at a tragic rate. The average annual rate of soil loss in the country is estimated to be 12 tons per ha per year. The rate of degradation is even higher on steep slopes and on places where vegetation cover is low. According to Leonard (2003) there are various interrelating forces, which have caused and are causing land degradation in Ethiopia. Clearing of woodlands and forests, unsustainable arable farming techniques, the use of dung and crop residues for fuel and overstocking of grazing lands are some of the proximate causes of soil degradation. Different researches revealed the magnitude of soil fertility decline and recognized the potential contributing factors for the soil fertility deterioration of the agricultural lands. These are, inadequate fallowing system, the varieties of crop are highly dominated by production of cereals, crop residues removed completely from the farmland, inefficient application of chemical fertilizers and unsuitable water and soil conservation practices are the added problems (IFPRI, 2010).

According to Lakew et al (2000), the direct causes of land degradation in Amhara regional states are production on steep slope and fragile soils with inadequate investments in soil conservation or vegetation cover, erratic and erosive rainfall patterns, declining in use of fallowing, limited recycling of dung and crop residue to the soil, limited application of external source of plant nutrients, deforestation and overgrazing. The underlying factors for the listed causes of land degradation are population pressure, poverty, high cost of and limited access to agricultural inputs, fragmented land holdings and others. Though the agricultural system in the Amhara regional state is of mixed farming that is crop production and cattle raising, the nutrient flow is one sided in which livestock feed on crop residues and only little of dung is returned to the farmlands (Tilahun, 2003).

Egersebra Mariam is one of the kebele's of Enebse Sar Midir Woreda of East Gojjam zone of the Amhara regional state. According to HEA (2007), the study area suffers from food insecurity due to degraded farmland, erratic rainfall small land holdings and infertile soils. From field

observation, it has been observed that the study area is highly degraded in which natural vegetation lacked due to deforestation and overgrazing. This is due to high population growth and scarcity of farm land which made natural environment to be highly degraded. The situation implies the prevalence of mismanagement of natural resources. Therefore, these situations triggered the researcher to explore soil management practices and challenges.

1.3 Objectives of the Study

The major objective of this study is to explore soil management practice and challenges focusing specifically on

- Identifying the most common indigenous and modern soil management practices used by farmers.
- To asses farmers perception of soil management and how do they identify the soils based on its fertility.
- To assess the farming practices in relation with their impacts on soil fertility
- To detect major challenges that the farmers face in relation with soil management.

1.4 Research Questions

Knowing farmers practices and challenges towards soil management is an important task to maximize agricultural productivity. In this regard, the following are basic research questions arises,

- ✓ What are the most common soil management methods that farmers used?
- ✓ How do farmers perceive soil management issues and how do they identify one soil from the other?
- ✓ Which method of soil management is preferred by farmers and why?
- ✓ Does the farming method affect soil management?
- ✓ What are the major challenges that farmers facing to manage their soil?

1.5 Significance of the Study

Soil fertility decline is major agricultural concern that Ethiopia has been facing. The way soils are managed has its own impact on agricultural productivity and food security. In this regard, the

results of the study can contribute a lot by identifying major soil management problems, assessing practices and challenges in the study area and provide possible solutions to the challenges that farmers have faced while managing soils. In addition to these, the study can serve as a reference for other researchers and development actors that deal with soil management.

1.6 Organization of the Study

This thesis has four chapters. The first chapter encompasses background of the study, chapter two contains a review of related literature in which soil management and practices have been reviewed. The third chapter is devoted to description of the study area and methodology. Chapter four is about findings and discussions followed by conclusions and recommendations.

Chapter Two

Review of Related Literature

2.1 Soil Management

According to Ezekiel (2004), one of the most important valuable things that human beings need for crop production and livestock production is soil. Soil needs proper planning and management to guaranty its life support and to get maximum yield. The treatment given to the soil to avoid loss, waste and damage is known as soil management. Soil becomes Prone to degradation whenever inappropriate land use and land management practices are adopted. Deforestation of natural vegetation to obtain fire woods and other benefits at a pace exceeding the rate of natural regrowth makes the soil to become erosion prone due to action of rainwater and wind that contributes to the removal and transport of valuable surface soil (PACA, 2010). Mismanagement of soil results in degradation of the soil through erosion, compaction, salinization, acidification and toxicity of soils by heavy metals. On the other hand, good management of soil can improve the soil quality by using cover crops, soil conservation methods, adding organic matter and careful application of chemical fertilizers, pesticides and machineries used for farming purpose (Peter et al, 2000).

According to Thomas (2012) there are two soil quality indicators: the inherent soil quality and dynamic soil quality indicators. Inherent soil quality indicators are those qualities obtained naturally like soil texture, soil depth and parent material of the soil. The dynamic soil quality indicators are those qualities that are dependent on soil management, such as organic matter content, nutrient and water holding capacity. As compared to dynamic soil quality indicators, inherent soil quality indicators are difficult to change. As a result, soil management for agricultural production focuses on dynamic soil indicators.

Decline in the soil fertility is the combined effect of reduction in soil organic matter, deterioration of physical properties of the soil, lowering of nutrient content and acidification. The problem of inherently infertile soil is different from the problem of degraded soil which has been fertile previously. If the soil was originally fertile but degraded later on, its fertility can be raised by the land use practice that looks like the natural ecosystem such as planting of trees. If the soil

is naturally poor, the task of upgrading such soil is difficult. Low productivity may relate either to the infertility of the soil caused by the natural condition of the soil or decline in fertility as a result of past land use (Anthony, 1990).

Ethiopia has a soil with natural characteristics of poor quality, which makes crop cultivation difficult and it needs special management. The most common nutrient depletion problems in Ethiopia are organic matter depletion, macro and micronutrient depletion, unbalanced application of chemical fertilizers and topsoil erosion. The organic matter depletion is caused by not returning animal dung and crop residues to the soil and excessive tillage. The driving factors for organic matter depletion are unavailability of biomass, using dung for fuel and using crop residue to feed animals. Macro and micronutrient depletions are caused by farming without replenishing nutrients for a long period of time, which often relate to continuous cropping of cereals, removal of residues and leaching (IFPRI, 2000).

2.2 Soil Management Methods

There are different soil conservation approaches which have an influence on the physical, chemical and biological status of the soil. Soil conservation Practices upgrade the fertility of the soil and make the soil to generate itself for the current and future agricultural yield (Keven, 2012). To sustain agricultural productivity the soil must have the required nutrient for plant growth, the physical structure has to be favorable for root penetration so that plants can absorb nutrients and, water and soil must have a medium for soil organisms, which are useful in decomposing organic material and releasing of nutrients (FAO, 1994).

2.2.1 Terrace

Terraces are channels constructed across at specific interval on contour lines. They intercept runoff and retard it for soil infiltration or direct it to an outlet at non erosive speeds (Ezekiel, 2004). It is an agricultural method which helps to collect the water that comes in the form of runoff and increase infiltration by controlling erosion. One of the reasons farmers use terracing as soil conservation method is to improve the efficacy of the agricultural potential of the land. Terraces create a level surface in accordance with contour lines of the slope. The level formed makes the water to spread, to decrease its velocity and permit more time to penetrate water in

different soil profiles. Terraces are highly successful in a situation where areas are endangered by soil erosion due to steep sloppiness, climatic conditions and erodible soil (Marcine, 2011).

2.2.2 Contour Ploughing

It is a tilling practice following the contour lines of the field slope. It is the opposite of up to down of the farming of the sloppy area. Contouring used to create furrows which are perpendicular to the field slope. The purpose of furrows is to check the speed of the water in the form of runoff, to promote water infiltration and to discharge excess water at non eroding velocity. Deep and permeable soils are effective for contour ploughing. Contour ploughing works in sloppy areas where the gradient of the slope is up to 10%. If the area is steep slope and the gradient is >10% contour ploughing should be accompanied by other conservation methods like, grass water ways to safely discharge water from the contours (Humberto and Ruttan, 2008).

Ruttan (1995) described that contour farming effectiveness decreases with increase in slope gradient, slope length and high intensity of rainfall. If rainfall exceeds the retention capacity of the contouring system, water will accumulate and accelerate erosion and even gullies may be formed. Best result can be obtained if contour ploughing is combined either with strip cropping or terracing (Ezekiel, 2004). The major limitation of contour ploughing is labor intensive. If contours are laid improperly, it speeds up the rate of erosion. Heavy soils with low infiltration capacity may result in the accumulation of water (Deborah, 2003).

2.2.3 Strip Cropping

It is the cultivation of different crops with different capacity to resist erosion. One strip carries crops that are less effective to control erosion than the next strip which carry crops that are more resistant to erosion (Hill et al, 2005). According to Ruttan (1995), those crops which resist erosion are grown down slope so that they can absorb water and mitigate the velocity of water and used to deposit sediments. The width of the strips of each crop depends on the steepness of the slope, the amount and nature of the precipitation and the erodibility of the soil (Ezekiel, 2004). This method is effective on gentle slope < 7 %. Strip cropping has the following advantages; it encourages the application of proper rotation and used for the production of both food and cash crops. As compared to terraces and other mechanical soil conservation methods,

strip cropping requires a minimum cost to maintain strips and they do not require a high degree of engineering for their exactness and accuracy like a terrace.

"*In strip cropping, crops are grown in a systematic way to protect the soil from wind and water erosion. There are three major types of strip cropping.*

Contour strip cropping: two or more crops are planted along contours in alternate strips.

Field strips cropping: the alternate strips are of uniform width across the field and do not necessarily curve to conform to the contour. Such method can be used in very irregular topography.

Wind strip cropping: tall, wind resistant crops and normal crops are planted alternately in narrower strips perpendicular to the direction of the prevailing winds" (T. C. Sheng, 1989).

2.2.4 Cover Crops

Cover crops are additional crops that are grown with the main crop and their purpose is to protect the soil against erosion (Keven, 2012). Cover crops can fix and trap nutrients, add organic matter to the soil, and reduce nitrate leaching, nutrient runoff, and soil erosion (Mark et al, 2007). Covering the soil with crops is important to protect the soil from wind and water erosion and by untying the soil they make root movement easy. Using leguminous as a cover crop is the best method to renovate the quality of the soil by adding organic matter and most importantly nitrogen. If cereals are used as a cover crop it reduces nitrogen loss by immobilizing nitrogen and avoiding leaching of nutrients (William, 2005).

Cover crops give different potential benefit to the health of the soil and to the crops that follow the cover crops and used for the maintenance of clean surface and ground water. In addition to these, cover crops improve the physical and biological properties of the soil, mitigate weed growth, and enhance water availability. In the case of compact soils, cover crops penetrate their roots into the soil and make the soil favorable for the better root growth of the main crop (Fred and Harold, 2009).

Cover crop management needs to consider the following. First, which cover crop is best suited for a given particular land has to be known. That is a cover crop which is compatible with the

main crop must be identified. The other consideration is that decision on how and when to avoid the cover crops must be taking in to account and mainly its interference with the main crops, either by taking much water during dry season or becoming weed for the main crop must be considered (Fred and Harold, 2009).

2.2.5 Crop Rotation

Humberto and Ratan (2008), defined crop rotations as systems in which different crops are grown sequentially on the same field in alternate seasons or years. There are three main types of rotation based on duration. These are monoculture (single crop with no diversity), short rotation (two year rotation) and extended rotation (more than two year rotation). Crop rotation is used to promote the fertility of the soil, reduce erosion, control pests and minimize financial risks that may emanate from crop failure. If farmers use legumes in crop rotation the availability of nitrogen increases because legumes can fix nitrogen from the atmosphere (Melissa, 2003).

2.3 Agroforestry

It is a land use system in which trees and shrubs, crops, pasture and livestock, in association with environmental factors of climate, soils and land forms which have ecological and economical interactions (Anthony, 1990). Agroforestry allow farmers to solve land use problem by producing food, fiber, fodder and fuel at the same time on the same farmland. As compared to other land use systems, agroforestry has two important characteristics. These are, tress has to be deliberately grown in the land use system and there must be significant interaction between trees and other components of the agroforestry system (Badeg and Abdu, 2003).

By using agroforestry, one can be benefited the maximum from the land. Every part of the land is considered suitable for useful plants. The focus in agroforestry is that, growing perennials and multipurpose plants, which can give yield benefits for a long period of time once planted. The benefits include, construction materials, food for humans and animals, fuels, fiber and shade. In addition to these, trees in agroforestry system protect the soil from erosion and improve soil fertility by fixing nitrogen from the atmosphere and extracting minerals from deep soil and deposit it while the leaf falls (Franklin and Scott, 2007).

2.4 Fertilizers

Fertilizers are substances that add nutrients to the soil to correct the deficient nutrients. Plants absorb nutrients from the soil. If the soil is used consecutively without treatments, the soil will suffer from deficiencies of minerals and these makes the soil infertile. To treat such soil, adding fertilizer is important. There are two types of fertilizers. These are chemical/artificial fertilizers and natural/organic fertilizers (Ezekiel, 2004).

According to Michael et al (2007) as compared to the world the share of the consumption of inorganic fertilizer in Africa is less than 1% approximately 1.3 million metric tons of inorganic fertilizers are used in Africa. Low fertilizer use in Africa can be seen from two perspectives, from the side of the farmers and from the side of suppliers. From the side of the farmers, high price and low incentives or subsidy during high and low production of yields affect fertilizer usage. In addition lack of awareness about fertilizer usage is factor that has an impact on chemical fertilizer usage in Africa. On the other hand, from the side of suppliers, the absence of private investors to distribute fertilizers which is related to the business environment is not comfortable due to excess regulations, High taxes and fees and the tendency of rent seeking is increasing. Provision of fertilizers is done by government agencies. In addition to these, small market size and high cost of transportation with poor infrastructure influences the distribution of fertilizers.

2.4.1 Organic Fertilizers

Organic matter has a lot of advantages for soil fertility management. It has the ability to hold water and serves as storage for dry season. It carries nutrients, especially helpful for sandy soils which consists small amount of nutrients and they are also important for soil organisms. Organic matter of a soil can be fresh organic material such as remains of plants or animals that has not yet changed into useful nutrient. When the remains of plant and animals completely changed into useful nutrient it is known as humus (Laura and Rienke, 2004).

Mark et al (2007) said that around 70% to 80% of organic matters of the soil come from the decomposed remain of plant or animals which have changed into humus. The most resilient and mature organic matter is humus. It takes a longer period of time to decompose and at the same

time it remains on the soil for an extended time. Organic matters are good sources of nutrients such as nitrogen, phosphorus, iron, copper and zinc. In addition, soil organic matter creates favorable physical and chemical features by binding nutrients through cation exchange which accounts for 20 to 70% of the total cation exchange capacity of the soil. Organic matter also improves soil structure as a result the soil can hold and infiltrate water and become conducive for soil organisms. Tilahun (2003) described that organic fertilizers may provide multiple benefits through improving the structure of the soil, water holding capacity, biological activity of the soil and extended nutrient release, but it could be unwise to expect the organic fertilizers to fulfill the plant demand for all basic nutrients. Most organic fertilizers contain very small quantities of some nutrients like Potassium and Zink to cover the full demand of the crop.

Organic fertilizers have distinct nature that makes them quite different from inorganic fertilizers. Most organic fertilizers consist less concentrated nutrients as compared to chemical fertilizers. In the majority of cases the application of organic matter is around 11.2 to 22.4 t/ha or even more. A given organic fertilizer may consist nutrients that are already ready to be consumed or become available after some times. Because of these natures of organic fertilizers, farmers shall anticipate when to apply the organic fertilizer so that the nutrients will be ready for the plants (Mark et al, 2007). The major disadvantage of organic matter as compared to inorganic fertilizers is that the amount of nutrient they carry is small. Therefore, they are required in an enormous amount in order to support crops significantly, but it is not always easy to find. For example, nitrogen in organic matter is from 5 to 25gN/kg but in the case of inorganic fertilizers it is from 100 to 460g N/kg. In addition to these, organic input management requires significant labor to transport and apply on the field (Thomas, 2012).

As far as organic matter application is concerned, in Ethiopia, farmers do not return animal excretion and crop residues to the soil and also highly till the ground. This is because of the fact that low availability of animal dung and farmers use the animal dung and crop residue for fuel and feed for the animals respectively. Though the severity of dung burning has not been measured at the national level, it is estimated that dung burning reduced agricultural productivity by7 % (IFPRI, 2010)

2.4.1.1 Manure

It is a combination of dung and urine mixed with straw or leaves. The quality of animal dung and urine is determined by the type of food that the animal is consuming (Laura and Rienke, 2004). Nutrient content of manure is influenced by the duration of storage, management and its contact with the rain. If the manure contacts with rain, it can be washed away. So manure has to be stored in a protected area. Applying fresh manures can cause human disease and the exposure is high from vegetables that are consumed as a raw food. To avoid this contamination manure composting and storing the manure for a long period of time is important (Doug et al, 2013). Manure fermented for a long period of time can provide balanced nitrogen and other macro and micro nutrients (Mark et al, 2006).

Best manures are the result of the long fermentation process among dung, urine and leaves or straw. Aged manure is best for soil fertility management. In order to use the manure properly animals has to be kept in a protected area otherwise if animals are allowed to move from place to place, then they can simply drop their dung and urine everywhere and nutrient can be easily leached or volatilized (Laura and Rienke, 2004). It is possible to apply manure on the field as a raw or in the compost form. If it is raw manure it will provide nutrient like nitrogen to the soil and create a conducive situation for healthy biological processes. If manure is composted the heat created while composting will kill weed seeds and breakdown pollutants of the soil. Manure application has to be with cautious because excess application of manure may result in salt accumulation and leaching (Mellissa and Sven, 2003)

2.4.1.2 Green Manure

Green manure is an organic matter in which cover crops are ploughed while they are fresh and green. When it mixes with the soil, the soil gets nutrient and moisture and this allows microorganisms to feed on it and the organisms upgrade the quality of the soil (Mellissa and Sven, 2003). Green manures have similar effects like mulch, but apart from that plant used as green manure penetrates their roots in the soil and which can improve the soil structure. One of the disadvantages of green manure is it is difficult to plough the land (Laura and Rienke, 2004).

2.4.1.3 Compost

Compost changes waste materials into nutrients and rehabilitate soil nutrients (Doug et al, 2013). Using compost as organic matter is highly economical and can provide both macro and micro nutrients. Depending on the material differences to be composted, the method of composting and its maturity the nutrient content of compost varies (William, 2005).

While applying compost, it is important to know about its constituents and to determine how to use it effectively. Compost is a poor short term provider of nitrogen to the soil because the mineralization process in the compost takes a longer period of time. Consecutive compost application is to exalt the amount of soil organic nitrogen and the potential to mineralize nitrogen (Mark et al, 2007). Compost is preferable than chemical fertilizer due to its balanced chemical composition and has a high water holding capacity and improves the structure of the soil (Laura and Rienke, 2004).

Churchill et al (1996) as cited by William (2005) said that as compared to manure and crop cover nutrient provision by compost is slow and this is because " *the higher degree of decomposition leading to the production of humic substances resulting in a slower release of nutrients, especially nitrogen*''(William, 2005)

2.4.2 Chemical Fertilizers

Chemical fertilizers are those fertilizers whose chemical constitutions are recognized. These fertilizers are ready to be consumed by plants and they can easily dissolve and leached. It can be applied before, during and after planting. Fertilizers hasten plant growth, but if dry weather occurs the soil may lose the available moisture through evapotranspiration due to the well-developed leaf. Fertilized crops can resist drought due to the presence of penetrating roots (Ezekiel, 2004). Chemical fertilizers can be applied in different ways and time. Fertilizers may spread over the whole field followed by ploughing of the land, it can be applied in rows next to or below the seed and can be applied once the crop has grown known as top dressing (Laura and Rienke, 2004).

Fertilizers have a dominant role in increasing crop production, but its accessibility to the majority of the farmer is questionable. There is a wide spread supply constraint which is related

to shortage of foreign currency at national level, lack of loan facilities and inefficient distribution system (Anthony, 1990). In the case of Ethiopia chemical fertilizer application has faced different challenges. The amount of chemical fertilizer applied is less than the recommendation due to limited credit access, the price of fertilizers is expensive and absence of roads and transport restrict on timely availability of fertilizer especially for peripheral areas (IFPRI, 2010).

2.5 Conservation Tillage

It is a system of planting crops with minimum disturbances of the soil that permit seeds to be sown, while ensuring maintenance of crop residue on the surface. The residue left on the surface protect the raindrop impact on the soil and minimize soil erosion. When runoff and evaporation are reduced, the water can easily penetrate into the soil (R.M Shetto, 1999).

Tillage for annual crop production is a major agricultural problem which causes soil erosion and loss of soil fertility. Any agricultural activity which permits the presence of bare land is unsustainable than agricultural activity that the ground is covered throughout the year. If the soil is tilled and left without vegetation cover, the soil will be exposed to different agents of erosion. Perennials are preferable than annual crops because they do not require tillage consecutively (Peterson, 2001).

According to FAO (2000), conservation tillage includes the following:

"*Zero tillage - planting seeds without any previous tillage or soil disturbances except to put the seeds in the right depth. During zero tillage, weed control is done by using herbicides.*

Strip or zonal tillage- a system where strips 5 to 20 cm in width are prepared plant the seeds while the soil between the intervening band remains covered without any disturbance.

Tined or vertical tillage- the land is prepared with implements which do not invert the soil and causes little compaction".

The advantages of no tillage are reducing compaction and degradation of the soil that may emanate from tillage. It also protects the soil from erosion due to the effects of residues left on

the soil. When water runoff and soil evaporation reduced as a result of no tillage, water holding capacity of the untilled soil, increase than the ploughed ones (Ezekiel, 2004).

2.6 Liming

It is the process of adding lime to make the soil less acidic. If the PH level of the soil is <5 the soil become acidic and impede plant growth. The limestone used to treat acidic soils has to reach as deep as the roots of the crops. The amount of lime should not be too much at once, because plants need time to adjust themselves to the change made from acidity. If excess lime is used, decomposition of organic matter will accelerate and this would allow freed nitrogen to be leached (Laura and Rienke, 2004).

When crops are intolerant to high PH, acid soils, liming is a solution. By correcting the soil PH and supply Calcium, lime improves the soil environment for plant growth. The most commonly used liming material is limestone or calcium carbonate ($CaCo_3$). The lime requirement depends on the soil acidity level of exchangeable Al saturation to 15%. Sandy soils are weakly buffered, so that small amount of lime is needed to provide Calcium and correct acidity. On the other hand, large amount of lime is required to reduce Al saturation in strongly acid clay soils due to their larger buffering capacity (Thomas, 2012).

2. Integrated Soil Fertility Management

ISFM can be defined as "*the application of soil fertility management practices and knowledge to adapt these to local conditions, maximizing fertilizer and organic resource use efficiency and crop productivity. These practices necessarily include appropriate fertilizer and organic input management in combination with the utilization of improved germplasm*'' (IFPRI, 2010). ISFM is a carefully designed and combined usage if chemical and organic fertilizers, tillage, rotation and moisture conservation. It involves using the available organic and inorganic nutrients efficiently. The system tries to minimize nutrient loss via leaching, erosion, volatilization and immobilization (RELMA, 2003).

CHAPTER THREE

DESCRIPTION OF THE STUDY AREA AND METHODOLOGY

3.1 Description of the Study Area

Egersebra Mariam kebele is one of the 33 kebles of Enebse Sar Midir woreda of East Gojjam Zone (Figure.1). It has an area of 1,968 hectares. The cable is subdivided into four gates, namely: Yedera, Egersebra, Denbeza and Michael. The total population of the Kebele is estimated to be around 5603. According to the kebele rural development and agricultural office, the study kebele enjoys Woina Dega climate.

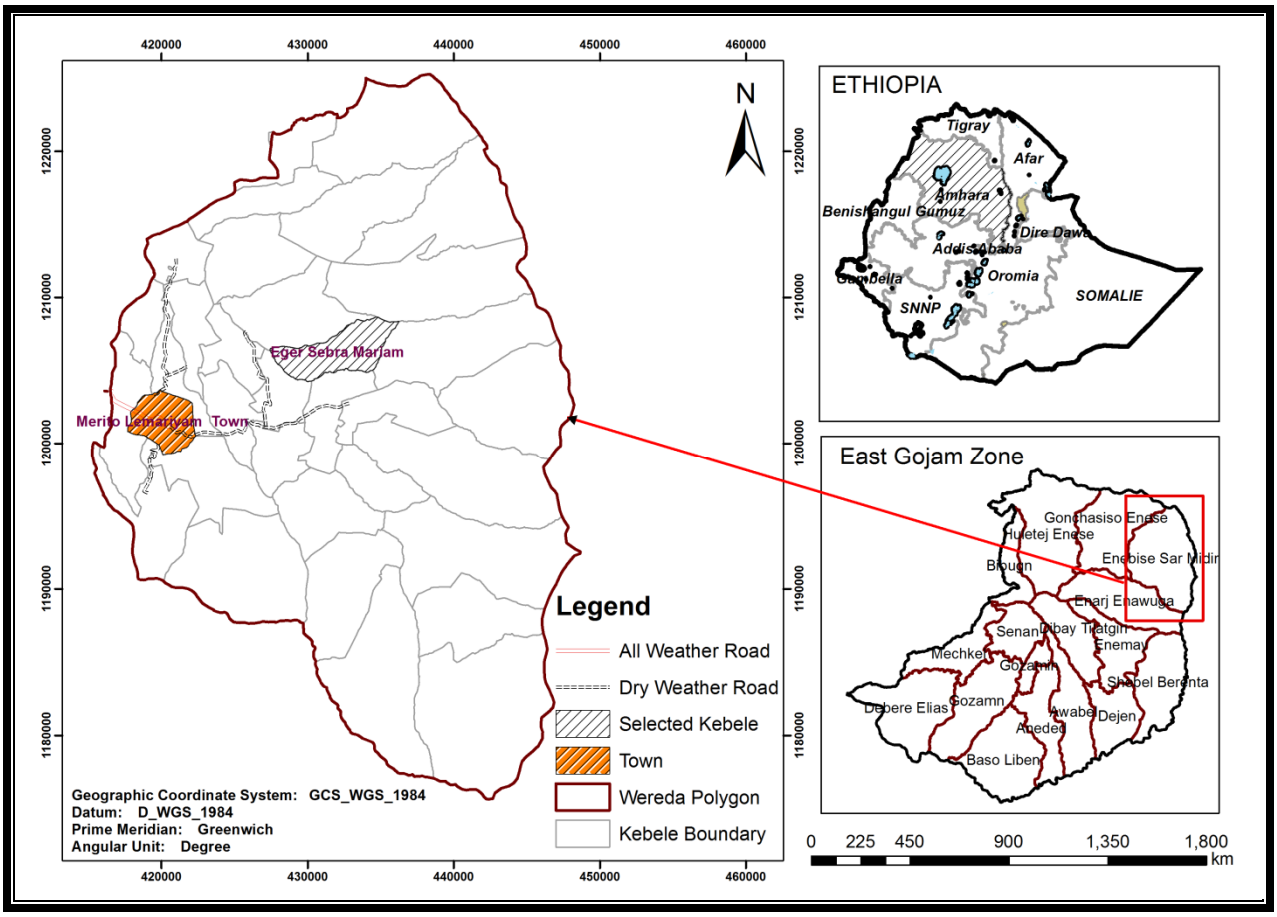

Figure 1 Map of the Study Area

3.1.1 Economic Activity

According to the kebele office of rural development and agriculture office the major economic activity in the Kebele is agriculture which is the single most dominant means of livelihoods of the people. There are few people who gain income from handicraft business activities like pottery and weaving and from selling of tea and local drinks (Tela and Areke). The dominant crops grown in the study kebele are cereals and leguminous crops such teff, wheat, beans, chickpeas, sorghum and haricot bean.

According to HEA Amhara livelihood report (2007), the kebele has been identified as one of food insecure kebeles of Enebse Sar Midir Woreda where by the livelihood of the farmers was assisted by PSNP. PSNP is a component of the Ethiopian government Food Security Program (FSP). FSP has been an essential feature of the food security investment strategy for chronically food insecure areas of the country since 2005. The program has an objective to contribute to reducing household vulnerability and improving resilience to hazards through asset protection methods. The program focused on the provision of resources to chronically food insecure households through direct provision of resource, either in cash or kinds to old people and to physically and mentally incapable persons and by making payments to those individuals who participate in labor intensive public work activities such as constructing terraces, roads and the like.

3.1.2 Soil Conservation

The most common soil conservation practices in the kebele were terraces on the mountain and on farm land, stone bounds, afforestation and composting. According to the Kebele Rural development and agriculture office, 85% of the area of kebele was covered by terraces and >200ha of bare land covered by forests.

3.2 Selection of the Study Area

Egeresebera Mariam Kebele was selected as a site for this research because of the fact that the study area has been identified as one of the food insecure kebele of Enebse Sar Midir Woreda which is found in Abay Beshilo basin livelihood zone. According HEA Amhara livelihood zone

report (2007), this zone suffers from chronic food insecurity due to erratic rain, small land holdings, degraded farm lands, infertile soils, pest infestation, livestock disease and malaria. In addition, poor infrastructure and remote location are some of the characteristics of the area. Farmers get additional income from PSNP, which functions for six months in a year. The program focuses on soil and water conservation and construction of infrastructures. These were some of the factors that have attracted the attention of the researcher to select the Kebele as study area.

3.3 Methodology

This research is a descriptive type of research in which the soil management practices and challenges of the study area have been discussed. The researcher has employed both quantitative and qualitative methods. In the quantitative aspect questionnaires both close ended and open ended questions were administered. For the qualitative data interview, focus group discussion and field observation were used.

3.3.1 Source of Data

Both primary and secondary data were used to conduct the study. The primary data were gathered by distributing questionnaires to a sample representative population group which had been identified by using the sampling techniques. Their information was supplemented by information gathered from key informants, members of focus group discussions, developmental agents, concerned officials, elders, etc. As far as secondary data is concerned, different books, journals, and different papers published or unpublished were used.

3.3.2 Sampling Techniques and Sample Size Allocations

In order to get representative and reliable information and to reach at a tenable conclusion about the study area, using sound research methodology is important. Thus the researcher employed both probability and nonprobability sampling methods. From probability sampling systematic sampling method and from nonprobability sampling purposive sampling method were used.

The study area had been subdivided into four administrative subparts, locally named as “Gots” namely, Egersebra, Yedera, Denbeza and Michael containing 350,200,250 and 250 households respectively.

Table 1 Household size of Gots

Name of Gots	Number of Households	Percent
Egersebra	350	32.7
Yedera	220	20.5
Denbeza	250	23.3
Micheal	250	23.3
Total	1070	100

From these four Gots two of them Egersebra and Denbeza were selected as samples purposively because the study area was homogeneous in its climate, human activity and socio economic Status so samples taken from the two Gots believed to be representative for the whole kebele. After selecting sample Gots sample households were selected by a systematic sampling method which requires a list of population units. Considering the financial and time constraints, it was decided to handle 10% households for detailed analysis. The two sample Gots collectively consist of 600 households. As per this sampling, Skip interval was 10. Accordingly, 35 households were selected from Egersebera Got and 25 households were selected from Denbeza Got. A total of 60 households were selected as sample households. One household was randomly selected and there after every 10^{th} household was identified as sample households.

Table 2 Sample Households

Sample Gots	Total household	Sample households
Egersebra	350	35
Denbeza	250	25
Total	600	60

3.4 Methods of Data Collection

Questionnaires, interviews, focus group discussion and field observation were employed to acquire the necessary data.

3.4.1 Questionnaires

To gather data about the practices and challenges of soil management in the study area questionnaires were developed and administered to the farmers. The questionnaire had four parts. The first part of the questionnaire entertained general information regarding respondent farmers. Part two of questionnaire assessed farmers' perception on soil degradation and soil management. Part three carried questions related to the most common soil management methods that the farmers have applied. The last part of the questionnaire examined major challenges that farmers faced while managing the soil. The questionnaire consisted of both close and open ended questions.

3.4.2 Interviews

Interviews were used as another means of data gathering. Both structured and unstructured interviews were applied. The structured interviews were used to gather information from the concerned kebele administrators and agricultural developmental agents. Both structured and unstructured interviews were provided for selected farmers. So that detailed information about soil management practices and challenges in the study area was explained. The interview sessions have created two way communications in which farmers can ask clarification and further explanation at the time of the interview.

3.4.3 Focus Group Discussion

Two focus group discussions were held by selecting farmers from Egersebra and Denbeza sample farmers. The participants in the FGD were selected purposively. Based on this each group was composed of one model farmer, one elderly farmer and three other farmers. The focus group discussions were conducted during 'Senbete' ceremony. In the study area 'senbete' has a fixed date which is the first Sunday of every new month. 'Senbete' takes place in Eger Sebera Mariam church yard. It is a traditional ceremony in which farmers sit together and discuss about different issues such as reconciliation of quarreled persons, quashing crime from its bud, how to tackle land degradation, i.e., land management, and discus on the best practices and share those good experiences with each other while drinking 'Tela' and eat a special bread called 'yesenbet Kita '.

Figure 2 Participants of the Focus Group Discussions

3.4.5 Field Observation

Field observation was started while writing the proposal and continued through the process of data collection. The field observation helped the researcher to observe the practical situation of soil management in the study area, challenges and progresses. Particularly, it was helpful to see the severity of soil degradation and works done to improve the situation.

3.5 Method of Data Analysis and Presentation

Both qualitative and quantitative methods were used to analyze the collected data. The findings of the study were analyzed by using the tabulation method in which data arranged in a table. The frequency column of the table shows the tally result or the number of respondents and the percent column shows the total percentage in each category.

CHAPTER FOUR

FINDINGS AND DISCUSSIONS

This chapter focuses on analysis and interpretation of the collected data. An attempt has been made to discuss farmers' perception about soil management, how farmers identify one soil from the other, which method of soil management is preferred by farmers, identifies factors affecting soil management and major challenges farmers faced while applying different soil management methods.

4.1 Socio Economic Characteristics of Household Respondents

Socioeconomic characteristics of the household respondents were gathered from different perspectives. The reason why the study had incorporated such information was to provide general highlight about the demographic and economic situation of the respondents and later on to see how some of the attributes influence the soil management practice of the study area.

In terms of sex distribution, 51 (85%) respondent were males and the rest 9 (15%) females. This showed that in the study area land possession was dominated by male. Based on the age distribution of the household, only 5% of respondents were between the ages of 18 to 30 years, whereas 81.6% were between the ages of 31 to 60 and 13.3% above 60. This has indicated that the majority of the household respondents was grouped in the working age group. In relation to the age distribution of the family members of household respondents, 43.5% were under the age of 17, while 53.4% were between 18 to 60 and the rest 2.6% were above the age of 60. Farmers' duration of stay in an area helped them to observe changes through time. In this regard, 13.3% of respondents have lived in the study area between 20 and 30 years and 86.6% lived for more than 30 years. As far as land possession is concerned, on the average 68% of the respondents possessed one hectare of land, whereas, 31.6% of respondents possessed 2.05 hectares of land. Farmers asserted that their land was fragmented and located at different places.

Concerning the ownership of animals, 86.6% of respondents owned animals and the rest 13.3% responded that they did not have a single animal. According to HEA Amhara livelihood zone report (2007), one of the most important determinants of wealth in rural area is the ownership of

livestock in general and ownership of Plough oxen in particular. Ownership of a pair of oxen allows better off households to prepare their land on time and rent-in the land of poor and very poor households on a contractual basis. In relation to this, among those who have owned animals 22 (36.6%) had single ox and26 (43.3%) had a pair of oxen and the remaining 12 (20%) did not have ox at all. Less than half of the respondents owned a pair of oxen. This showed that those farmers without ox were forced either to rent their land based on crop sharing agreement or pay the oxen labor in a sum of money. Frequency and percentage distribution of the above information is summarized on the next page (Table 3).

Table 3 Socio Economic information about household respondents

No	Attributes	Alternatives	Response frequency	Percent
1	Sex	Male	51	85
		Female	9	15
		Total	60	100
2	Age of the household head	< 18 years	-	-
		18-30 years	3	5
		31-60 years	49	81.6
		>=61 years	8	13.3
		Total	60	100
3	Educational status	Illiterate	14	23.3
		Read and write	33	55
		Functional adult education	5	8.3
		Primary education	8	13.3
		Total	60	100
4	Age distribution of Household members	0-17	166	43.3
		18-30	106	27.8
		31-60	99	25.9
		>61	10	2.6
		Total	381	100
5	Duration of stay	<10 years	-	-
		11-20 years	-	-
		21-30 years	8	13.3
		>31 years	52	86.6
		Total	60	100
6	Landholding size per hectare	<0.5	1	1.6
		0.5-1.5	41	68.3
		1.6-2.5	19	31.6
		>2.5	-	-
		Total	60	100
7	Time taken to go from home to farm	< 30 minute	32	53.3
		30 minutes	7	11.6
		30 minutes-1 hour	20	33.3
		>1 hour	1	1.6
8	Number of animals	Ox	74	29.7
		Cow	46	18.4
		Goat	84	33.7
		Sheep	23	9.2
		Equine	22	8.8
		Total	249	100
9	Ownership of ox	Single ox	22	36.6
		Pair of oxen	26	43.3
		No ox	12	20
		Total	60	100

4.2 Perceptions on Soil Degradation and Soil Management

4.2.1 Farmers Perception about Soil Types and Fertility Status

Farmers employ different methods to differentiate one soil from the other. Their knowledge emanated from their long experience in the agricultural activity. Respondent farmers were asked to classify soils based on its color, fertility status and depth. Such soils are locally known as "Keyate" while 18 (30%) respondents identified their soil as fertile, deep with a color of dark brown, locally known as "Taska" and 2 (3.3%) respondents identified their soil as low in its fertility, medium in depth and light gray in its color locally called "Nechate" (Table 4). From the interview made with selected farmers, they have determined the depth of the soil by evaluating the extent of labor required to plow the land. They said that if the soil is shallow, tilling is a difficult task due to the presence of large amount of stones which restricts ox and hoe movement. This is not the case for deep soils. In this regard, 40 respondents, (66.6%) identified their soil as infertile, shallow and red in color. To determine the fertility of the soil, farmers used productivity of the land, although other factors such as rainfall matters a lot in agricultural production. As compared to the three types of soil identified by the respondents, soil which has dark brown color.'Taska' was known for its high productivity as compared to other types of soils.

Table 4 Types of soils in the study area, according to respondents

Soil types	Attributes			Respondents	
Local name of the soil	Color	Fertility	Depth	Frequency	Percent
Keyate	Red	Low	Shallow	40	66.6%
Taska	Dark Brown	High	Deep	18	30%
Nechate	Light Gray	Medium	Shallow	2	3.3%
Total				60	100%

4.2.2 Extent of Soil Degradation

Whenever inappropriate land use and management practices are adopted, soils are exposed to degradation. Soil degradation can be caused by the type of agricultural activities and practices such as land use, crop grown and management practice adopted (PACA, 2010). Ethiopian farmers have awareness about problems associated with soil degradation and traditionally employ conservation methods at the farm level (Alemayehu, 2007). In response to the question "to what extent soil degradation is a threat to your agricultural activity", 43 farmers (71.6%) replied that soil degradation was a menace to their agricultural activity. 17 respondents (28.3%) answered that soil degradation was not a threat to their agricultural activity. So majority farmers in the study area agreed that soil degradation as a potential threat to the agricultural activities. In relation to the soils of their own plots 43 farmers (71.6%) responded that their soil was degraded, 15 farmers (25%) replied their soil was in a good condition and the rest 2 farmers (3.3%) appeared to be indifferent.

Those farmers, who had identified their soils as degraded, based their conclusions on declining crop production from time to time. In this regard, duration of stay in the area helped to compare differences as a passage of time. More than 86% of respondents had been living in the area for more than 30 years. These farmers indicated the situation by comparing the amount of crop they had gained in the past without inputs with the current situation in which crop production decreased from time to time while efforts were made to maintain soil fertility. The situation worsened to the extent that farmers were unable to be self-sufficient in food production. In addition, farmers noticed the situation in a decrease in soil depth and increase in stoniness from time to time.

Concerning their opinion on the possible reasons for soil degradation farmers had suggested topography as a major factor. Most part of the study area was mountainous; as a result the soil was highly exposed to erosion caused by wind and rain water. Participants in the focus group discussion revealed that the root cause of soil degradation was population growth. They said that in the past the population size of the area was small and shortage of farm land was not an issue. As a result, they had practiced following. Not only this, most of the areas which had been

covered by forests and grasslands had been brought under farm lands because of population explosion, resulting in new demands for farm lands.

Nowadays land was highly fragmented and farmers tilled their land continuously without fallowing. The other reason indicated by the participants in the FGD was the removal of vegetation like forests and grasslands which had an impact on soil degradation.

The impacts of natural vegetation degradation were that the soils were exposed to erosion because there was nothing to protect them. Absence of grassland made the number of homestead animals to decline from time to time and the animals mainly fed on crop residue which made the farmlands without cover and exposed them to erosion caused by wind or running water. Absence of forest land affected fuel supply; as a result farmers had used cow dung as a source of fuel which had been used to maintain soil fertility. Rapid population growth and destruction of natural vegetation were the two major causes of soil degradation, according to the respondents.

Topography is one of the determining factors of soil erosion, and erosion control mechanisms determine the agricultural suitability of the land. If the slope of the land is high, the land will be exposed to severe erosion due to increased runoff velocity. High slope areas are difficult for agricultural uses because tillage becomes difficult due to the topography and the shallowness of the soil (FAO, 2000).

In this regard farmers were asked to identify farm lands according to its slope by saying steep, moderate and plain, 35 respondents (58.3%) replied that the slope of their land was steep while 5 respondents (8.3%) said that the slope was medium and 20 (33.3%) farmers replied that their land was plain (Table5).

Table 5 Farmers' Perception on the Slope of the Farm

Slope	Frequency	
	Number	Percent
Steep	35	58.33%
Moderate	5	8.33%
Plain	20	33.33%

Considering the impact of topography on agricultural activity, 39 farmers (65%) acclaimed its inverse relationship with their agricultural activities. They said that steep farm lands were highly exposed to wind erosion, especially after harvest when the soil remains without vegetation cover. Not only this, land preparation of steep farmlands was very difficult because of the shallowness of the soil. During rainy season, the seeds and the fertilizer were frequently washed and displaced to make uneven clusters of plants. Thus, there would be parts without plants where as the clusters would be devoid of healthy plants, so as to affect the grain production or yield.

When farmers asked to assess the rate of soil fertility reduction on their farm lands, as many as 40 (66.6%) revealed that the soil fertility reduction rate was high, while 3 of them (5%) held it as moderate. The remaining 17 (28.8%) confirmed that soil fertility reduction was low. The respondents answered the question by comparing the situation with what they had experienced in the past. From the interview made soil fertility problem in the study area manifests itself through a decline in production from time to time

To summarize, what has been discussed above about farmers' perceptions on soil degradation, farmers in the study area were able to categorize the soil based on its color, fertility and depth. Three types of soils were identified locally called "Keyate", "Taska" and "Nechate". "Taska" was dark brown in color, high in its fertility, deep in its depth and best for agricultural activities. Most farmers in the study area thought that soil degradation was a threat to agricultural outputs and the soil they plough was degraded. The major reason forwarded by the respondents to causes of soil degradation was high population growth resulting in the plowing of marginal lands. Topographically, most farmers possessed steep lands as a result the soil easily washed away by wind and rain water. Most of the farmers had agreed that rate of soil fertility reduction was high. These showed that the soil of the study area was highly degraded.

4. 3 Fertilizers Application and Types of Fertilizers Used

Under this topic, the most common soil management practices in the study area have been identified. Soil management methods as per their rate of prevalence were sorted out. In addition, the farming practices and their impacts on soil fertility have been recognized.

Farmers were requested to indicate their preference between organic fertilizer and chemical fertilizers. 56 respondents (93.3%) had preferred organic fertilizers. The reason why they had chosen organic fertilizer was that organic fertilizers were less costly as compared to chemical fertilizers and free from causing an adverse effect on the soil. The remaining 4 farmers (6.6%) replied that they had preferred both chemical and organic fertilizer.

Concerning the actual distribution by types of fertilizers, as many as 50 of respondents (83.3%) had used organic fertilizer, one farmer had used only chemical fertilizer while 4 (6.6%) had used both chemical and organic fertilizers. Remaining 5 respondents did not use any of the fertilizer (Table 6). Farmers who had used chemical fertilizer were asked whether the amount of chemical fertilizer they used was according to the recommended rate, the farmers confessed that the amount of fertilizers (Urea and DAP) was lesser than with that of the recommended rates 100kg Urea and DAP per hectare. The reason for applying lesser amount ascribed by the users was the unaffordable price of chemical fertilizer.

Table 6 Farmers Use of Fertilizers by Types

Types of fertilizer	Frequency	
	Number	Percent
Organic fertilizer only	50	83.3%
Chemical fertilizer only	1	1.6%
Both	4	6.6%
Neither organic nor chemical fertilizer	5	8.3%
Total	60	100%

From the FGD it was revealed that most farmers had rejected the idea of using chemical fertilizers. They said that since erratic rainfall pattern, chemical fertilizers might stay on the farm longer than the necessary time without being dissolved. This situation damaged the seed before it sprouting. In the interview, farmers explained that even though the timing and the amount of rainfall was as required, the slopy nature of the land causes fertilizers to be easily washed away to the lower part of the farm land and adjacent to the stone terrace. The other factor that had prompted farmers to resist the application of chemical fertilizers was escalation of its price from

time to time and fears of debt that they would not be able to repay if crop failed. Farmers believed that if they began to use chemical fertilizers the soil would adapt these fertilizers without which the desired output could not be obtained. In relation to this, Barry and Ejigu (2005) reveled that cost, lack of credit, poor availability and the risk of loss of investment through crop failure due to drought or pest were reasons why farmers did not use fertilizers at the recommended rate. The Kebele DA approved that the chemical fertilizer consumption in the whole Kebele was 43 quintals in 2005/2006 E.C agricultural season. When it was divided by the number of households in that Kebele, it was around 4.019 kg/house hold which showed that in the study area the application of chemical fertilizers was insignificant. The reason why farmers had used scanty amount of chemical fertilizers was explained by DAs as follows: There was an attitudinal difference of farmers who feared the growing price of fertilizers from time to time and avoid the dependency of farmland on fertilizers. In addition, the blanket recommendation that had been done without testing nutrient of the soil created the doubt on the efficacy of the fertilizers.

Farmers were asked whether or not using chemical fertilizer alone can alleviate soil fertility problem. Only 3 respondents (5%) said that application of chemical fertilizer alone would solve soil fertility problem. 54 respondents (90%) retorted no to the question. They suggested that from their past experience it was better to use crop rotation and organic fertilizers which did not have an adverse effect on their land and economy than chemical fertilizers. The rest 3 respondents (5%) appeared to be indifferent. In relation to this, Tilahun (2003) explained that degraded soils rarely respond to external inputs, such as mineral fertilizers, and hence reduce the efficiency and return of fertilizer use. Degraded soils have also very poor water holding capacity partly because of low soil organic matter content that in turn reduce the fertilizer use efficiency. Therefore, it is best to use both organic and chemical fertilizers.

As far as organic fertilizers were concerned the most common organic fertilizer used in the study area was compost. The compost was made of mainly from household refuses, ashes, residues of leaf, bark and weeds. Most farmers did not add animal dung during compost preparation because of the presence of few animals due to absence of grazing lands. Dung obtained from these animals was used for fuel consumption. The Kebele DA replied that around 85% of the farmers had begun to use compost since 5 to 6 years back. Those who had not used organic fertilizers

mentioned the following reason; its labor intensiveness from preparation, transportation to dispersal along with shortage of animals made compost preparation a difficult task.

4.4 Uses and Misuses of Crop Residue

Crop residues left on the ground can protect the soil from erosion and improve soil fertility through adding organic matter to the soils. In actual practice 47 respondents (78.3%) confirmed that they had used crop residue as a fodder for animals while, 8 respondents (13.3%) had sold crop residues to generate income for the family. Those farmers who did not have ox used the generated money to cover the animal or human labor cost incurred at the time of land preparation. Only 2 respondents (3.3%) had used crop residue both as fodder and as a source of additional income (Table 7).

Table 7 Crop residue usage by Farmers

Purpose	Frequency	
	Number	Percent
Leave it on the farm land	-	-
Sell	8	13.3%
Fodder	47	78.3%
Fuel	-	-
Fodder and sell	2	3.3%

The reason for using crop residue as fodder by most of the farmers were because of the fact that in the study area there was no as such personal or communal grazing land which could provide fodder for animals. None of the respondents left crop residue on the ground to protect the soil from erosion and to maintain its fertility, although from the focus group discussion it was revealed that they were aware about the benefits of crop residue in maintaining soil fertility.

4.5 Crop Rotation

As compared to mono cropping, crop rotation has a lot of agronomic, economic and environmental advantages. Crop rotation improves organic matter content in the soil. It recovers

soil structures, reduces soil degradation and increases productivity and farm profitability in the long turn. It also helps to control weeds and diseases; as a result, there will be a significant reduction in pesticides and weedicides use (PANE, 2012).

All respondents unanimously answered that they had the practice of maintaining soil fertility by using crop rotation since ancient times and still they had practiced crop rotation. Farmers alternatively grew different crops in different agricultural season. The most common crops used in crop rotation were wheat, bean, Teff and haricot bean. The most widely used rotation types in the study area were one year rotation, but from the interview with DA few farmers in the kebele had employed two year rotation. Crop rotation has an advantage of increasing soil fertility since leguminous plants fix nitrogen from the atmosphere. In addition, it has its own contribution to minimize the frequency of ploughing. According to the respondent farmers, frequency of ploughing varies from crop to crop for example, in the study area land preparation for Teff required repeated ploughing up to 8 times until the texture becomes fine, but in case of bean it was enough for land to be ploughed at the time of sowing. So alternating Teff with bean helps the soil to maintain its fertility and minimize tillage frequency. Crop rotation in the study area was considered as one of the oldest methods of soil fertility management.

4.6 Perennials

Perennials are crops continuing to remain in the same field for many years. Most of them are deep rooted so the plants access water and nutrients that are found far below and adapt themselves to extreme condition because they are deep rooted as compared to annual crops. They require less fertilizer and water and avoid the routine seasonal tasks of ploughing and sowing seeds which is a common feature of annual crops (premaculturenews.org).

Concerning perennials 40 respondents (66.6%) replied that they didn't have perennials in their field. The remaining 20 respondents (33.3%) planted perennials. Out of the 20 respondents15 (75%) of them planted perennials at the backyard not on the main land and the most common perennial in the area was Gesho (Rhamnus prinoides) (Figure3). It is a plant, which is used in the preparation of local beer and mead, called "Tela" and "Teje" respectively in Amharic.

Figure 3 Gesho (Rhamnus prinoides)

The remaining 5 of the respondents (25%) replied that they grew sesbania sesban around the boundary of their farm land (Figure 4). Sasbania sesban grows well in the tropics. It is and significant nitrogen fixing tree. sasbania sesban is a short living tree up to 6 or 7 years and grow up to 6m high. It grows best under moisture stress area. It has a wide range of adaptation from 200 to 2400m a.s.l (ESGPIP, 2008). Sesbania sesban has variety uses. It serves as a fodder for cattle and goats, for fuel wood because it produces a high woody biomass in a short period of time and improves soil fertility by fixing nitrogen. On the average sasbania can fix 600kg N/ha/year (Ross and H. Max, 1998).

Farmers who have planted perennials answered that they have got different benefits. Those who planted “Gesho” replied that it was used for home consumption, and sometimes for sell when the production was in excess. Those who had planted sasbania mentioned the following advantages:

1. Serving as separate of farm land from others.

2. Protecting the soil from erosion

3. As fodder for animals

4. As source of fuel wood

The researcher had asked the DA about the spread of sesbania in the keble. The DA replied that sesbania was recently introduced perennial in their kebele and planted on the sample farm lands which were controlled and followed by farmers daily, to protect the plant from being damaged by animals. Because of the multi advantages that sasbania has, the DAs office was trying its best in inculcating awareness among farmers about the benefits of planting sasbenia.

Figure 4 Sesbania Sesban Plantation

Those farmers who had not grown perennials were asked to explain their reasons for not planting perennials; the main reason was shortage of land, scarcity of water, and lack of awareness about its multiple benefits. According to the kebele DA there was a challenge in getting seedlings that can adapt the environment of the kebele because perennials did not get much attention like other soil conservation methods.

As far as cover crops are concerned none of the respondents had used this method. The soil remains without vegetation cover especially after harvest. The reason why farmers did not cover the land was unfamiliarity about the advantages of cover crops.

4.7 Tillage

Tillage for annual crop production is a major agricultural problem which causes soil erosion and loss of soil fertility. Land without vegetation cover is highly exposed to wind and water erosion and frequent tillage aggravates the situation (Peterson, 2001). Concerning the frequency of ploughing of the fields farmers replied that it depends on the type of crops to be sown. Wheat, beans and teff were the dominant crops in the study area. Among these crops, the land preparation for teff was the most strenuous and requires repeated ploughing of 5 to 8 times. The reason why teff land had ploughed frequently was that unless the soil becomes fine in texture, the teff couldn't mix with the soil easily. In addition, repeated ploughing reduces weeds. For the sowing of wheat the frequency of ploughing was from 3 to 5 times. The only crop which required minimum tillage in the study area was bean. According to the respondents, bean seeds could be broadcasted at the first or second ploughing. Farmers also explained the positive and negative impact of frequent ploughing. They replied that frequent ploughing has an advantage of smoothing soil so that the seed can mix with the soil easily and minimizes the occurrence of weeds. On the other hand, the disadvantages of frequent tillage were it aggravates soil erosion and reduces the amount of soil available in the farm.

4.8 Measures Practiced to Control Soil Erosion

More than half of the respondents had possessed steep slope land and these farmers were asked how they had protected the land from erosion. Concerning this aspect, 35 (58.33%) farmers whose farm lands were on steeper slopes mentioned their ways of protecting land from erosion, they replied that contour ploughing had practiced since long period of time and terracing was introduced recently. Two types of terrace were common in the kebele, i.e. terraces constructed on the bare mountains and on farm lands. In the study area terrace construction was not the duty of individual farmer rather farmers who had participated in the PSNP were responsible. More than 85% of the land in the study area had been terraced. Interviewed farmers witnessed that productivity had increased since the construction of terraces. In this regard a study conducted by Alemayehu (2007) showed that soil terracing is largely reducing soil erosion though it is difficult to absolutely stop erosion.

Figure 5 Terraced Farmland

To conclude what has been stated above, the study area was highly degraded and agricultural productivity was low. To improve the situation, farmers had employed different soil management techniques both modern and traditional. To protect the physical loss of soil, farmers built terraces and practiced contour ploughing. To preserve soil fertility dominantly farmers had used crop rotation and compost.

The application of chemical fertilizer was very low, possibly to say, insignificant. This was due to lack of awareness and expensiveness of chemical fertilizers. Though crop residues can protect soil from erosion and improve its fertility, in the study area, farmers did not leave the residue on the ground rather they had used it for forage and the rest sold to the market. With regard to tillage, farmers had a tendency of ploughing the land frequently to increase production and reduce weeds, though it had an adverse effect in creating conducive condition for the agents of erosion like wind and water.

Only few farmers had planted perennials like “Gesho” at the backyard. Few farmers had grown sesbania sesben along the boundary of the farms. Shortage of land, water supply and lack of seedlings were mentioned as major factors that had prevented farmers from planting perennials.

4.9 Factors that Influence Soil Management

4.9.1 Size of the Farm and Distance between Farm and Home

Concerning the impact of distance between residence and farm plots 37 respondents (61.6%) answered that long distance between home and farm had a negative impact on soil management. It was more specific with the transporting compost from backyard to farm because of the bulky nature of the compost. In the study area, there were few equine animals so farmers were forced to transport the compost using the human labor. The longer the distance, between farm and home, the lesser will be the follow up of the soil management by the farmer. Concerning the farm size, 31 respondents (51.6%) answered that small land holdings had an adverse impact on soil management such as terraces which took some portion of the land which would have been used for crop production. Though that was the case, farmers were willing and cooperative in the construction of terraces because they knew that soil loss could have been worse had there not been terraced. The remaining 29 respondents (48.3%) mentioned that the size of the farm did not affect the soil management.

4.9.2 Extension Service

DAs provide the necessary information to the farmers on new technologies. It is expected that the more the contact between the DA and the farmer, the better can be the soil management (Wegayhu, 2013). In addition to DA's model farmers can also contribute a lot in the soil management activity. Farmers were asked to what extent DA's encouraged them to adapt modern soil management techniques. 32 respondents (53.3%) replied that DAs had encouraged them to use modern soil conservation methods while the remaining 28 respondents (46.6%) had the adverse opinions about the DA, saying that DAs did not encourage them to use modern soil conservation methods.

In this regard, the DA replied that though their number was 3 in the Keble they had tried to reach the farmers and give assistance to them. The ratio between the DA and the farmers was 1to 350. This ratio had restricted their availability as it was expected. The topography of the study area had also influenced their connection with the farmers. To tackle this difficult situation, the DAs had used one to five grouping to organize farmers and provide the necessary information about

soil management. In the Keble there were 35 developmental groups which had consisted 175 one of five groups. By using these groupings, the DAs mainly communicated with the developmental group leaders and the developmental group leaders communicated with their respective one to five group. Through this ways DAs had tried to minimize the aforementioned challenges.

Farmers were asked whether or not they apply new soil management techniques provided by the government via DAs, 54 farmers (90%) answered that they had used soil management methods mainly compost and terrace. As it has been mentioned farmers had strong resistance to use chemical fertilizers. From the interview with DA, the most common soil management methods that had been recommended to the farmers were, terracing, compost, chemical fertilizers and planting trees in bare lands. The DA said that good results were obtained from compost and terrace. Afforestation was also good. Almost 200 hectares of bare land were covered by indigenous species of vegetation.

Figure 6 A. afforestation on Ambalay mountain B. Shutelay Mountain.

0nly 20 respondents (33.3) declared that DAs had shared their knowledge about the advantages and disadvantages of different modern soil conservation methods while 35 respondents (58.3%) answered that they got information about the advantages and disadvantage of each soil management methods from farmers who had been trained. The remaining 5 (8.3%) respondents

revealed that they had on any external source of information instead they had used their own experiences.

Farmers learn more from their colleagues, neighbors by sharing experiences with one another. In this regard, when farmers asked about the presence of role model farmers in their vicinity, 25 respondents (41.6%) accepted their presence. 32 (53.3%) replied that they did not know model farmers in their vicinity and 3 respondents (5%) revealed themselves as model farmers.

Those farmers who had asserted the presence of model farmers were asked whether these models had any contribution to their soil conservation practice, 20 of them (80%) reacted that model farmers had shared their experience and helped them to work hard. This experience sharing was usually done at the time of the coffee ceremony at a household level and at the time of 'Senbete' where the majority of the farmers met once in a month.

Farmers were also asked to evaluate the efforts made by the government to conserve soil, 58 respondents (96.66%) agreed that the government had used maximum efforts to conserve soil rehabilitate the environment. In the FDG made, farmers asserted that the government had planted trees in areas which had been bare and this was done with the participation of the community so as to provide better preservation of the forests, it supplied fertilizer to the farmers through associations on credit basis and appreciated and recognized model farmers from "Got" to national level.

Respondent farmers were asked to list out the most common soil management methods that they had used and to explain the advantages and disadvantages of each particular method. The following soil management methods were dominantly recommended to the farmers, Use of compost, terrace on farm lands, chemical fertilizer application and planting sesbania were highly recommended.

In relation with the use of compost farmers mentioned the following advantages. Compost had improved soil fertility, increases the amount of soil, which helped the penetration of plant roots and improves moisture holding capacity of the soil. The disadvantages of compost mentioned by farmers were in connection with its bulky nature which made it labor intensive from the time of preparation up to transportation and dissemination to the field.

Concerning terracing, respondents said that terracing had prevented the soil from erosion. But unless it is made properly, the destruction is worse than erosion which might occur in areas without terrace. Sasbania plantation though it was practiced by few farmers, it was revealed that the plant had diversified uses. Such as it had protected the soil from erosion, and served as a supply of food to homestead animals. When it dries, it was used as a source of fuel. The limitation of sesbania was its unavailability to the farmers.

Conclusions and Recommendations

Soil is one of the basic natural resources which require maximum effort for its management. Degraded farmlands and infertile soils are one of the causes of food insecurity in Ethiopia. Thus, soil management helps to prevent loss of soil via erosion and enhance its performance. The way soils are used has its own positive or negative impact on sustainable land management.

Using their own experience farmers were able to classify the soil into three based on color, fertility status and depth, locally named as “Keyate”, “Nechate” and “Taska”. Out of the three, “Taska” was known for its better productivity.

The study revealed that soil degradation was a threat to the majority of the farmers and most farmers classified their soil as highly degraded. Farmers noticed the situation by observing the reduction in agricultural productivity from time to time. Topography, population growth and deforestation of natural vegetation were mentioned as the major causes of soil degradation.

Topographically majority of the farmers had categorized their farm as steep slope. Such topography of land aggravates soil erosion caused by wind or running water. According to the respondents the rate of soil fertility reduction in the study area was high. To enhance the fertility of the soil most farmers preferred organic fertilizers than chemical fertilizers. The following reasons were raised for their preference of organic fertilizer. Organic fertilizers did not require financial capability and had no adverse effect to the soil. The most common organic fertilizer used by farmers was compost. In the study area, compost was mainly made from household wastes, dry or green residues and ash. Due to small number of animals, farmers did not add cow dung to the compost and this had its own impact on the quality of the compost. Chemical fertilizer consumption was insignificant mainly because farmers were not interested to use it. They did not want to make their land dependable on chemical fertilizers. Fear of debt due to crop failure, doubt about its efficacy due to erratic rainfall pattern in the study area and the escalating price of fertilizers were some of the factors which prevent farmers. Farmers showed strong resistance to use chemical fertilizers mentioning the following reasons fear of fertilizer debt due to crop failure, its effectiveness because of erratic rainfall and the escalating price of the fertilizers. That is why farmers showed strong resistance towards using chemical fertilizers.

Crop residue in the study area mainly served as forage. Though farmers were aware of the benefits of leaving residue on the ground, none of them had applied it. This was because no other alternative to feed animals.

Crop rotation had been practiced by farmers for a long period of time. Cereals and leguminous crop alternate in different agricultural season. Among its advantages, crop rotation increased soil fertility while leguminous fixes nitrogen; minimized frequency of tillage especially at the term of leguminous crops. In addition, it helped to control weeds and pests.

Planting perennials on the farm was not common only "Gesho" had been planted in the back yard. There was shortage of perennial seedlings which can adapt the environment and farmers were not well informed about economic and environmental benefits of perennial. In addition, shortage of land and scarcity of water were raised as factors for the absence of perennials. Few farmers grew sesbania around the boundary of farm land. Sesbania is a multiple purpose tree which can fix nitrogen from the atmosphere, as a result, soil fertility increases. It is used as forage and source of fuel when it dries. Though sesbania has a number of benefits, its plantation in the study area was small.

Since cereals including Teff were the dominant crop the frequency of ploughing differs from one crop to the other. Farmers ploughed the teff land up to 8 times. Such repetitive ploughing of farmlands had aggravated the removal of soil by wind or running water from the surface. The main reason for repeated ploughing was to increase productivity and minimizes weeds.

Because of the steep nature of the land, contour ploughing and terracing were common soil management methods used to prevent soil erosion. The distance between home and farm land was an additional factor that affects soil management. Most respondents had agreed that the longer the distance is the lesser the follow up they make to the soil. Especially farmers had suffered a lot to transport compost. In the same manner, more than half of the farmers who had owned small farm land suggested that soil management methods like terrace took some part of the farm which could have been used for crop production.

Farmers revealed that DAs had encouraged them to use modern soil management techniques. Though it was below half, significant number of farmers had explained DAs did not encourage

them to use modern soil management methods. The reason for this was that, DAs number was small and topographical constraint that is inaccessibility of the area due to the presence of ups and downs.

Farmers did not apply all soil management methods that were recommended. Composting, terrace and afforestation were commonly used in the area. More than half of the farmers did not get information about the pros and cons of modern soil conservation methods from DAs, instead farmers who had been trained and model farmers were the one who shared experiences about soil management methods.

Farmers had identified different soil management methods with their advantages and disadvantages. In these regard, most farmers had good attitude to compost and terraces by mentioning the following advantages: it had improved soil fertility, increased the amount of soil, it holds moisture. The disadvantage of compost was consumed labor from its preparation to dissemination. Terraces prevented soil from erosion, though it took a portion of land which could have been covered by crops. If it is demolished due to poor quality of construction erosion became worse than erosion, which had been occurring before the construction of terraces.

Recommendations

- The soil in the study area is highly degraded, in order to improve the situation, different soil management methods such as chemical fertilizers, strip cropping and others have to be implemented in addition to compost, terracing and crop rotation.
- The life of the people in the study area was highly dependent on crop production. The land was highly fragmented and degraded. To avoid further fragmentation, off farm activities have to be expanded, such as pottery, weaving, milling and selling of traditional drinks such as ‘Tela’ and ‘Areke’ which can generate income.
- Absence of grazing land had its own impact on the livestock production and on soil management. In this regard, though they were few, farmers who have planted sasbenia tree benefited a lot. So sasbenia plantation has to be expanded and practiced by other farmers.
- As far as chemical fertilizers are concerned, there was attitudinal difference among majority of farmers about the efficacy of chemical fertilizers and fear of debt because of

its expensiveness. Providing continuous discussion with farmers and giving training to the farmers on the advantages of chemical fertilizers, about the exact time and amount of application of fertilizer is important. Most importantly, testing the soil and identifying the deficient nutrient is central for the right recommendation. Thereafter, it is possible to minimize the resistance of the farmers towards using chemical fertilizers.

- Government has to invest more on training DAs. If DAs are available in adequate number, there will be a wide access to have a contact with farmers exchange information about different soil management methods.
- Perennials that have both economic and environmental advantages shall be introduced to the farmers. So that farmers can escape from food insecurity, get additional income; protect soil degradation by minimizing the frequency of tillage and maintaining its fertility.
- In order to have uninterrupted information flow between farmers and DAs, one to five and developmental groups had contributed a lot in dissemination of information and experience sharing. Such fora need to be strengthened. Ceremonies like 'Senbete' can serve as fora to discuss about soil management issues with the farmers.

References

Alemayehu Asseffa, 2007.*Impact of Terraces Development on Soil Properties in Anjeni Area West Gojjam*. MA Thesis. Addis Ababa University.

Anthony young, 1990. *Agroforestry for Soil Conservation.* UK: CBA international.

Badge Bishaw and Abdu Abdulkadir, 2003. *Agroforestry and Community Forestry for Rehabilitation of Degraded Watersheds on the Ethiopian Highlands.* International symposium on contemporary development issues in Ethiopia. July 11-12,2003, Addis Ababa Ethiopia.

Deborah Duveskog, 2003. *Soil and Water Conservation with a focus on Water Harvesting and Soil Moisture Retention.* Harare,Zimbabwe: FARMESA.

Doug Collins, Carol Miles, Craig Cogger, Rich Koenig, 2013. *Soil Fertility in Organic System: A guide for gardeners and small acreage farmers.* Pacific North West extension publication.

ESGPI, 2008. *Fodder Establishment Management and Utilization Techniques for the Small Holder Farmer.,* Technical bulletin No.17

Ezekiel A. Akinrinde, 2004. *Soil: Nature, Fertility Conservation and Managemet.* Nigeria: AMC publishing, university of Ibadan.

FAO, 1994. *Soil Management for Sustainable Agriculture and Environmental Protection in the Tropics. Land and Water Development.* United Kingdom: Oxford press.

FAO, 2000. *Manual on Integrated Soil Management and Conservation Practices Land and Water. Bulletin* No 8. Franklin Martin and Schott Sherman, 2007. *Agroforestry Principles*. USA: ECHO

Fred Magdoff and Harold Vanes, 2009. *Building soil for Better Crops: Sustainable Soil Management.*3 rd ed. University of Maryland: SARE.

HEA, 2007. *Livelihood Profile Amhara Region: Abay Beshilo Livelihood Zone Report*. WWW.heawebsite.Org

Hill Kuyipers, Anne Mollema and Egger Topper, 2005. *Erosion Control in the Tropics.* Netherlands. Wageningen: Agromisa foundation.

Humberto Blanco and Ruttan Lal, 2008. *Principles of Soil Conservation and Management* USA: ECHO.

IFPRI, 2010. *Fertilizer and Soil Fertility Potential in Ethiopia Constraints and Opportunities for Enhancing the System*. Washington DC: IFPRI.

Keven selwin Nancy, 2012. *Manual for Best Practices in Soil Conservation and Soil Fertility Management for Farmers in Seychelles.* Seychelles: SAA.

Lakew Desta, Menale Kassie, S. Benin and J. Pende,2000. *Land Degradation and Strategies for Sustainable Development in the Ethiopian Highlands Amhara Region.* Nirobi:Kenya

Laura van scholl and Rienke Nieuwenhuis, 2004, *Soil Fertility Management*. Wageningen: Agromisa Foundation.

Leonard Berry, 2003. *Land Degradation in Ethiopia: Its Extent and Impact.* www.FAO.org

Marcin K. Widomski, 2011. *Terracing as a Measure of Soil Erosion Control and Its Effect on Improvement of Infiltration in the Eroded Environment.* Poland: In Tech.

Mark Gaskel, Richard Smith and Jeff Mitchel et al, 2007. *Soil Fertility Management for Organic Crops.* University of California publication. http://anrcatalog.ucdavis.edu/

Melissa vantine and sven verlinden, 2003. *Maintaining Soil Fertility under an Organic Management System.* West Verginia University.

Michael Morris, Valerie A. Kelly, Ron J. Kopicki, and Derek Byerlee, 2007. *Fertilizer Use in African Agriculture.* Wasington DC: World Bank

PACA, 2010. *Soil Degradation*, New Delhi India. www.coseveagri.org

PANE, 2012.*Crop Rotation Benefiting Farmers, The Environment and the Economy.* EU Permaculture News.org posted 2012.

Peter Gruhn, Francesco Goletti and Montague Yudelman, 2000. *Integrated Nutrient Management, Soil Fertility, and Sustainable Agriculture Current Issues and Future Challenges* IFPRI: Washington DC.

Peterson Sullivan, 2001. *Sustainable Soil Management.* Washington: ATTRA

R. M. shetto, 1999. *Indigenous Soil Conservation Tillage Systems and Risks of Animal Traction on land degradation in eastern and southern Africa.* Harare Zimbabwe: ATNESA.

RELMA, 2003. *Soil Fertility and Land Productivity. A guide for extension workers in the Eastern Africa region*. Technical handbook No.30. Nairobi Kenya: English press limited.

Ross C. Gutteridge and H. Max Sheldon ed., 1998. *Forage Tree Legumes in Tropical Agriculture.* University of Queensland: The Tropical Grass Land Society of Australia INC.

Ruttan Lal, 1995. *Sustainable Management of Soil Resource in the Humid Tropics.* Japan: United Nations University Press.

T. C. Sheng, 1989. *Soil Conservation for Small Farmers in the Humid Tropics.* FAO soils bulletin No 60.

Thomas Fairhurst ed., 2012. *The Hand Book for Integrated Soil Fertility Management.* Nairobi: CABI.

Tilahun Amade, 2003. *Opportunity and Challenges in Reversing Land Degradation the Regional* Experience. Addis Ababa: CIAT.

Wagayehu Bekele, Derjaw Fantie et al, 2013 Determinants of the Use of Soil Conservation Technologies by Smallholder Farmers: The case of Hulet Eju Ense: *Asian Journal of Agriculture and Food Science Vol. 01 Issue 04.*

William R. Horwath, 2005. *The Importance of Soil Organic Matter in the Fertility of Organic Production System.* Western nutrient management conference vol. 6. Salt Lake city, UT.

Annex 1

Questionnaires

Dear respondents:

This questionnaire is designed to gather data on the practices and challenges of soil management in Egersebera Mariam kebele of Enebse Sar Midir Woreda of East Gojjam Zone. To achieve this purpose and to deeply investigate the case, your response to the questions given below has a crucial value. Therefore, you are kindly requested to read the questions carefully and give accurate and real data. The response that you reply will not be used for any other purposes other than this research work, so be free and give your honest and genuine response.

Thank you in advance for your Cooperation!

Date----------

Read the questions and use tick mark (√) or circle your choice

I General information

1. Sex

Male -------- Female --------

2. Educational status

A. Illiterate B. Alternative basic education

C. Functional adult education D. Primary education E. Secondary education

F. TVET G. Diploma H. Degree and above

3. Age

A. <18 B. 18-30 C.31-60 D.>61

4. Family size total------- Male----- Female-----

5. For how long have you been here?

A. <10 Years B. 11-20Years C.21-3OYears D. >31 Years

6. How many hectares of farm land do you have?

A. <0.5 B. o.5 to 1.5 C. 1.5 to 2.5 D. >2.5

7. What type of farming do you practice as a major source of income?

A. Crop production B. Animal rearing C. Both D. Other, specify----------

8. How far the farmland is distant from your home?

A. Around the home B. Around 1km C.1 up to 2.5 km D. >2.5km

9. Additional income source other than farming ----------

10. Number of bovines and equine animals

Animal	Number	Total
Ox		
Cow		
Goat		
Sheep		
Equine		

11. What is the dominant crop that you produce?

A. Teff B. Cereals c. Leguminous D. Fruit and vegetables E. Other----------

II Questions related to farmers perception on soil and soil management.

1. How do you explain the soil type of your farmland based color, fertility and depth? Fill the table below based the given clue:

Fertility less fertile, moderate, fertile

Color Black, red, gray…….

Depth, deep, moderate, shallow

Local name Of the soil	Color	Fertility Status	Depth

2. Do you think that soil degradation is a treat to your agricultural activity?

A. Yes B. No

3. Do you think that your soil is degraded?

A. Yes B. No C. I do not know

4. If your answer to question number 3 is yes, how do you notice it?----------

5. What are the possible reasons that degrade your soil?

A. The soil is exposed to high rainfall B. The soil is exposed to wind erosion after harvesting C. Absence of agricultural inputs D. Traditional plowing system

6. How do you evaluate the slope of your farmland?

A. Sloppy B. Moderate C. Flat

7. If your answer to question number 6 is "A" does it has any impact on farming?

A. Yes B. No

8. If you say yes to the above question, write the impacts----------

---

---

9. Do you think that developmental agents support is sufficient enough to assist you?

A. Yes B. No

10. If you say yes to question No 9 how?----------

---

11. If you say no to question No 9 why?----------

III. Questions related with the most common soil management methods that farmers apply to upgrade the soil.

1. How do you see the rate of soil fertility problem on your farm?

A. High B. Medium C. Low D. I don't know

2. If your answer to question number one is high, how do you treat it?

A. By using chemical fertilizers B. By using organic fertilizer

C. both D. Other, specify----------

3. Which fertilizer do you prefer most? Why?

A. Chemical fertilizer----------

B. Organic fertilizer----------

4. Do you think that the amount of chemical fertilizer that you use is enough to get optimum production?

A. Yes B. No C. I don't know

5. How many times do you use chemical fertilizers in one agricultural season? Use the table below to answer the question and use (√) to answer frequency of fertilizer application and time of application shall be identified by saying **before sawing, while sawing and after sometimes crops grow**

Frequency of fertilizer application		Time of application
One		
Two		
Three		

6. What are the major challenges that you face towards using chemical fertilizers?

A. Expensiveness B. Shortage of supply C. Lack of credit D. Lack of awareness

7. Do you think that using chemical fertilizer alone can soil fertility problem?

A. Yes B. No C. I don't know

8. If your answer to question number 7 is No. what other things shall be done to improve soil fertility? ----------

---

9. Do you use organic fertilizer?

A. Yes B. No

10. If your answer to question number 8 is yes, which of the following organic fertilizer is used by you?

A. Compost B. Manure C. Green manure D other specifies

11. If your answer to question number 9 is no why?

A. I don't have enough animals B. I used the manure for fuel consumption

C. Difficult to transport to the farm D. Lack of awareness

12. For what purpose do you use crop residue?

A. Leave it on the land to increase the fertility B. Sell it

C. Used it as a fodder D. Used it as a fuel E. Other, specify----------

13. Do you use crop rotation to maintain soil fertility?

A. Yes B. No

14 If you say Yes to question number 13, which crops do you alternate?

A. Cereals with leguminous B. One cereal with the other cereal C. teff with Niger seed D. Other, specify----------

15. Do you have perennials?

A. Yes B. No

16. If you say yes to question No15, what advantages do you get?----------

17. If you say no to question No15, why?

A. There is no enough land B. Difficult to get perennials

C. Lack of awareness about the importance of perennials D. Other, specify----------

18. Do you use cover crops to protect the soil from erosion?

A. Yes B. No

19. How often do you plough in one agricultural season?

A. 1 times B. Up to three times C. From four to 8 times D. > Eight times

Type of crop	Frequency of ploughing
teff	
Other cereals	
Oil seeds	
Fruits and vegetables	

20. Do you think that repeated ploughing of the land has a negative impact on the soil?

A. Yes B. No

21.If you say yes to the above question, list some of the impact----------

---

---

22. If your farmland is slopy how do you prevent the soil from erosion?

A. Contour ploughing B. Stone bounds C. Terracing D. Dyke

23. Do you employ the new technological methods of soil management provided by the government through developmental agents?

A. Yes B. No

24. If you say yes to the above question, list the methods introduced----------

---

---

25. If you say no to question number 23, why? Mention your reasons----------

---

IV **Challenges towards soil management**

1 .Does the distance between your home and farm land has an impact on soil management?

A. **Yes** B. No

2. If you say Yes to the above question how?

A. Difficult to transport agricultural products B. It consumes much time to reach farm land

C. Other, specify----------

3. Does the size of your farmland have an impact on soil management?

A. Yes B. No

4. If you say yes, list the impacts----------
---

5. Are there model farmers in your vicinity?

A. Yes B. No

6. If you say Yes to the above question, do they have any contribution to the soil management you make***?***

A. Yes B. No

7. If you say Yes to the above question, what are their contributions?

A. Encourage me to use modern soil management techniques

B. Provide practical support

c. Share their experience

D. Other, specify----------

8. Who give you information about the Pros and cons of modern soil management methods?----
---

9. Do DAs encourage you to use modern soil management methods?

A. Yes B. No

10. Do DAs encourage you to share experience with model farmers?

A. Yes B. No

11. How do you see the effort of the government towards soil management?

A. High B. Medium C. Low

12. Do you think that Modern soil management methods provide by DAs are effective?

A. Yes B. No C. I do not know

13. If you say No why?

A. No prior discussion with farmers about pros and cons

B. The methods disregard the environmental conditions

C. Expensive in terms of money and labor

D. Other, specify----------

14. List some of the soil management methods recommended with their advantages and disadvantages.

Soil management methods	Advantages	Disadvantages

DECLARATION

I hereby declare the thesis entitled ***Soil Management Practices and Challenges in Egersebra Mariam Kebele, Enbse Sar Midir Woreda of East Gojjam Zone, Ethiopia*** has been carried out by me under the supervision of Dr. K. N. Singh, Department of Geography and Environmental Studies, Addis Ababa University, Addis Ababa during the year 2013/14 as part of Masters of Art in Geography and Environmental Studies Specialized in Land Resource Management. I further declare that this work has not been submitted to any other university or institution for the award of any Degree or Diploma.

Amelework Asmare Muse

Signature----------

Addis Ababa University

Addis Ababa

Date June, 2014

CERTIFICATE

This is certified that the thesis entitled ***Soil Management Practices and Challenges in Egersebra Mariam Kebele, Enbse Sar Midir Woreda of East Gojjam Zone, Ethiopia*** is benefited work carried out by Amelework Asmare Muse under my guidance and supervision. This is the actual work done by Amelework Asmare Muse for the partial fulfillment of the award of the Degree of Master of Art in Geography and Environmental Studies specialized in Land Resource management Addis Ababa University, Addis Ababa, Ethiopia.

Dr. K.N. Singh

Signature----------

Department of Geography and Environmental Studies

Addis Ababa University