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ASSESSMENT OF SOIL MANAGEMENT PRACTICES IN HADERO TUNTO ZURIA WOREDA, KAMBATA ZONE, CENTERAL ETHIOPIA REGION .

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January, 2024

Hawassa, Ethiopia

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PRACTICES OF SOIL MANAGEMENT IN HADERO TUNTO ZURIA WOREDA, KAMBATA ZONE, CENTERAL ETHIOPIA REGION.

.

BY

Deselegn Dunamo

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DECLARATION

I hereby declare that this MA thesis is my original work and has not been presented for a Degree in any other University, and all sources of materials used for this thesis have been duly acknowledged.

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APPROVAL SHEET

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This is to certify that the thesis entitled “practices of soil management in Hadero Tunto Zuria Woreda, Kambata Zone, Centeral Ethiopia Region.” submitted in partial fulfillment of the requirements for the degree of Master of Arts in geography and environmental studies and, has been carried out by Deselegn Dunamo under our supervision.

Name of Major Advisor	Signature	Date
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EXAMINERS' THESIS APPROVAL PAGE

We the examiners" board approve that this thesis has passed through the defense and review process"

Name of Major Advisor	Signature	Date
Internal Examiner I	Signature	Date
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Table of Contents **Page**

LIST OF TABLES

LIST OF FIGURES

ABBREVIATION/ACRONYMS

DA	Development Agents
FAO	Food and Agriculture Organization
GDP	Growth Domestic Product
HTZW	HaderoTunto Zuria Woreda
KTZ	KembataTembaro Zone
LDC	Least Developed Countries
M.a.s.l.	Meter above sea level
SNNPR	South Nations, Nationalities and Peoples Region
SPSS	Statistical Package for Social Sciences
SWC	Soil and Water Conservation
SWCP	Soil and Water conservation practice
UN	United Nations

Abstract

The purpose of the study was to assess the practice and challenges of soil management for rehabilitating degraded land in sampled kebeles of Hadero Tunto Zuria Woreda, Kambata Zone, and Centeral Ethiopia Region. *The subjects of the study were 151 survey households' heads, 16 focused group discussants and 2 natural resource experts and 10 key informants 2 development agents. Totally 181 respondents were participated in this study. Descriptive research design with mixed research approach was employed. Questionnaire, interview, personal observation and focused group discussion were used as data collection tools. Quantitative data was analyzed by frequency, percentage and one sampled t-test while qualitative data was analyzed by descriptive narration. It was generalized traditional land management was practiced in a better way in Mugunga and Homa Kebeles of Hadero Tunto Zuria Woreda. Both physical and biological traditional land management were practiced in study area. The effects of soil management in study area were crop yields increased, soil erosion prevent, soil-water retention improved, productivity of land enhanced, biophysical aspect of land improved, income of farmers increased, fodder for animals obtained and soil fertility improvement. It known that practice traditional land management was not easy and straight forward but was challenged by lack of co-ordination of key stakeholders, limited technical assistance from agricultural office experts, conservativeness of farmers to adopt additional advice than their indigenous knowledge, declinations of farmland size to adopt their indigenous knowledge. Recommendation forwarded were, Hadero Tunto Zuria Woreda should make farmers to practice traditional land management together with modern land management to reduce the challenges of technical aspect, physical soil conservation should be constructed at far vertical interval and by focusing on stabilization conservational structures because land size in study area decreased from time to time and farmers and agricultural office experts should work in a coordinated way.*

CHAPTER ONE

Introduction

1.1. Background of the study

Land is one of the most important productive assets of rural residents in developing countries (Xu & Du, 2020).Natural resources are essential livelihood assets in countries of Sub-Saharan Africa (Roe et al., 2009). The population of the world is dependent on land resource for food and other necessities. Hence, land and water resources are the basis for humans to generate income and produce consumable goods and services (Wallace, 2007).However, inappropriate practices cause severe land degradation in terms of soil erosion, soil fertility depletion, water shortage and food insecurity (FAO, 2008) in many countries of the region.

Land is the solid part of the surface of the earth, or a parts of the earth's surface marked by boundaries. Land comprises a complex set of natural resources primarily soil, water and biological resources, their diversity, as well as interactions with the atmosphere and the underlying geology. The product of their interactions, a range of interlinked ecosystem goods and services, is the foundation for sustainable livelihoods, social unity and economic growth (FAO, 2017). In addition land is the integrating component of all livelihoods depending on farm, forest, rangeland, or water habitats and it is uses for agriculture and other land uses, encompassing soils, climate, vegetation, topography and other natural resources.

Land degradation is a problem of global dimensions and affects all terrestrial ecosystem services on every side of the world and it has been recognized for over 100 years in Africa (Kotiaho & Halme, 2018). Land degradation is also the consequence of multiple processes that both directly and indirectly reduce the potential of land and adverse effects on the biodiversity (Ajeye, 2014). The problem of smallholder farm land management is among the most challenging issues in rural area across the world to practices land use management.

The estimates of global extend of land degradation shows that Asia has highly affected and followed by Africa, Where as the Europe is the least effected (Zika M & Erb KH , 2009). United Nations Development Program (UNDP) estimates $42 billion in income and 6 million hectares of productive land are lost every year. As per UNDP the conditions in Africa are worsening with dust storms, damaged water sheds, loss of forests and lower agriculture productivity, which is linked to human poverty, migration and instability (WMO, 2005). Sudan the population is depends on the livestock for their subsistence. It is estimated that 2.6 billion people are affected by land degradation and desertification in more than a hundred countries, influencing over 33% of the earth's land surface (WMO, 2005).

In addition to this, land availability is limited in space and time due to erosion, and this influences livelihoods, especially of the rural poor who directly depend on them (Antoci et al., 2009).Soil erosion is the main cause of land degradation and a leading factor contributing to poor agricultural development in developing countries (Gemechu 2016). Currently, soil resources are the main sources of livelihoods for most people of the world, such human exploitation being the foremost factor for soil degradation (Molla and Sisheber 2017).These studies confirm that soil erosion results in the loss of an important natural resource and there is the need to manage soil through different soil management mechanisms.

According to (Belay et al. 2015; Pingalietal. 2014) land degradation has been the critical challenge for Sub-Saharan African (SSA) countries. The causes of land degradation are complex and vary from place to place. The major drivers of land degradation are generally grouped into two: proximate and underlying causes. The proximate causes are natural factors such as biophysical conditions, topographic and climatic conditions, and inappropriate land management practices, whereas the underlying factors are mostly anthropogenic, which include population growth, land tenure, and other socio-economic and policy related factors. The conservation and management of land and water resources for sustainable growth in agricultural productivity and poverty reduction in developing countries has remained one of the most challenging policy issues for a long time (Bekele *et al*, 2007).

In sub-Saharan Africa, land degradation is one of the biggest problems that threatening the lives of millions of people (Talukder et al., 2020). Like as other sub-Saharan African countries, land degradation is one of the major problems in Ethiopia. It has been negatively affecting the agricultural production, livelihoods, and provision of other ecosystem goods and services in the country. Ethiopia is a large and most populous country, located in the horn of Africa an estimated population of 109 million in 2018 (World Bank 2018), about 79 percent of whom live in rural areas. Agricultural production is largely rain fed and dominated by small scale farmers and enterprises, which produce most of the country's crop and livestock products. Agriculture is the basic economic sector on which the country relies for its social and economic development.

Its contribution to the gross domestic product (GDP) (42%), employment opportunity (84%) and foreign exchange earnings (90%), of the country and it makes the incontestable sector in the countries development prospect (CSA, 2016).

Ethiopia is one of the sub-Saharan African countries where deforestation, degradation of the soil and impoverishment of both ground and surface water largely impedes socio-economic development (Ginjo, 2000). The Ethiopian highlands? have been experiencing declining soil fertility and sever soil erosion due to intensive farming on steep and fragile land (Amsalu and De Graff, 2006; Fikru, 2009). Soil erosion by water is major problem in the country. It is estimated that more than one billion tons of top soil are lost every year. This is equivalent to a land area of the completely Ethiopian highlands (1/2 million km2) losing 3mm soil depth a year. Erosion is most severing in the highlands for obvious reasons: topography is rough, rainfall is intense, population pressure is high, and land management is poor. Research stations in these areas have measured soil loss under arable use, on small runoff plots, of up to 280 tons/ha (Tantigen and Mohammed et al., 2009).

Agriculture is not only affected by environment alteration but also contribute to it and ten to twelve percent of global greenhouse gas emissions are due to human food production and also intensive agriculture has led to deforestation, overgrazing and widespread use of practices that result in soil degradation(Niggli et al., 2008). Degradation of soils can considerably decrease the soil's capacity to produce food and consequently about 66 % of the total world's population is malnourished (Pimentel and Burgess 2013; World Health, 2000). Land degradation is a major cause of poverty in rural areas of developing countries (Nyssen et al., 2007). MoARD and WB (2007) reported that cultivation on steep and fragile lands with inadequate investments in soil conservation or vegetation cover, erratic and erosive rainfall patterns, declining use of fallow, and limited recycling of dung and crop residues to the soils are largely responsible for continued soil degradation in Ethiopia.

Soil fertility management involves sustaining and increasing soil fertility and maintaining food production in an economically, ecologically and socially acceptable way (Usman, 2008).Soil fertility management can boost the capacity of agricultural production to adapt to more unpredictable and extreme weather conditions such as droughts, and floods, reduce greenhouse emissions and reverse carbon losses from soils (Van Oost et al., 2004).Soil management practices can be classified as those affecting tillage, placement, and incorporation of residue and nutrients. It is important to understand that changes in soil management practices affect soil water balance, temperature, biological activity, and gas exchange between the soil and the atmosphere.

Sustainable soil management means cropping, pastoral and forestry use of the limited and only partially renewable resources soil, water and plant nutrients to safeguard soil productivity also for future generations and prevent or reverse degradation process (Senait, 2002).The objective of sustainable land management is to harmonize the complementary goals of providing environmental, economic and social opportunities for the benefit of present and future generations, while maintaining and enhancing the quality of the land (soil, water and air) resource. They include the stabilization of the soil by stone lines, terraces, herbal (grass) strips and various forms of agro forestry measures, for example; planting and management of trees, shrubs and windbreaks hedges .However, these technical solutions alone are not the remedy for the problem (Senait, 2002).

Follett (2001) summarized the effect of soil management on soil organic carbon (SOC) as being attributed to: tillage and soil management systems; management to increase the amount of crop cover; and increased efficiency in the use of inputs (N and water) by the cropping system. There have been several reviews in the past decade on the role of soil management practices on mitigation of GHG (e.g. Martens et al., 2005). An interesting conclusion from their work was that agricultural impacts on C cycling in soil needed greater understanding before the full potential of soil management practices on C mitigation strategies could be better quantified.

Earlier, West and Marland (2002) summarized the effect of changing tillage practices that could result in a reduction in CO_2 emissions from agriculture equivalent to 368 kg C ha^{-1} yr^{-1} but would vary by cropping system and climate regime. Similar conclusions were reached by Franzluebbers (2005) in which he found that reductions in tillage intensity would increase the SOC content but the impact on other GHG emissions was less well defined.

Reed (2008) as well as Lostarnau et al. (2011) noted that stakeholder participation is a key element in natural resource management and can improve decentralized democratic decision making processes and thus should be encouraged. The practice requires commitment of all concerned parties and empowering of disadvantaged members of communities through advice and trainings (Reed, 2008; Lostarnau et al., 2011).Stakeholders need to receive research results and information informants and language to suit their prior knowledge and personal interests (Geeson, 2011).According to Reed (2008), environmental problems are dynamic, requiring up to date and apparent interventions using sound policies and diverse stakeholders. Present day sustainable land management (SLM) approaches are observed to divert their attention towards incorporating the needs and aspirations of the various stakeholders through increased stakeholder participation (Emtage et al., 2007).

Producing more food to feed the rapidly rising world population, while maintaining and conserving the environment, has become a global challenge (Ambler, 2000). Based on this theoretical and empirical background this study will be done to assess the practice and challenges of soil management for rehabilitating degraded land.

1.2. Statement of the problem

The degradation of natural resources is among the main problems facing human beings all over the world. Soil loss due to erosion, depletion of surface and ground water and loss of biodiversity are among the principal global environmental problems (Lal, 2001; Pimentel, 2006).Degradation of soils can considerably decrease the soil's capacity to produce food and consequently about 66 % of the total world's population is malnourished (Pimentel and Burgess 2013 ; World Health 2000).

Even if a large number of conservation campaigns were undertaken through Food-For-Work (FFW) programs, the efforts didn't bring significant changes as expected (Kidane et al., 2014; Teshome et al., 2016).

Land degradation and its related decline in the productivity potential of agricultural land are challenging the economic and social well-being of the current and future generations on earth (Keno and Suryabhagavan 2014; Haregeweyn et al. 2012).The incidence of land degradation is mostly posed on soil. For instance, (Eswaran et.al,2001: Scherr&, Yadav ,2001:, Moran et.al ,2007) pointed out the effect of land degradation includes accelerated soil erosion by wind and water, soil acidification, soil alkalinisation, soil salination, soil water logging, destruction of the structure of soil. Therefore, studying soil management practice and its challenge is crucial to respond for land degradation problem in study areas.

Land degradation can be remaining an important global problem concern because of its adverse impact on agricultural productivity, food security and the quality of the environment. Due to land degradation in most developing countries, agricultural productivity reached the level beyond the subsistence requirement of a household (Antenah, 2010). Producing more food to feed the rapidly rising world population, while maintaining and conserving the environment, has become a global challenge (Ambler, 2000).This confirms that there the need to eradicate the above challenges by appropriately managing soil in study area.

Land degradation causes exploitation of soil resources, reduces soil productivity and alters composition of vegetation; thus influencing billions of people around the globe directly or indirectly (Ravi and D'Odorico, 2005). Human population is increasing at a shockingly high rate and the productive capacity of soil resources necessary to sustain that population is increasingly decreasing because of soil degradation (Gete, 2000).

A numbers of studies have been conducted to investigate land degradation and land management
activities in different parts of Ethiopia. However, land degradation in the form of soil erosion has been remained the major challenge that is adversely affecting the agricultural performance of the country (Amdihun et al., 2014).

Study made by Megersa (2011) focused on traditional land management practices without enco mpass improved/introduced land management technologies. his study was more general because land management encompass water , soil , forest and more so that it is difficult to put concrete solutions for the problem . However this study focused on soil management and its challenges specifically.

A study conducted by Gitima and Legesse (2019) determine farmers' decision to use improved land management practices such as farmers' decision to use *fanyajuu* and stone bund improved land management technologies in Gindara watershed in Loma district Dawuro Zone. Their study was not able to pinpoint the challenges but the current study include the challenges of soil management.

Ethiopia challenged with the dilemma of producing sufficient food for its rapidly growing population on the one hand, and protecting the resource base upon which this is dependent on the other. Maintaining a sustainable balance between those two has been a major contest for the country (Melaku, 2000).Even though agriculture is the major source of livelihood in Ethiopia, land degradation in the form of soil erosion has hindered its productivity (Hengsdijk et al., 2005; Balana et al., 2010). But their study not show the management practice and challenges soil which was done in this study.

In one peasant association of northern Ethiopia (Andit Tid in the North Shewa zone of the Amhara region), Holden, Shiferaw and Pender (2001) found that SMC measures (soil bunds and *fanya juu* terraces) had statistically insignificant impacts on land productivity in all regressions (but a negative coefficient in almost all regressions). Benin (2006), based on a survey of 434 households representing the highlands of the Amhara region as a whole, found that stone terraces had significantly positive impacts (a 42 percent increase) on average crop yields in a reduced form regression for lower-rainfall parts of the Amhara region, but insignificant impacts in a structural regression.

Kassie and Holden (2006) found that physical conservation measures (*fanya juu*) resulted in lower yield in a high rainfall area of the Ethiopian highlands in western Amhara, compared to non-conserved plots. Finally, Pender and Gebremedhin (2006) conducted a survey of 500 households representing the semi-arid highlands of Tigray, and found higher crop yields from plots with stone terraces (an average yield increase of 23 percent), and estimated the average rate of return to stone terrace investment to be 46 percent.

Investments in SWC practices enhance crop production, food security and household income (Adgo et al., 2013). Studies show that despite the availability of many best SWC practices in watershed management, they are highly localized, and are not being expanded to other areas, while land degradation due to soil erosion and deforestation are still the main problems in Ethiopia.

Several studies underweight the effects of soil and water conservation. For instance, Eshatu (2004) and Bewket (2007) reported that SWC measures were inefficient in reducing soil erosion and restoring soil fertility. Conversely, other studies indicated a positive contribution of SWC measures to the reduction of soil erosion, conservation of soil moisture, and restoration of vegetation cover and diversity (Hengsdijk et al. 2005; Vancampenhoutet al., 2006; Mekuria et al. 2007).The soil and water conservation measures which had been practiced even in Ethiopia did not help to mitigate the problem of soil erosion and environmental degradation (Habtamu, 2006). Agricultural report before 10years on the status of soil degradation pointed its seriousness clearly. For instance,1998-2002 said soil highly depleted(HTZWARDO, 2017). . Research done by Mulgeta(2019) on the variation of soil nutrients in conserved and non-conserved areas indicated in conserved area the content of soil nutrients improved while in non-conserved areas the soil nutrient content not showed improvement. But this study not showed the effects of soil conservation in study areas. Therefore, this study was done to investigate the practices and challenges of soil management for rehabilitating degraded land in stated district.

1.3. Objective of the study

1.3.1. General objective of the study

To investigate the practices of soil management in Hadero Tunto Zuria Woreda southern Ethiopia.

1.3.2. Specific objective of the study

- ✓ To examine the practice of soil management in study area
- ✓ To appraise the ecological, economic and social effects of soil management in study area
- ✓ To identify the challenges of soil management practice in study area

1.4. Research Questions

At the end of the study the following research questions got answer

- ➢ To what extent soil management is practiced in study area?
- ➢ What are the effects of soil management in study area?
- ➢ What are the challenges of soil management practice in study area?

1.5. Significance of the study

The finding of the study can provided information on the limitation and strength of soil management so that agricultural office of Hadero Tunto Zuria Woreda will be benefited by strengthens best practice of soil management and taking remedial action on the weakness of their soil management practice. Farmers can be benefited by adopting alternative soil management practice suggested based on the finding. Policy makers and NGO's that work natural resource management can use the finding of the study if need is raised.

1.6. Delimitation of the study

This study is delimited geographically and thematically. Geographically, this study was done in two sampled rural kebeles of Hadero Tunto Zuria Woreda. Thematically, this study was done to assess the practice of soil management because land degradation had different forms that need more than one years' time to study so that this study focused land degradation in the form of soil erosion.

1.7. Limitations of the study

It is obvious that research work can be not totally free from limitation. Accordingly, some limitations faced in this study were: most of the respondents were busy and had no enough time to respond to questionnaires and interview. Some of them who had enough time were also reluctant to fill in and return the questionnaire as per the required time. Thus, researcher was attempted to arrange convenient time and contacted with sampled households, kebele development agents and agricultural office natural resource experts repeatedly. Another challenge was lack of well-organized documented data. Despite all these challenges, it was tried to critically analyze the available data to answer the questions raised in the study.

1.8. Definitions of key terms

Soil productivity: the capacity of soil for producing plant under a specified system of management (Siddowav et.al, 2016).

Soil degradation: decline in soil quality, or reduction in attributes of the soil in relation to specific functions of value to humans (Doran and Jones, 1996).

Soil rehabilitation: Process of returning degraded soil to a functional state

Land degradation is an environmental phenomenon affecting dry lands, leads to loss of economic and biological quality of an agricultural land (Mantel, & van Engelen , 1997).

Crop rotation refers to temporal arrangements and allocations by growing various crops on the same piece of land (Yilkal, 2007)

Cutoff drains- constructed to avoid hindrance land preparation for main cropping season (Mushir, 2019).

Fallowing is one of the traditional practices of leaving the cropland uncultivated for one or more years for the purpose of recovering land fertility and minimizing soil degradation (Yilkal, 2007)

Fanya-juu terraces are constructed by throwing soil up slope from a ditch to form a bund along a contour and the term is coined from Swahili language; meaning, "throwing up-hill (Woldeamlak, 2003).

Traditional soil conservation refers to local practices or techniques, which have adopted by the farmers since long time ago as distinct from the new by introduced or modern techniques imposed from outside (Kumela, 2007).

1.9. Organization of the Thesis

This study comprised of five chapters' .chapter one deals with introduction: background of the study, statement of the problem, basic research question, objective the study, significance of the study, delimitation of the study, limitation study, definition of key terms and organization of the study. Chapter two deals with review of related literature. Chapter three deals with research methodology. Chapter four deals with result and discussion. Finally, chapter five deals with conclusion and recommendation.

CHAPTER TWO

Review Literature

2.1. Concepts of land degradation

Land degradation is a broad term including more than just soil (Yesuf and Pender, 2006). The World Bank (2007b) defines land degradation as a reduction of resource potential, the loss of utility or potential utility resulting in temporary or permanent lowering of current or future productive capacity of land.

Various sources suggest that 5-6 million hectares of arable land worldwide are being lost annually to severe degradation (Hamdy and Aly, 2014). Due to severity of land degradation, Africa as a whole has become a net food importer since Saharan Africa because 65% of the population is rural, and the main livelihood of about 90% of the population is agriculture (Project Development Facility, 2007).

Land degradation in the form of soil erosion, sedimentation, depletion of nutrients, deforestation, and overgrazing are the basic problems facing farmers in the Ethiopian highland, and these limits their ability to increases agricultural production and reduce productivity and food security. Land degradation, which includes degradation of vegetation cover, soil and nutrient depletion, is a major ecological and economic problem in Ethiopia (Hailesillasie et al., 2005).

Land degradation is deterioration of soil in terms of its quality and productivity due to improper use, is a major global issue and will remain high on the international agenda in the 21st century due to its effects on agronomic productivity, the environment, and food security (Gashaw, 1999).

2.2. Indicators of land degradation

2.2.1. Decline of Water Availability

All sorts of vegetable and fruit production require enormous amount of water for its productivity water serves as a main limiting factor on their production (Pimentel et al. 1997). According to an estimate one hectare of corn field utilize about 7 million liters of water during its 3 months of growing season (Pimentel et al. 2004) and additional 2 million of water loss due to evaporation from soil surface as result of soil erosion due to water and strong wind forces. All of these result in less water availability for growing vegetation. Enhance water runoff significantly affect water Holding capacities which result less water availability for the growing crops (Pimentel et al. 1997).

2.2.2. Nutrient Losses

Essential plant nutrients such as nitrogen, phosphorous, potassium and calcium dominantly decline due to erosion. The eroded soil has three times more nutrients as compared to remaining soil surface (Young, 1989). Fertile soil estimated to have 1 to 6 kg of nitrogen contents, 1 to 3 kg of phosphorous contents and 2 to 30 kg of potassium contents whereas the left over soil having only 0.1 to 0.5 kg per ton of average nitrogen contents (Schertz et al. 1989; Langdale ,1992). To overcome these problems large quantities of fertilizers are being used. The cost of loss of basic soil nutrients is estimated to be about several billion dollars each year (Torah et al. 2004). If the surface of soil is about 300 nm deep the usage of commercial fertilizers and livestock manure replace the lost of nutrients but this practice is usually expensive for poor farmers and nations. Not only expensive these synthetic fertilizers also affect the human health and also result in soil, air and water pollution (Brevik , 2013 ;Unnevehr et al. 2003 ; Hakeem et al. 2011 ; Hakeem et al. 2014).

2.2.3. Soil Organic Matter

100 tons of organic matter per hectare is usually present in fertile soil layers (Pimentel et al. 2006; Sundquist, 2010). Fertile soil's organic matter typically consist about 95 % of nitrogen and 25 % to 50 % of the phosphorous (Allison 1973). Erosion typically affects the top fertile layer of soil because most of the organic matter of dead plants and animals lies in this upper layer. Fine soil particles are mostly degraded by wind and water erosion and larger particles and stones are left behind and making it unsuitable for growing vegetation. A large number of researches report that the eroded soil contain large amount of organic matter about 1.3 to 5 times more than left over soil (Lal 1994). The reduction of organic matter in left over soil from 0.9 % to 1.4 % results in about 50 % loss in crop production and ultimately in yield (Libert 1995 ; Sundquist , 2010).

Depletion of the nutrients, organic matter and structure of soil results in the degradation of ecosystem and also significantly affect the crop yield. Productivity of any area is dominantly affected by the results of strong wind and water erosion. Soil erosion not only affect crop yield but also significantly affect total biomass of biota and biodiversity of any ecosystem substantially (Lazaroff 2001; Walsh and Rowe, 2001)

2.3.Land Management Practices

According to (Gessesse et al., 2019) land administration practices that have utilized in Ethiopia categorized into two extensive categories: indigenous and introduced, with extraordinary levels of acceptability, areal coverage, and benefits.The acceptance and implementation of these administration practices rely on the desire and willingness of farmers, which in turn requests non-stop and wonderful overall performance from agricultural professionals and researchers. It is now not easy to put common standards to categorize land management practices into indigenous and introduced. As a result, this categorization is finished primarily based on the direct purposes of the management methods why farmers apply to their farmlands in the find out about location (Zewdu & Desta, 2015).

2.4. Types of land management practices

Land management practices are describe the activities on the ground that use appropriate technologies for the improvement or maintenance of productive capacity of the land. This includes activities such as soil and water conservation, soil fertility management and controlled-grazing. Thus sustainable land management approach emphasizes finding economically viable, socially acceptable and ecologically sound solutions at a local level, which could promote participatory land management practices to deal with land degradation. In Ethiopia, a significant number of studies have been done on land degradation and land management practices in different parts of the country. These works mainly focus on nature of land degradation, traditional farmers' land management practices, soil and water conservation by government and other actors, farmers' perception on soil fertility change and on causes of land degradation (Heyi and Mberengwa, 2012).

The division of soil and water conservation measures in to physical, biological, and agronomic land management measure is arbitrary. First of all they are not mutually exclusive, as they often complement each other and also some of the measures might have several features from the different types of soil and water conservation.

According to Hurni et al. (2016), SWC measures are recommended to be implemented based on agro-ecology and land use type. All SWC measures are classified into physical, agronomic and vegetative type (biological) and their implementation is agro-ecological and land use type specific. According to Biratu *et al.,* (2021), key LM options that are widely implemented and studied in Ethiopian agricultural landscapes can be grouped as:

1. Physical land management practices: Attempts to control the energy of erosion act by manipulating the surface topography. Example soil/ stone bunds/, bench terraces, fanyajuu, waterways, trenches, ditches, cut off drains and check dams etc.

2. Biological land management practices: A biological land management's practices are planting of vegetation to increase fertility of land. Example whereas grass strip, exclosure, and agroforestry are biological practices

3. Agronomic land management practices: Provide away of affording protection to the soil cover surface roughness and anchorage effects. Examples cover crop, conservation tillage (CT), mulch, ridge, Contour plowing, fallow, crop rotation and manure,

List of some LM practices such that have been studied in the country and addressed are described briefly as follows:

Stone bunds: where stones are collected from cultivated land and piled across the slope that ultimately forms stone embankments.

Bench terraces: where steep slope converted into a series of steps with horizontal ledges and vertical walls.

Soil bunds (level/graded): where the soils are excavated and placed at the downhill and form soil embankments across the slope (1% gradient for graded bund case).

Fanyaajuu: where soils are excavated and placed at the uphill and form soil embankments across the slope (with 1% gradient for graded bund case).

Manure: where cattle manure is mixed with soil before planting.

Mulch: where the upper soil surface is covered with straw, stalks and standing stubble.

Conservation tillage (CT): where the soil is not tilled or tilled minimally using modified tillage implements or improved traditional techniques with minimum soil disturbance and ridges.

Grass strip: where selected deep-rooted grasses are planted and formed as hedges across the slope.

Agroforestry: where trees are grown or planted with agricultural crops and livestock in the form of dispersed intercropping or scattered trees in the farm, windbreak, hedgerows, parklands and as boundary trees.

Enclosure: where the degraded lands are protected or closed from domestic animals or grazing with no or very limited human interference (cut and carry of grass/feed) and left for natural regenerations.

2.4. Importance of land management

Protect land degradation and soil erosion: Soil and land degradation is one of the fundamental problems confronting sub-Saharan Africa in its efforts to increase agricultural production, reduce poverty and alleviate food insecurity. Unfortunately, many conservation programs designed to address soil and water degradation in the traditional agricultural sector have fallen far short of expectations. Several studies have showed that despite a number of potential soil and water management technologies developed, adoption by farmers is still very low. This has been due to a complex socio-economic and demographic factors that have affected the choice of land and water technology investment to improve food security. Gaps have been identified in the way researchers and extension workers have packaged research result to make them more user-friendly for the farmers. Knowledge sharing mechanisms have not been incorporated in the broader agricultural extension systems to help disseminate success stories emanating from research. As studies conducted by Pender et.al (2006) revealed, the government of Ethiopia and a consortium of donors have undertaken a massive program of natural resource conservation to reduce environmental degradation, poverty and increase agricultural productivity and food security. However, the adoption and adaptation rate of sustainable land management (SLM) practices is low. In some cases, giving up or reducing use of technologies has been reported (Lemenih et al., 2014)

Maintains ecological balance: Therefore, successful scaling up of SLM technologies in the study area will promote afforestation programs which can maintain the degraded ecology (Hurni, 1988). Drought, desertification, lack of rainfall, and deforestation are problems directly related to one another and can only be mitigated if significant SLM technologies are applied.

Improve food security: According to Miheretu and Yimer (2015) study on the effect of sustainable land management on food security the main idea was that agriculture is the dominant economic sector in Ethiopia that accounts for about 45% of the GDP, 85% of the employment and 90% of the foreign exchange earnings. The vast majorities of the population, about 85%, lives in rural areas and derive their livelihoods directly or indirectly from agriculture. The agricultural sector is predominantly subsistence in nature, in which the major part of farm production is for household consumption. Small-scale subsistence farms, with an average land holding of less than one hectare, occupy about 90% of the cropped land and produce around 95% of the total agricultural output (Gronvall, 1995).

2.5. Mechanisms of soil management

2.5.1. Traditional Soil Conservation Practices

Traditional (Indigenous) knowledge includes the complex of practices and decisions made by local people. It based on experience passed from one generation to the next, but it changes, adapts and assimilates new ideas (Oudwater & Martin, 2003). Failing *et al.(*2007), define local knowledge as the full variety of insights, observations and beliefs related to a particular decision that do not stem from conventional scientific expertise. Some of the holders of this knowledge are long-time community residents, some are aboriginal people, and some are resource users with specialized knowledge.

Traditional (Indigenous) soil conservation practices are simple structures of a short-term nature that could reshuffled each year to make use of the soil captured above the structure and avoid rodent production (Tsegaye and Bekele, 2010). They built upon farmers' traditional (indigenous) knowledge as part of their farming practices that have evolved through the course of time without any outside institutional interventions. These technologies are one of the inherited and transferred from generation to generation (Megersa, 2011).

The most perceived and preferred traditional(indigenous) soil conservation practices include zero-grazing, agro-forestry (woodlot), trash lines, grass strips, minimum tillage, contour ploughing, animal manures, fallowing and biological or agronomic methods such as cereal-legume intercropping, crop rotation and mulching, residues of crop production (*Ayalew et al.*, 2009).

Mostly soil conservation practices in Ethiopia assumed as a traditional knowledge (Watson Curry, 2009). For instance, United Nations Educational Science and Cultural Organization as world heritage know Konso people in southern Ethiopia for traditional farming conservation where these terrace practices are registered. The Konso terraces are estimate to for much more decayed year's terraces for soil conservation in Ethiopia. However, few found in very less areas and most of them, have limitations in lay out construction quality (Watson Curry, 2009).

2.5.2. Mechanical (physical) soil conservation technologies

The aims of mechanical measured are to maximize soil and water infiltration, minimize run off, reduce slope length and gradient. It generally minimizes the force of wind and velocity of run off to reduce soil erosion. Mechanical Soil conservation methods include soil and stone bunds, terracing, and waterways built on farm and other types of land resources. Ponds, terrace out let, gully control that are suitable for water conservation measures are to be taken so, as to prevent the formation of gullies and contour terracing are methods used to prevent soil erosion. Along the contour series of ridges or bunds of mud are formed to check the run off. In channel, terrace a shallow channel of dug and the mud deposited along the lower edge of the channel. In broad base ridge terrace channel is formed on the contour by excavating the mud. These methods are used as supplements to biological methods. Other methods which check the formation or widening of gullies by constructing bunds, dams drains or diversion through which excess runoff water is channeled (Addisu ,2011).

2.5.3. Agronomic (Biological) soil conservation technologies

The biological measures divided into Agronomic, Agro-ecological and dry farming method. In agronomic practices normally, the land is possess a vegetation covers to prevent erosion by water and wind. These types of practice are contour farming, mulching, crop rotation, strip cropping etc. Agro ecological measures are cultivation of grass in a land, which heavily eroded. Inlay farming, grass is cultivated in rotation with regular crops. This helps in soil conservation as well as produce fodder to cattle. Dry farming methods may practices where rainfall is low, in definite, and variable. In dry farming methods only crops are that can sustain a very low rain full can grow. The most aspects of dry farming are conservation of soil moisture and fertility practices (Addsu, 2011). Therefore, range from reduced to more intensive tillage depend several factors such as climate, soil properties, crop characteristics and socio-economic factors.

2.5.3.1. Crop cover

Cover plants (alfalfa, vetch, etc.) can be cultivated during off-season periods when the soil is bare and can be grown between the main plant rows. These products prevent soil erosion, renew soil nutrients, keep weeds under control, and protect soil health by reducing the need for herbicides (Concerned Scientists, 2019).

2.5.3.2. Crop Rotation

Planned sequence of growing crops, including legumes, in a regularly recurring succession on the same piece of land (Brady and Weil, 1999).Crop rotation decreases soil and nutrient loss from runoff and erosion, increases soil organic matter and favors stable aggregation of soil, add organic matter to the soil, stimulate a greater variety of soil microorganisms which enhance carbon and nutrient cycling (Bierman and Rosen, 2005).The extended growth period obtained with cover crops also extends the duration of root activity and the ability of root-exuded compounds to release insoluble soil nutrients (Lim, 2010).

Crop rotation is an indigenous and practical way for managing agro-ecosystem biodiversity by enhancing soil health, minimizing pests and disease outbreaks (Barbieri eta.al,2019).This method enables farmers to improve the structure of the soil, increase the soil organic matter and rooting depth. This happens when secondary crops are grown in order to enhance soil health. As a result of the extensive shattering of soil aggregates during seedbed preparation and harvesting, root crops are particularly destructive to the soil structure. Therefore, it is advised that root crops should be grown once in every three years. Corn can be grown in the following year with two years of silage followed in succession by three or more years of forage. Leguminous crops (such as pea and chickpea) during crop rotation help in modifying soil functional microbial communities. In the rotation, cover cropping or mulching, and zero tillage should be incorporated too. Crop rotations can provide better opportunities for the growth of some soil functional microorganisms (Gurr,G.M eta.al 2016). This brings about rich biodiversity within the soil ecosystem as both the shallow feeding crops and deep rooted crops activates varying species of microorganisms per time thus creating a buildup of microbes exhibiting varying characteristics to colonize the soil. Thus, different crops can produce various residues and root exudates to boost soil microbial diversity and activity, and increase soil microbial biomass as well as enhance C and N cycling (Liu,2017).

2.5.3.3. Manure and Other Amendments

Returning manure to crop fields recycles a large portion of the plant nutrients removed in harvested crops. Such manures like farm yard and green manures even compost manure. Application of these manures to the soil returns plant nutrients. However, nutrients can be lost from manure during storage, handling and application (Bierman and Rosen, 2005).

2.5.3.4. Fertilizer Application

Fertilizer is referred to relatively soluble nutrient sources with a high concentration. They supply essential elements in a variety of chemical forms. They have high water solubility, immediate availability to plants, high concentration, accuracy and uniformity with which specific amounts of available nutrients can be applied (Bierman and Rosen, 2005). They supply Nitrogen, phosphorus, potassium and other nutrients.

2.5.3.5. Planting of Leguminous Crops

Legumes add nitrogen to the soil, mostly falling leaves and their nitrogen-rich root nodules decompose underground. The organic matter produced by legumes is rich in nitrogen, which improve soil fertility (Farm Radio International, 2009). Leguminous crops also serve as green manure and cover crops, which all help in improving soil fertility (Russel, 1977). Such legumes as groundnut, peanut, cowpea, Lima beans, Mucuna and African yam beans.

2.5.3.6. Integrated Soil Fertility Management (ISFM):

ISFM refers to a set of soil fertility management practices that include the combined use of fertilizer, organic inputs and improved planting materials coupled with the knowledge on how to adapt them to local conditions for improved nutrient use efficiency and crop productivity (Ruttan et al., 2011).They include, rotation of cereals with legumes, intercropping of cereals with legumes, manure applications, fertilizer application and various other forms of soil nutrient management practices coupled with use of appropriate planting materials and good agronomic management. For example, intercropped or rotated cereals benefit from nitrogen that is fixed by the preceding or rotated legumes in addition to sustaining better ground cover which reduces soil water and nutrient losses through evaporation and soil erosion. Ground cover also decreases the compacting and crusting effects of raindrop, thereby helping in maintenance of soil porosity, water infiltration, soil water retention and rain water use efficiency (Pareek,2017)). Integrated soil fertility management technologies can therefore improve the soil physical, chemical and biological characteristics (soil health), and support adaptation of agro-ecosystems to the changing climate and climate variability (Havlin, et al, 2005).

The major physical measures include construction of bunds, check dams and hillside terraces (Gebremicael et al.,2005). The biological measures include exclosure of degraded land from human and animal interferences, tree seedling production, a forestation, and tree plantations around homesteads (Mekuria et al., 2011).

2.6. The role of stakeholders in soil management

There appears a shift towards stakeholder participatory approaches to enable local farmers involve in passing natural resources management decisions (Roe *et al*., 2009). According to FAO (2008), the use of farmer field schools have enabled farmers to improve their land and water management practices in many parts of Africa.

Stakeholders need to receive research results and information in formats and language to suit their prior knowledge and personal interests (Geeson et.al, 2011).In the context of promoting soil conservation practices, researchers should always find suitable opportunities and methods to consult with stakeholders, to establish the main concerns and the nature of barriers and constraints to adopting such practices.

Farmers form key stakeholder partners in SLM practices, but are often neglected in planning and decision making processes (Grimble and Wellard, 1997). Farmers' participation in planning, selecting, deciding, appraising and adopting of SLM technologies provides the opportunity to exchange useful information among participants and could strengthen institutional transparency and equity. Reed (2008) as well as Lostarnau*et al*. (2011) noted that stakeholder participation is a key element in natural resource management and can improve decentralized democratic decision making processes and thus should be encouraged.

2.7. The effect of soil management

2.7.1. The effects SWCP on biophysical aspects

2.7.2. Reduction in soil erosion and slope gradient

Land covered by plant biomass, living or dead, is more resistant to wind and water soil erosion and experience relatively little erosion because rain drop and wind energy are dissipated by the biomass layer and the topsoil is held together by the biomass (Pimentel et al., 2005).

2.7.3. Reduction of work overload

SWCP reduces runoff water and improves ground water capacity. So, it makes easier access to water and had particularly reduced women's workload and therefore increased "quality" of life. More time was used for family care and domestic work by saving time in activities such as fetching water, security and carrying heavy loads (Ismo, 2006). According to (Wagayehu, 2003) economic benefits of SWCP for the household came as water for all year round agricultural production and time used for water related activities, e.g. fetching water and laundry, at homes. Several crops were harvested and more time was left for domestic work due to easier access to water resources.

2.7.4. Effects of soil management on livestock feed availability

Most of the world's livestock, particularly ruminants in pastoral and extensive mixed systems in many developing countries, suffer from permanent or seasonal nutritional stress (Bruinsma, 2003). Poor nutrition is one of the major production constraints in smallholder systems, particularly in Ethiopia. Many researchers have been carried out to improve the quality and availability of feed resources, including work on sown forages, forage conservation, the use of multi-purpose trees, fibrous crop residues and strategic supplementation. There are also prospects for using novel feeds from various sources to provide alternative sources of protein and energy, such as plantation crops and various industrial (including ethanol) by-products. The potential of such feeds is largely unknown. Given the prevalence of mixed crop–livestock systems in many parts of the world, closer integration of crops and livestock in such systems can give rise to increased productivity and increased soil fertility (Mcintire et al., 2005). In such systems, smallholders use crops for multiple purposes (food and feed, for example), and crop breeding programmes are now well established that are targeting required quality as well as grain yield in crops such as maize, sorghum, millet and groundnut.

Rehabilitating degraded land by SWCP can addressing livestock nutritional constraints. Gully treatment with different rehabilitation measures results generating of different livestock feed specious. Forage plants such as Elephant grass and Sesbania sesban were planted as stabilizers of conservation structures reduced soil losses, improved the availability of organic inputs for soil improvement, and offered animal feed and consequent increase in cash income (Tilahun, 2003). These forage plants are fast growing and the farmers harvested frequently and fed their cattle. The farmers who have these forages at their homestead could not suffer from the shortage of feed as those who had not planted. The plant species also greatly contributed to the stabilization of the soil conservation structure. Sesbania sesban, legume plant species, besides being used as bund stabilizers and feed, it was chopped and incorporated in to the soil for improvement of soil fertility (Tilahun 2003).

SWCP increases crop production by improving soil chemical and physical properties (Mulugetand Karl, 2010) and crop residues uses for animal feed, and it helps full filling the nutritional need of livestock as it is the most part to get the economic benefit obtained for the livestock (Dubale, 2001). The nutritional needs of farm animals with respect to energy, protein, minerals and vitamins have long been known, and these have been refined in recent decades (Mcintire et al., 2005).

2.7.5. The effects of SWCP livelihood improvement

Soil erosion has decreased in many parts of the developed countries by means of good agricultural practices and SWC methods. As a result, these countries produce more food today than 50 years ago. In fact, many of the world‟s developed counties increased their food per capita in the last fifty years (Roetter and Keullen, 2008). SWC can improve soil organic matter, total N, available phosphorous (P), bulk density, infiltration rate and soil texture cost (Mulugeta Demelash and Karl, 2010), and this is very important to increase land productivity which is one livelihood determining main factor . Straw, from cereal field crops is also used as construction, fuel and fencing materials (Dubale P., 2001). That is why, in many cases crop residues are in high demand in some local market for different uses. Economic impact has been mainly achieved through increased crop production. An increase in crops has two-fold effect. First, it helps to secure food for the household and, secondly, to create a surplus which can be sold (Wagayehu Bekele, 2003). According to Wagayehu Bekele (2003), increased cropping gave food for the families and there was no need to buy food grain from the market. Surplus was sold in the market and income was used for family expenses such as education, clothing, sugar, tea, salt, and improved housing. Later, more organized cash crop production plantations were started.

2.9. Challenges of soil management

2.9.1. Climate change

Land clearing for agriculture leads to an increase in the decomposition of organic matter in the soil, transferring the carbon stored in the organic matter into CO2 which increases the CO2 concentration in the atmosphere (Daniel and Edward, 1998).Climate change refers to some observable variations in the climate system that are attributable to human (anthropogenic) activities especially those that alter the atmospheric composition of the earth and ultimately lead to global warming (IPCC, 2007).

Climate change threatens to increase the potential for soil erosion, reduce soil quality, lower agricultural productivity and negatively impact food security and global sustainability, making it one of the most severe challenges we will face in the 21st century. Climate change leads to increased activity of soil microorganism that will cause a loss of organic matter and nitrogen in the soil, accelerated soil degradation, erosion as well as weakening in the capacity of the agricultural ecosystem to resist natural disasters (Lim, 2010).Climate is expected to bring more extreme weather events such as flooding, drought and more unpredictable weather. These changes will truly deepen problems with soil fertility (Farm Radio International, 2009).

2.11. Land degradation in Ethiopia

The principal environmental problem in Ethiopia is land degradation in the form of soil erosion, gully formation, fertility loss, desertification and deforestation (Melaku, 2000). Land degradation had created serious limitations to economic development and food security in several developing countries, particularly in areas where population densities are high like Ethiopia (Amsalu and de Graaff, 2006). Ethiopian highlands in general and South Central highlands in particular is suffering from rapid population growth and wide variety of excessive land degradations mostly soil degradation, deforestation, drought and ground and surface water impoverishment. This environmental situation not only undermines the agricultural production capacity but also threaten the sustainability of many regions in the country (Amsalu and de Graaff, 2006).

Recognizing the problem of land degradation, the government of Ethiopia was promoting soil and water conservation (SWC) technologies to reduce soil erosion, restore soil fertility, rehabilitate degraded lands, improve micro-climate, improve agricultural production and productivity and restore environmental condition (Hurni et al., 2005; Vancampenhout et al., 2006; Bewket, 2007; Mekuria et al., 2007).

As an empirical studies show that highly interlinked various socio-economic, institutional, biophysical and cultural attributes has influential roles in farmers’ decision about the practice of soil conservation measures in different area of Ethiopia. The challenges in the study area categorized, personal, institutional and economic factors (Knowler and Bradshaw, 2007). The adoption and use of soil conservation practice conceptualized as determinants of soil conservation measures. In this section, empirically related studies discussed as follows: It is clear that various challenges determine land, soil conservation practices in different parts of the world or even in different locations within a given country due to differences in agro-ecological as well as socio-economic setting under which the low level of success of conservation initiatives (Fikru, 2009).

2.1. Empirical Literature Review on Land management Practices

Study conducted by Ibrahim (2020) the factors affecting farmers’ willingness to pay for sustainable land management practices in Homosha woreda, BenshangulGumuz Region, Ethiopia. The study data was collected from 200 households randomly selected from four kebeles of the district. The multinomial logit model was used to estimate determinants of willingness to pay using data generated from socio-demographic and economic characteristics. Data were analyzed using discrete choice models including the multinomial logit model, mixed logit model, and conditional logit model using STATA-14. The socio-economic factors (family size, marital status) and socio-economic (type of crop, land size, land form, livestock, awareness about SLM and technology) found to be the factors that determine the decision to adopt SLM. From the total 134 male household heads 27 respondents were not implementing SLM practices and 107 respondents were implementing SLM practices. Whereas from a total female household heads 11 were not implementing SLM practices and 55 respondents were implement SLM practices.

The study concluded that households are to pay more than 66% cost for any sustainable land management bundle to improve agricultural production by examining their total willingness to pay for SLM. Family size and marital status in socio-demographic characteristics and landform, type of crop, awareness, technology(modern fertilizer), livestock, and land size was found to vital determinants of households willingness to pay and was confirmed by others study (Adimassu et al.,2012); (Arega et al., 2018); (Deichert et al., 2017).

Study conducted by Sewenet et al., (2019) the determinants of crop land management practices the case of North Gonder zone, Northwest Ethiopia. The land management problems like soil erosion, overgrazing, and deforestation have steadily increased in Ethiopia. Data were collected by primary and secondary sources were collected 120 household heads drawn by random sampling techniques. The data werre analyzed the determinants of land management practices are in multinomial logit model. The independent variables are sex, age, education level, and family size, farm to home distance, mass media, credit, market, income and road distance to farm plot. The significant variables include age of household, education level, access to mass media, amount of income, farm distance to home and the frequency of extension contact.

According to (Miheretu and Yimer, 2017) determinants of farmers' adoption of land management practice in Gelan sub-watershed of Northern high lands of Ethiopia. Agricultural land is a scarce resource in high lands of Ethiopia. The Ethiopian high lands have been experiencing soil fertility decline and sever soil erosion due to encroachment of intensive farming system on steep and fragile lands (Amsalu and De Groaf 2007). Agriculture has been practiced in the watershed for very long time and it is the main economic activity and source of livelihood. The study were collected data from both primary and secondary sources. The primary data were obtained from the field survey supplemented with secondary sources in order to substantiate the study. The focus group discussion, key informants interview and capture their experiences of land management practices. The study sample determination for multinomial logistic regression indicates minimum of 10 cases per independent variables (Hosmer and Lemeshow, 2000). The data was collected from 176 randomly selected farming households using a survey questionnaire and was analyzed using multinomial logit model (MNL). The dependent variables of the study was adoption or use of land management practices by farmers on their plot of land. The independent variables are : age of household head, education level of household, household size, off-farm activity, distance from plot to home, training in LMP, credit access, livestock ownership of household head, farm size, land tenure security, distance from plot nearest market, slope of the farm plot of household, plot land quality as perceived by household head, access to extension services, availability of economic incentives for LMP and perception of the household head about soil erosion problem are identified.

The study results shows that the average age of farmers was 43.61% years with minimum of 25 and maximum of 62 Years. The survey result indicates that out of 176 samples household respondents, the majority (84.09%) were males and the remaining (15.91%) were females. Women headed farmers were constrained by family labor because those women were responsible for both farming and household activities. Land management improves the productivity of agriculture and income of farming communities (Esa et al., 2018). The household survey revealed that 35.8 and 23.3% of farmers use stone bund and chemical fertilizer use respectively to control soil erosion and to enhance fertility status of farm land. The factors influencing the adoption of land management practices were examined using MNL (multinomial logit regression) model. The results showed that education, family size, slope of the plot, tenure security, training, access to farm credit and extension service positively and significantly affect adoption of land management practices while age has a negative and significant influence on adoption.

The study conducted by Agboola et al., (2018) the determinants of preference for land management practices among food crop farmers in north central Nigeria. Data were collected from 345 farmers using multistage sampling techniques and analyzed with multinomial logit model. The result show that both traditional and modern land management coexist in the area. The multinomial logit model were used to analysis by using STATA-11 software. The multinomial logit estimates in seven different type of dependent variables (organic manure, bush fallowing, crop rotation, inorganic fertilizer application, cover cropping and mulching) were inorganic fertilizer was selected as reference or base category. The independent variables significantly explained the use of land management practices ($p<0.05$) were age of household head, education level, household size, livestock owned, off-farm income, land tenure security, farm size, distance of pilot to residence, distance of plot to market and distance of plot to all weathered road. The study recommended to related to family planning, education and other means of reducing family size and dependency ratios will help reduce land degradation and increase crop production.

The study conducted by Gatbel et al., (2019) impacts of soil and water conservation practices on livelihood: The case of watershed in Gambela region, Ethiopia. The study followed multistage sampling technique was used. The data was collected from 132 household were selected from three kebeles of Goder woreda. The current state of SWC in Zeiy watershed are based on according to Hurni et al. (2016). SWC measures are recommended to implement based on agro-ecology and land used type. All SWC measures are classified in to physical, agronomic, and vegetative type and their implementation is agro-ecological and land use type specific. The analysis result indicate that major respondent household in mekakelegna in metti(9%), and (11%) adopted integrated SWC measures which combine different land management practices such as physical, biological, and agronomic measures. The most respondents of household are largely practicing agronomic conservation measures. Analysis result indicated that, out of 50% of household who practiced SWC, 25% of household adopted combination or integrated SWC practices and the remaining 50% are non-practiced households.

Soil and water conservation for income source distribution in rural income generating activities (RIGA2015) project on its survey across Ethiopia obtained that 51% share of household income is derived from crop production. This study result shows 58% of the total household in the study watershed earned their income from crop sales. The impacts of SWC measures on crop yield: the analysis result indicated that means the total crop yield for SWC practiced respondent household is higher (44.74 quintal per hectare in household) than SWC non-practiced respondent household (23.29 quintal per hectare per household) with mean total crop yield difference equivalent to 21.5 quintal per hectare per household. The relationship between SWC adoption and crop production per household was tested. The analysis result revealed that there is positive and statistically significant relationship between SWC adoption and crop production. The effect of SWC on rehabilitating of farm land confirmed by Hish et al. (2017) found statistically significant difference between conserved and non-conserved farm land in terms of soil organic matter were higher mean organic matter content was recorded in conserved farm land in non-conserved fields. Another study carried out by Hailu (2017) was significant difference between conserved and non-conserved plots in terms of soil organic carbon content, total nitrogen and available phosphorous of which conserved plots have relatively higher than non-conserved plots. The finding suggested that adoption of SWC measures improve availability of soil nutrient and increase the rehabilitation of farm land.

The study conducted by Gitima and Legesse (2019) the determinants of farmer's decision to use improved land management practices in Gindara watershed, southern Ethiopia. The themes of the study are the principal environmental problem in Ethiopia is land degradation in the form of sever soil erosion, gully formation and soil fertility loss. To overcome this problems, promoting appropriate land management technologies are best option. The total of 286 sample household heads were selected using randomly sampling procedures. Data was gathered through questionnaires, key informant interview, field observation and focus group discussion. The study using multinomial logit model analysis the quantitative data by using SPSS version20. In this study multinomial logit model was applied in this study to identify the factors that determine farmer's decision to use improved land management practices such as fanyajuu and stone bund. Multinomial logistic model is more appropriate to treat the determinants of farmer's decision to use land management technologies as a multiple choice decision. The model result of multinomial logistic regression for fanyajuu and stone bund land management technologies are age of household was significant at less than 5% and 1% probability level with the expected value and negatively related with farmers decision to use fanyajuu and stone bund as land management technologies respectively. This finding confirm study made by Heyi & Mberengwa (2012) and Simon et al. (2013) that reported age of the household affects decision on land management practices and conservation strategies negatively

According to Miheretu & Yimer (2017), and Tesfaye (2017) also study show that older farmers probably have shorter planning horizons and are physically weaker, more resistant to change, and hence they are not interested in adopting land management technologies. Level of education was found to be statistically significant at less than 10% and 5% probability level to use fanyajuu and stone bund respectively and this study is in line with the study made by Gemechisa (2017). Family size influences the use of farmers decision analysis revealed that was found statistically significant at 1% probability level to use anyajuu and stone bund. This study is confirms with

Heyi and Mberengwa (2012). The result revealed to that access to credit has positively determined farmer's decision to use fanyajuu and stone bund improved land management practices. The finding of this study is similar to a study made by (Gemechisa, 2017). The off-farm income has positively correlated with farmer's decision to use fanyajuu and stone bund at 1% significance level. This result contradicts with the findings of Amsalu and deGraaff (2007) The variables of farm size was statistically significant at 5% and 1% probability level with the expected value and positively related to use fanyajuu and stone bund land management technologies respectively. The results that large farm sizes are positive to land management technologies. Extension service plays a great role in awareness about farmers to practice land management technologies. The result revealed that extension services has positively correlated with farmer's decision to use stone bund at 1% significance level and it is similar to Tesfaye (2017) extension service support land management to farmers. Land security has positive and significant at 1% significance level and the study result was Similarly, Ragassa (2005). Slope of farm land determines farmer's decision on particular land management statistically significant at 1% probability to construct stone bund and the study finding line with Kifle et al., (2016) Investments in SWC practices enhance crop production, food security and household income (Adgo et al., 2013). Studies show that despite the availability of many best SWC practices in watershed management, they are highly localized, and are not being expanded to other areas, while land degradation due to soil erosion and deforestation are still the main problems in Ethiopia.

Yohannes (1989) compared barley crop and biomass yields above the bund (soil accumulation area) and below the bund (soil loss area) of fanya juu terraces in the Andit Tid area of northern Shoa during three cropping seasons from 1986 to 1987. The average barley yield was 1650 kg ha-1 above the bund, which was 43 % higher than below the bund.

Ciampalini et al., (2012) reported that in the Aksum area (Tigray, northern Ethiopia), SWC measures have been applied for centuries, most likely first implemented during the Aksumite Kingdom (400 BC to 800 AD). Thus, Terracing was developed under traditional agriculture in the highland of Tigray (Haregeweny et al., 2015). In line with this, "*Dagets*" are the common traditional techniques of SWC in Tigray (J.Nyssen, 2015). Virgo and Munro (1977) reported that terracing was developed under traditional agriculture in the Tigray Highlands and the Chercher Highlands.

The traditional terraces in Konso constitute a spectacular example of a living cultural tradition stretching back 21 generations (more than 400 years) (Besha, 2003). In the first half of the 20th century, Italian (Giglioli, 1938) and British (Joyce, 1943) chroniclers noted the indigenous SWC measures of northern Ethiopia (reviewed by Nyssen et al., 2004). Farmers in Kindo Koisha woreda (southern Ethiopia) mitigate the problem of declining soil fertility through organic manuring, a succession of specific crops, and a short fallow at the lowland (Tizita, 2016).

Besides, SWC practices of farmers in Maybar, south Wello, and indigenous irrigation system in Amaro Special Woreda, southern Ethiopia; where farmers constructed waterways over gullies using grooved big logs. Additionally, the diversion structure is constructed of thrash and tree branches are some of the indigenous technologies that can be cited (Tizita, 2016).

Furthermore, traditional SWC practices are well recognized in Ethiopia, for example in Gojjam, ditch drain surplus runoff. Besides, scattered contributions have been made on bench terracing for khat (*Catha edulis*) (Reij, 1991), the traditional technique of using lynchets in Tigray (Nyssen et al., 2000), on fallowing in the Wolyta Zone (Amede et al., 2001), ditches for seasonal surface drainage in farmlands in the northwest highlands (Monsieurs et al., 2015).

The study conducted by Teshome et al., (2016) the title of household-level determinants of SWC adoption phase: Evidence from North-West Ethiopia high lands. The study based on survey of 298 household in three watersheds. An ordered probit model was used to analyze the derivers of different stages of adoption of soil water conservation. The dependent variables of the study was SWC doption phases such as: Dis-adopters (non-adopters), initial adopters, actual adopters and final adopters. The independent variables are age, family size, farm labor, distance to road, average parcel size, cultivated size, farm size, slope, tools, off-farm, income, tenure security, training, SWC program, high cooperation, medium cooperation, low cooperation, formal position, labor sharing, erosion problems, and SWC profitability. The descriptive results indicate that sample households are found in different stages of adoption. Among the sample households initial adopter (30.5%) and final adopters (30.9%) form the largest group. About 21.2% and 18.5% of the sample household falls under actual adopters and dis-adopters

The study conducted by Gebere et al., (2021) on the analyzing factors affecting the sustainability of land management practices in Mecha Woreda, Northwestern Ethiopia**.** In his study revealed that several factors influence the long-term viability of land management practices after they are implemented. Allocating communal grazing fields to individuals, sustained supply of cattle fodder, lack of community agreement, ownership of improved cattle breeds, lack of enforcing community bylaws, open cattle grazing, lack of supervision from development agents, low quality of implementation, low benefits, barriers for farming practices, poor participation of household heads during planning and decision making and lack of short term benefits are the main factors that determine the sustained and continuous use of land management practices. Majority of his study of the sample households are men headed and the majority of sample respondents (92.3%) are in the productive age group, which is critical significant for implementing and maintaining sustainable land management practices. The results show that binary logistic regression model is very significant and fits the data well. In a binary logistic regression model with robust standard error, among 12 variables 9 are significant and the rest variables which are lack of supervision of development agents and low quality of implementation are insignificant. The findings of this study reveal that a consistent supply of cattle feed from adopted land management methods has a considerable and favorable impact on the long-term viability of land management measures.

Study conducted by (Agidew and Sigh, 2019) factors affecting the adoption of sustainable land management practices at farm level in North Eastern high land of Ethiopia Teleyayen sub watershed case study. The data collection take under household questioners' survey, binary logistic regression model and descriptive statistics were used to analyze the data. In Ethiopia land degradation is the major cause of agricultural productivity and continuing food insecurity and rural poverty. SLM practices as part of effort to improve environmental condition ensure sustainable and increased agricultural production and reduce poverty. Farming system in the area are carry out mixed agricultural activities which are crop production and livestock practices. The land is scarce resource in the area due to high population pressure and land degradation. The sample farm household heads were drawn through multi-stage sampling technique. The methods of data analysis are conducted in the study includes descriptive statistics like standard deviation frequency, mean and percentage and inferential statistics like logistics regression. The analysis explains the relationship between dependent and independent variables. It also affect explain the key adoption factors affecting SLM practices. Eight SLM practices were considered to identify farmers' decision to adopt such practices which are only 11.2% of the total households were non adopters, while 88.8% were adopters of SLM practices. The adopters of SLM practices in this study refers to use one or more of SLM practices in a given farm plot.

Study conducted by (Adimassu and Kessler**,** 2012) farmers' investments in land management practices in the (central rift valley) CRV of Ethiopia. The land degradation as problems they will be more willing to invest in land management practices. In this study water erosion and fertility depletion are taken as main indicators of land degradation. The factors that positively influence farmers' investment in land management practices are household resources endowment s, access to information. The study carried out in the CRV and aims to explore farmers perception of land degradation (water erosion and fertility depletion), assess farmers investment in land management and identify factors that determine farmers decision concerning how much to invest in land management practices.

The study conducted by Latawiec et al., (2017) the title of improving land management in Brazil: A perspective from producers. Land use in Brazil is predominantly dedicated to cattle ranching, which is principal driver of deforestation in the Amazon and Cerado the vast biodiversity savanah of central Brazil. The majority (88%) of Brazilian cattle farm are extensive, low productivity system that are commonly degraded and provide very low economic returns for farmers. The study was performed in Amazon part of the state of Mat Grosso. Mat Grosso is one of the fastest growing agricultural region in the world (Graesser et al., 2015). A pilot questionaries' were developed of the basis of consultation with local farmers to maximize the relevance of study conducted and issue related to the adoption of improved management practices. By descriptive statistical analysis were performed using SPSS statistical 20. One of the technique that may increase cattle ranching productivity is the use of integrated system on the same farm (Herrero et al., 2010). The majority (88%) had adopted integrated crop-livestock system and the remaining (12%) had slivopastural livestock forestry system. Improved pasture management is most often achieved pasture in Mato Grasso through the use of rotational grazing. By fencing pasture areas and dividing them in to plots this method optimizes the establishments of forage species and plant growth and prevents degradation, thus increasing the availability of pasture for cattle (Oliveira, 2020).

According to Oduniyi (2021) factor driving the adoption and use extent of sustainable land management practices in south Africa revealed that among the 250 sampled respondents, 177(70.8%) adopted SLMP and 73 (29.2%) did not. This indicates that the majority of the farmers adopted or used at least one SLMP at their farm plot.

The results which indicate that the mean difference between the continuous variables, namely the age of the farmers, the number of years spent in school, farm size, the number of years of farming, frequency of extension visits, and income. The gender effect on study that male household farmers have access to farmland and participate more in farming activities than their female. This is confirmed by (Oduniyi, 2013, Gebre et al., 2021) study on adoption of sustainable land management practices. The study results revealed that the gender of the farmer, age of the farmer, number of years spent in school by the farmer, number of years of farming or the experience of the farmers, the frequency of extension visits and being a member of a social organization significantly affect the farmers' adoption of SLMP.

Study conducted by Manjur (2006) farmers' perception and determinants of land management practices in ofla woreda, southern Tigray in Ethiopia. Accelerated land degradation has become the major threat to rural livelihood and sustainable natural resource management in the Tigray Region as a whole. The essential data were collected from 130 randomly selected farm households. Descriptive statistics and binary logit model were used for analyzing quantitative data. Method of data analysis are when one or more of the explanatory variables in a regression model are binary, some of variables determine land management practices.

Summary of literature review and knowledge gap

2.11.1. Socio-Economic Factors

Economic variables can play important role in determining the adoption of soil conservation practices of the household. Among the economic factors, farm size is an important variable in relation to the adoption of soil and water conservation (Akililu and De Graaff, 2006). Farm size is one of the factors that affect farmer's decision to soil conservation technologies (Tadesse and Belay 2004) especially physical structures as if terraces imply a long payback period. While the investment costs of soil conservation are readily determined, measuring the benefits is more challenging. Farm size is one of the factors that affect farmers' decision on soil conservation technologies, (Akililu and De Graaff, 2006).This implies that farmers with relatively larger land size had better chance of adaptation of soil conservation technologies than farmers with smaller plot of lands.

The reason towards the positive relation of farm size with adoption to the fact that conservation structures engage part of the scarce land and due to these farmers with small plot of lands could not afford to occupy part of their land with the structures (Bekele and Holden, 1998). Contrary to these, some studies have shown a negative correlation between farm size and practice of soil and water conservation. The soil conservation practices conceptualized as discussion through their impacts on farmers' decisions to control soil erosion. These are intercropping and crop rotation, ploughing, fallowing and the planting of trees, use of manure and other sources of organic matter, use of technologies (fertilizer and selected seed) and practice of soil conservation measures (Lakew, 2006; Mesfin, 2010). Among socio- economic factors, labor availability, farm size and land tenure are the major issues for this discussion

2.12. Variables

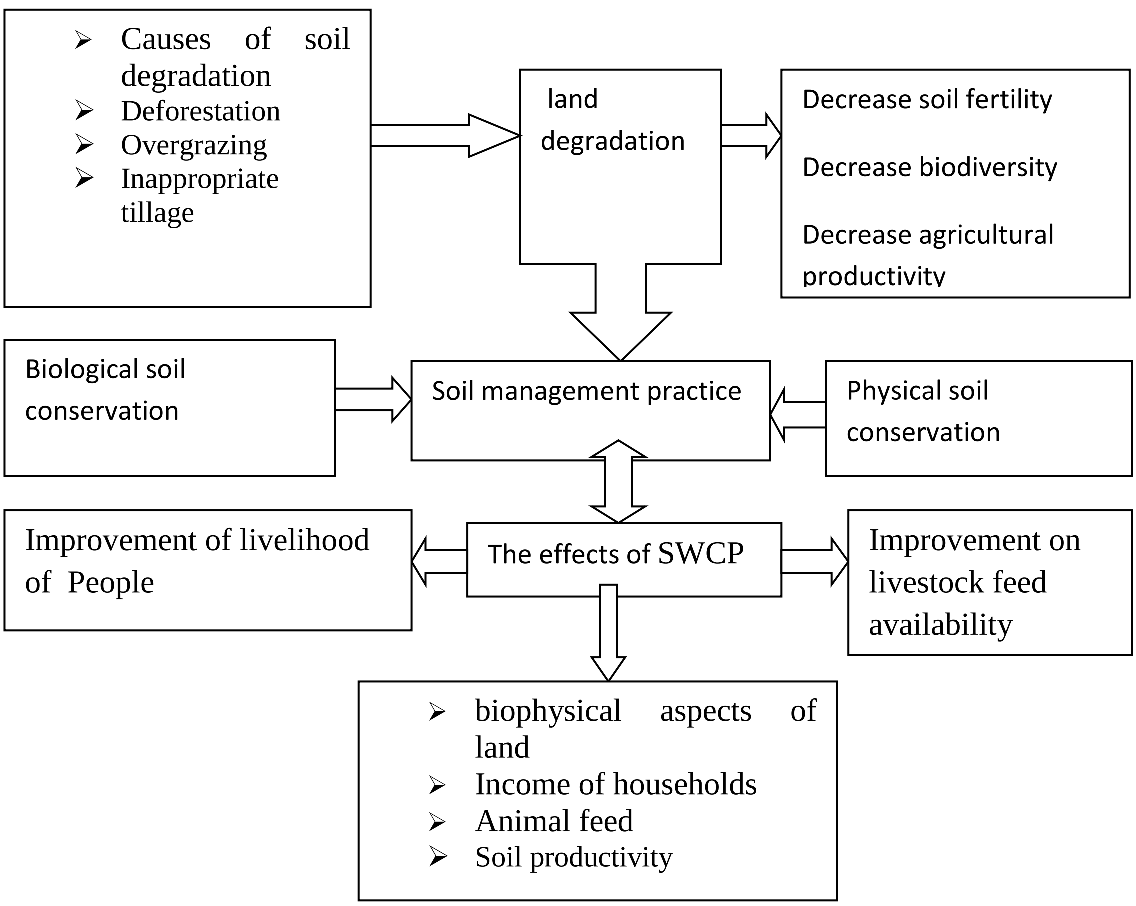
2.8.1. Dependents variables

Land degradation and Rehabilitation of degraded land

2.8.2. Independent variables

Causes of soil degradation and Soil management practice

2.9. Conceptual framework



Source: the investigator of the study

Figure 1. Conceptual framework

2.10. **Summary of literature review and knowledge gap**

In this unit key issue reviewed were land degradation in world, developing countries, Ethiopia and its management practice, importance of land management, mechanisms of land management practice, effects of land management practice and challenges of land management practices and empirical review of international and national level with regard to land management practices and the factors affecting land management practice. The knowledge gap was most of empirical studies done on the land management practice unable to consider traditional land management and modern land management in single study but simply tried to study either of them. Beside to this, most of empirical studies done missed qualitative aspects of research that may provide the real (actual) information about farm land management practice. Finally, in most of the study farm land management practice was not studied with corresponding effects of soil management practice.

CHAPTER THREE

3. Research Methodology

The major purpose of this study is to investigate the practices and challenges of soil management for rehabilitating degraded land in Hadero Tunto Zuria Woreda, Kembata Tembaro Zone,and South-Ethiopia**.** In this chapter aims to frame the technique followed in conducting research and the activities cared out with in design specification are discussed.

3.1. Descriptions of the study area

The Kembata Zone (KZ) is one of a zone in central Ethiopia region. It is bordered on the south by Wolayita, on the southwest by Dawro, on the North West by Hadiya, on the north by Gurage, on the east by Halaba special woreda, and on the southwest by an exclusive of Hadiya zone. The administrative center is Durame. It is 301km far from Addis Ababa and 119km from Hawassa. Kembata Zone (KZ) have seven woreda and three city administration like, KedidaGamela, Kachabira, Angacha, Doyogana, Damboya, Tembaro, Hadero Tunto zuria woreda and Durame, Shinshcho, and Hadaro city administrations. There are 32 secondary schools in the Zone. Hadero Tunto Zuria Woreda (HTZW) is one of woreda Zone KZ. It has four secondary schools, 34 primary schools and one preparatory school.

3.1.1. Location

Hadero Tunto-Zuria Woreda is one of the Woreda in the Southern, Nations, Nationalities and Peoples Regional State of Ethiopia and it is a part of Kembata-Tembaro Zone.HaderoTunto-ZuriaWoreda is bordered on south by Wolayta zone, on the west by Tembaro woreda, on the north by Hadiya Zone and on the east by Keche-Biraworeda .Currently the district comprises two towns and thirteen rural kebele, which is located in three different agro-ecological zones. The district is located 343 km away from the south of the capital city Addis Ababa and 152 km southwest from the regional state Hawassa. The total area coverage of the district is 18050.06 hectares (Tadesse, 2013). Its geographic position is between latitude $7^{\circ}9'30''$-$7^{\circ}19'0''N$ and $37^{\circ}34'0''$-$37^{\circ}44'0''$ E longitude.

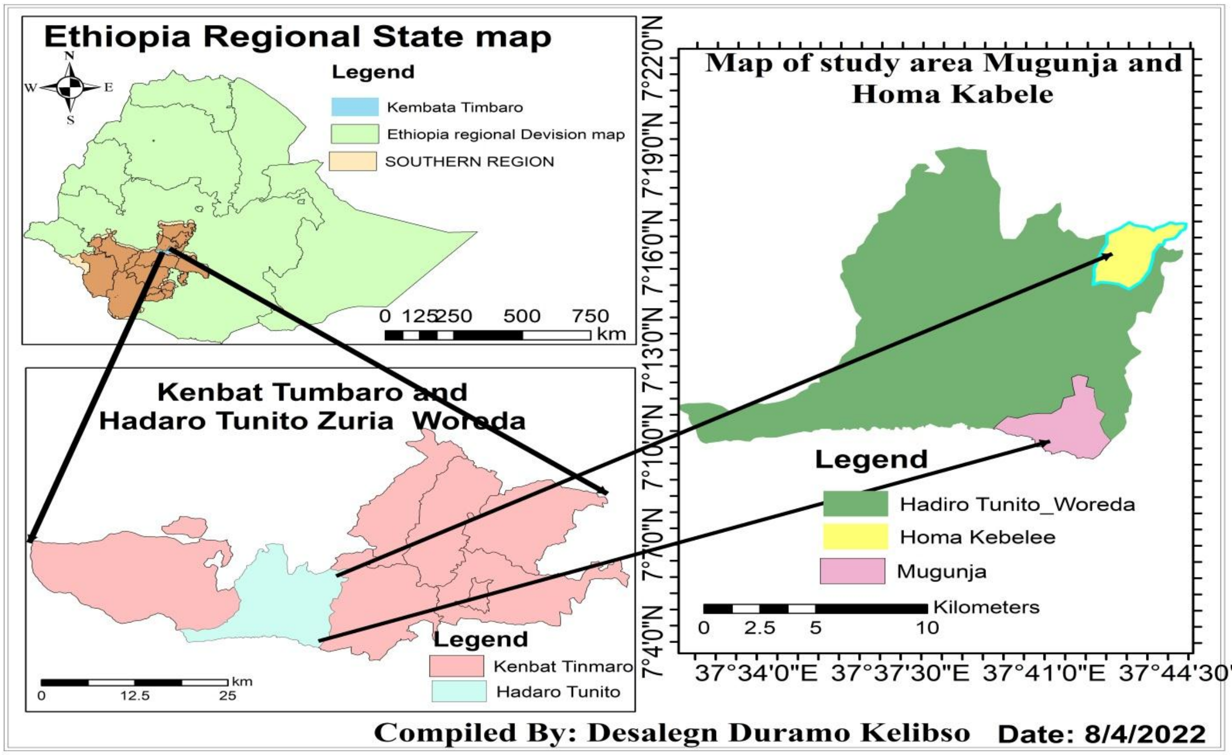


Figure 2.Study area map

3.1.2. Climate and Topography

The mean annual temperature of the Woreda ranges from 18^{o}c-32^{o}c with mean annual rainfall range of 800mm - 1200mm. It also has a bimodal rainfall distribution such as “Belg”,) and “Kiremit” season.Kiremt is the main long rainy season, which begins in mid-June and extends to the end of September, whereas the Belg is the short rainy season, which extends from end of February to early April (Tadesse, 2013).The Hadero Tunto district has diverse topographic features; plains, mountains and valleys. Its altitude varies from 1300-2600 meter above sea level. Three distinct agro-ecological zones, highlands (Dega), Midland (Woyinadega) and lowland (Kola) also characterize the study area and of which the midlands is dominant agro-climatic zone (Agricultural and Natural Resource Development Offices of Hadero-Tunto district, 2018*).*

The nature of a particular geographic entity has multi-dimensional implications up on the development of physical infrastructure, human way of life, the type of production of crops, the land use conditions and the type of flora and fauna exists. The relief of the study area is characterized by some plain, plateau, rugged and ridges terrain, which are generally high lands.

The elevation range is between 1634m-2800m above sea level; the highest place in the study area is Tora hill which is approximately 2800m peak. The slopes of the study area are categorized as gently sloping, moderately sloping and steep therefore, majority of land in study kebeles are moderately sloping slope (HTZWARDO, 2017).

3.1.3. Vegetation

Hadero Tunto district has been visibly covered by natural forests in past. However, currently the district involves plantation forests and farmers incorporating trees on-farms such as woodlots on farmlands, boundary plantings, trees in croplands and agro forestry home garden. Important species of trees and shrubs in the area, which are retained or planted by farmer on-farms, includeCordiaafricana (Wanza), Podocurpus gracilior (Zigba), Olea Africana (Weyira), Aningeriaaltissima (Kerero), Croton machrostachus (Bisana), Cordia-africana, Ficusspp, Crotonmacrostachyus, Cupressuslusitanica, Perseaamericana, Mangiferaindica, Grevillearobusta,Casimiraedulis, Coffeaarabica, Eucalyptus spp etc. The district is characterized by mainly red and unfertile soil type (Agricultural and Natural Resource Development Offices of Hadero-Tunto district 2018).

3.1.4. Soil type

According to Ethiopian Soil Map extracted by ATA, 2017, the soil type of the study area is Dystric Nitosols.Nitosols are inherently fertile, but large areas in Ethiopia have now been depleted due to continuous cultivation, leaching and erosion (Eyasu, 2002). The main properties of DystricNitosols are one of the best and most fertile soils of tropics.

3.1.5. Farming systems

The existing farming systems in the Woreda are somewhat mixed farming. Intensive and continuous cultivation and overgrazing are common farming practices in the area. The common types of land use in the area can be divided into four categories: arable land, grazing land, forest plantations and human structures, such as roads and villages. Grazing land is normally very scarce in the area. The main cereal crop grown in the area is teff (Eragrostisteff) followed by wheat, Enset (Ensetteventricossum) is also stable food for the area. Fruits and vegetables are also common.Agroforestry practice is also common practice in Hadero TuntoZuriaworeda where predominantly enset (Enseteventricossum), Coffee arabica,Perseaamericana, and Zea mays and other crops are intercropped. This practice is mostly confined to homesteads, but with steady advancement outwards. Cordia-africana, Albizagummifera, Croton macrostachyus, Gravelia-robusta are also commonly kept in and around the farmlands, particularly trees/shrubs such as Gravelia-robusta, Sesbanea-sesiban,pigeon pea (Cajanscajan) and others are commonly used for biological soil and water conservation.(source?)

3.1. 5. Socio-economic and demographic characteristics

The total population of Hadero Tunto Zuria woreda, based on 2007 census was 98,375of whom 48,548 were men and 49,827 women; 23,539 or 23.93%of its population were urban dwellers. The majority of the inhabitants are protestants, with 91.8%of the population reported that belief, 4.79% practiced Ethiopia Orthodox Christianity, and 2.51% were catholic. The main livelihood of the population of the study area is farming. People in this study area practice mixed agriculture which involves crop production and animal rearing which depends mostly on seasonal rainfall and land management of farming. (HTZWARDO, 2017).Based on 2013 census conducted by CSA Hadero Tunto Zuria woreda has a total population of 107385 of whom 51992(48.41%) are men and 55393(51.58 %) are women. 9630 or 9.83 % of its population are urban dwellers. Based on 2014 census conducted by CSA Hadero Tunto Zuria woreda has a total population of 11500285 of whom 5678840(49.38%) are men and 582144427(50.62 %) are women. 9630 or 9.83 % of its population are urban dwellers. The majority of inhabitants were protestant Christians with 82.07 % of the population reporting that Christianity group, 10.35 % are Orthodox Christianity's 5.17 % were catholic Christianity's and 2.23% were Muslims.

3.2. Research Design

The objective of the study was to assess the practice of farm land management in Hadero Tunto Zuria Woreda .To achieve this objective descriptive cross-sectional research design with mixed approach was used because the data collected one at a time without recurrently collecting data and are generally quick, easy and cheap to perform. According to Grove, Gray, and Burns (2014), this method is appropriate when a study's aim is to describe variables that have already occurred or are currently occurring as a process. Moreover, in this study mixed research approach was employed because most of the data collected through interview, focused group discussion and the nature of the practices and challenges of soil management for rehabilitating degraded land requires collecting and analyzing both quantitative and qualitative data in order to cross validate the weakness one research method with strength of the other. A mixed research methods is an approach that combines quantitative and qualitative research methods in the same research inquiry. It is an approach in which the researcher collects, analyses, and integrates both quantitative and qualitative data in single study or in multiple studies (Creswell, 2003).

3.4. Sources of Data

Primary data are the first-hand data collected by recruiting participants while secondary data are based on results and findings of researches conducted by other people (Eriksson and Kovalainen, 2008).In the same vein, to obtain relevant information on the practices and challenges of soil management for rehabilitating degraded land in Hadero Tunto Zuria Woreda KembataTembaro Zone, both primary and secondary data sources were used. To this end, primary data sources are households from sampled rural Kebeles while secondary data sources were: research papers, articles and books that related to the study.

3.5. Population, Sample Size and Sampling Technique

3.5.1. Population of the study

According to Saunders et al. (2012) defines a research population as the total collection of subject or elements about which a researcher wishes to make inference and draw conclusions. Based on this theoretical concept, the study areas population has an estimated population about 998 household heads out of which the Homa kebele has population about 472 household heads and the Mugunjahas population about 526 household heads. Two (2) development agents, two (2) agricultural office natural resource experts, 16 focused group discussion and 10 key informants. Total target Population of the study was 1028 .

3.5.2. Sample Size Determination

Appropriate sample size depends on various factors relating to the subject under investigation like the time aspect, the cost aspect, the degree of accuracy desired, etc (Gupta and Gupta, 2002). If sample is too small, it might be difficult to achieve the objectives of analysis. But if it is too large, it may result in resource wastage when dealing with the sample. Sample error will arise because of not studying the whole population. Whenever sampling, it is usual to miss some helpful information about the population (Kothari, 1990). The higher the desired precision or the level of confidence, the larger will be the sample (Browen and Starr, 1983). Based on 2013 census conducted by CSA Hadero Tunto Zuria woreda has a total population of 107385 of whom 51992(48.41%) are men and 55393(51.58 %) are women. 9630 or 9.83 % of its population are urban dweller (HTZWARDO, 2017). Hadero Tunto zuria woreda had 14 rural kebeles. Out of this Homa and Mugunja Kebles' were selected.

The total number of household heads in mugunja kebele is 526 while the total number of household heads in Homa kebele is 472. Two development agents of natural resources experts at Kebele level, two agricultural office natural resource experts. 5 key informants from each kebeles equal 10 and 16 focused group discussion. Total Population of the study was 1028 participants. The numbers of respondents (household heads) from each rural kebeles was determined with the help of Kothari formula (Kothari, 2004).

$$n= \frac{z^2.p.q.N}{e^2(N-1)+z^2.p.q}$$

Where; n = sample size

Z = 95% confident limit (interval) under normal curve which is 1.96

p = 0.5(proportion of population to be included in the sample that is 50%)

q = non-occurrence of event = 1- 0.5 = 0.5

N = Total number of house hold = 998

E = margin of error or degree of accuracy (accepted error term 0.05) mungunja 526

Homa 472

$n= \frac{(1.96)^2(0.5)(0.5)(998)}{(0.05)^2(998-1)+(1.96)^2(0.5)(0.5)}$ $n= \frac{958.4792}{2.4925+0.9604}$ $n= \frac{958.4792}{3.4529}$ = 278 which is 27.9% of total study population

out of total sample 278, from mugunja kebele 80 sample respondents were selected by using $^{(278)(526)}/_{998}$=147 while that of Homa kebele $^{(278)(472)}/_{998}$ = 131

$n_i = \frac{N_i}{N} * n$is used for sampled distribution in each kebeles

Sample distribution among clusters

The clusters were taken from administrative structures of local kebel but not made by the investigator for the purpose of the study. Accordingly, mugunja and homa kebele had four kebele each so that sample was distributed to each cluster accordingly.

Table 1.sample distribution among sampled villages of mugunja kebele.

s/n	Name of sampled village (Got)	Total household head	Sample household head
1	Cluster 1	124	35
2	Cluster 2	132	37
3	Cluster 3	128	36
4	Cluster 4	142	39
5	Total	526	147

Source: mugunja kebele administration

Table 2.Sample distribution among sampled villages of Homa kebele

s/n	Name of sampled village (Got)	Total household head	Sample household head
1	Cluster 1	128	36
2	Cluster 2	102	28
3	Cluster 3	120	33
4	Cluster 4	122	34
5	Total	472	131

Source: Homa kebele administration

3.5.3. Sampling Technique

.Hadero Tunto Zuria Woreda had 14 kebeles. Out of theses kebeles two (homa and mugunja kebeles) were selected by purposive sampling technique based on the report of agricultural office the two kebeles were more degraded and so that more soil management practice done. Thus, to examine the practice and its effect the respective kebeles were selected purposively out of kebeles of Hadero Tunto Zuria Woreda. Therefore, out of this Homa and Mugunja Kebles' were purposively selected since most of degraded formerly and most soil management practice was reported by Hadero Tunto zuria woreda agriculture office in 2012 and 2013 annual report.

All clusters of sampled kebele were included purposively to get full information from the whole kebele about the status of soil management, its effects and challenges. Household heads of the study area were selected by using simple random sampling technique because randomization error cannot be occurred since whichever of them were included in the study the main purpose of the study is providing information on the practice and challenges of soil management.

3.6. Instruments of Data collection

Questionnaire, interview, observation and focused group discussion were used as data collection instruments to collect comprehensive information for the study.

3.6.1 .Questionnaire

Questionnaire is a list of carefully designed questions or a set of questions usually in a highly structured written form to be answered by selected group of research participants or respondents (Gay, Mills and Airasian, 2009).

In this study survey questionnaire was employed as the major data collection tool. This is because it is convenient ways to conduct survey and to acquire necessary information about the practices and challenges of soil management for rehabilitating degraded land in Hadero Tunto Zuria Woreda, Kembata Tembaro Zone from large number of respondents within short period of time. According to Best and Kahn (2003), questionnaire is a highly appropriate data collection tool, to get wider information from widely dispersed sample population and make possible an economy of time and expense and provides a high proportion of usable responses. Based on study issue the questionnaires were developed by researcher.

Both closed and open-ended questions were employed in order to take their advantages for the study purpose. Kothari (2004) indicates that closed ended questions have the advantages of easier to handling, simple to answer, quick and relatively inexpensive to analyze and interpret whereas the open-ended questions have benefits to allow obtaining depth and variety of responses from respondents. It was first prepared in English and then translated into Amharic language, to attain better communication with sample respondents for practical field work.

It is designed to collect data from 278 sample Kebele respondents'. Accordingly; the questionnaires were constructed based on the objective of the study. The questions developed consist components of questionnaire such as the title that gives an appropriate caption for the substantive content of the questionnaire ,the introduction that the main objective of the questionnaire and guarantee of anonymity of respondents confidential treatments of the information supplied, the responses interaction that specific mode or modes of completing the questionnaire, biographical information which gives personal data of respondents, question statement which is actual substantive quant ant of the research, the gratitude at end the of the instrument that is appreciating the respondents by thanking them. The type of questions were closing ended and open ended. The questionnaires were administrated households of sampled kebeles of the study area.

The questionnaires were distributed and collected by researcher. The questionnaires were consists of issues such as socio demographic characteristics of respondents, the levels the practices and challenges of soil management for rehabilitating degraded land in study area, the role played by stakeholders in terms of their participation in the practices of soil management for rehabilitating degraded land and the challenges of soil management for rehabilitating degraded land. The question applied the likart type of rating scale .strongly agree 5 agree =4, undecided =3, disagree=2 strongly disagree=1and very high=5 or very high=5 high=4 medium=3 low=2 very low=1

3.6.2. Key informant interview

Interview is the form of data collection involves recording data as the interview and that takes place or shortly after words. In review will be under taken in the form of person to person encounter using semi structured question and it has been used to enable respondents address matters in their own terms and words (coherent et.al, 2002).The value of interviews as a data collection method is highlighted by Gillham (2005) in stating that "there is a wide recognition of the special importance of narrative as mode through which individuals express their understanding of events and experiences".

Key informants are persons who had lived in the localities for long periods of time and hence know very well about the history of the soil management practice and its challenges in study areas. They have good knowledge of the levels the practices and challenges of soil management for rehabilitating degraded land Hadero Tunto Zuria Woreda, Kembata Tembaro Zone. The selection of these Key informants (KI) was done through snowball method. Snowball Sampling is an option for locating information rich key informants and critical cases (Goodman 1961).The method yields a study sample through referrals made among people who share or know of others who possess some characteristics that area of research interest. The method is well suited for a number of research purposes and is particularly applicable when the focus of study is on a sensitive issue, possibly concerning a relatively private matter, and thus requires the knowledge of insiders to locate people for study. During the selection of key informants, three farmers will be asked randomly to identify and give seven KIs as defined above. Then the identified KIs are ranked and the most frequently appeared three persons were assigned as KIs in each selected kebeles. From Homa Kebele 5 key informants and From Mugunja 5key informants and 2 development agents of the two kebele who work as natural resource management,2 natural resource experts were interviewed. Total of 14 key informants were participated in this study. Thus, to get views and opinions about levels the practices and challenges of soil management for rehabilitating degraded land, semi structured interview were prepared for the purpose of triangulating and substantiating the reliability of data collected through questionnaire.

3.6.3. Focus Group Discussion

Group discussions consisting of 8 household head in each of the two kebeles was done once in each study kebele. The group discussions involved one group in each kebeles and the researcher facilitated the discussions at all sites. The main points for discussion included an open ended check list in order to gain in-depth about farmland management covered during the structured interview and to check whether patterns found in the households are validated by focus groups.

3.6.4. Observations

Observations of the general setting of agricultural environment can provide valuable background information about the farm land, pasture land and non-afarm land in study area where this research was being undertaken. During field work, land degradation, soil erosion status, current land use, vegetation cover, current land management practices carried out by farmers in order to increase their agricultural production and decrease land degradation and soil erosion were observed.

3.7. Validity and Reliability of data collection Instrument

Validity refers the extent to which an instrument measures what it is supposed to measure and the reliability of the research instrument is the extent to which an instrument yields the same results on repeated measures (Haber &Lobiondo - Wood 2006). The validity of instruments were assessed for the clarity of the items, pilot test or pre-test was done. It is administered to 2nd Tunto Kebale that was not included in the final study.

To enhance content validity, appropriate and adequate items relevant to research objectives were constructed as the questionnaire. To ensure reliability of the instrument, the pilot test or retest technique of assessing the reliability of the instrument was used. The technique involves administering the same instrument to the same respondents twice. These were administered at an interval of one to two weeks. The instrument are pilot tested with 12 households (7 male & 5 female), that are selected for pilot study. They were not involved in the main study. SPSS 20.0(statistical package for social science) data analysis software was employed.

3.8. Methods of Data Analysis

The data collected on the practice of soil management was analyzed by descriptive statistics percentage and one sample T-Test. The effects of soil management was analyzed by descriptive statistics percentage and one sample T-Test .The data collected on the challenges of soil management for rehabilitating degraded land was analyzed by descriptive statistics percentage and presented in tables and interpreted accordingly .Qualitative data that gathered by semi structured interview, observation and focused group discussion was added to the information obtained from quantitative analysis to support it and make comprehensive interpretation. SPSS 20.0(statistical package for social science) data analysis software was employed.

3.9. Ethical Considerations

The main objectives of the research and or the questionnaire, guarantee of anonymity of the respondents and confidential treatment of the information supplied was explained to participants that the information provided by them used for the study purpose. Moreover, it was ensured confidentiality by making the participants anonymous to eliminate the problems of ethical dilemma and facilitate smooth flow of information between data collector and respondents. Finally appropriate credit was given for any use of another person’s idea or word and the letter of permission was written from Hawassa University to ensure that the study was for the academic purpose.

CHAPTER FOUR

4. RESULTS AND DISCUSSIONS

In this section the data collected were analyzed, presented and interpreted based on the objective of the study. The analysis of quantitative and qualitative data was done based on the information obtained through the questionnaires, interviews, personal observation and focused group discussion. The purpose of these data was to assess the practices and challenges of soil management for rehabilitating degraded land in study area. In view of that participants of the study were 151 survey households' heads, 16 focused group discussants and 2 natural resource experts and 10 key informants 2 development agents. Totally 181 respondents were participated in this study. To this end, the unit divided into four sub sections. The first section deals with demographic characteristics of respondents. The second section deals with the practices of soil management in the study area, the third section discussed the effects of soil management in study area and finally the fourth section deliberated challenges of soil management in study area.

4.1. Demographic   and socio economic Characteristics of the Respondents

As can be seen from the table 3 above, respondents in terms of sex 113(74.8%) of the respondents were male while the remaining 38(25.2%) of them were female. With regard to age 17(11.3%) of the respondents were at the age interval of 31-40years while the rest 112(74.2%) and 22(14.6%) of the respondents age group 41-50years and above 50years respectively. In terms of educational level, 12(7.9%) of the respondents were educated primary school while the remaining 97(64.2%), 27(17.9%) and 15(9.9%) of the respondents educated secondary, diploma and 1st degree respectively. with regard to marital status,107(70.9%) of the respondents were married while 14(9.3%) and 30(19.9%) of them unmarried and divorced respectively. This implied that the respondents most of them were male which in turn point out that there was gender prejudice during participation of rule of law issues. the participants were old enough that can provide the intended information promptly with regard to education they learned above primary level that help them understand and engage in implementation of rule of law.

Table 3 .. Respondents' Social Demographic Characteristics

	Category	F	%		Category	F	%
Sex	Male	149	82.3	Education	Cannot read and write	24	13.3
					Can read and write	65	35.9
					Primary	50	27.6
					Grade 10/12th	23	12.7
	Female	32	17.7		Diploma	12	6.6
	Total	181	100.0		Ba/BSc Degree	7	3.9
Age	18-25year				Total	181	100.0
	26-33years	13	7.2	Land size	0.1-0.5ha	9	5.0
	34-41 year	95	52.5		0.51-0.75ha	36	19.9
					o.76-1ha	90	49.7
	42-49 year	53	29.3		Above 1ha	46	25.4
					Total	181	100.0
	50-57 year	20	11.0	Annual Income	2000-5000Bir	11	6.1
					5001-7000Bir	50	27.6
					7001-10000Bir	75	41.4
					Above 10000Bir	45	24.9
	Total	181	100.0		Total	181	100.0

As can be seen from the table 4 below , respondents in terms of sex 113(74.8%) of the respondents were male while the remaining 38(25.2%) of them were female. With regard to age 17(11.3%) of the respondents were at the age interval of 31-40years while the rest 112(74.2%) and 22(14.6%) of the respondents age group 41-50years and above 50years respectively. In terms of educational level, 12(7.9%) of the respondents were educated primary school while the remaining 97(64.2%), 27(17.9%) and 15(9.9%) of the respondents educated secondary, diploma and 1st degree respectively. with regard to marital status,107(70.9%) of the respondents were married while 14(9.3%) and 30(19.9%) of them unmarried and divorced respectively. This implied that the respondents most of them were male which in turn point out that there was gender prejudice during participation of rule of law issues. the participants were old enough that can provide the intended information promptly with regard to education they learned above primary level that help them understand and engage in implementation of rule of law.

Table 4.charctersiscs of respondents for qualitative data

	Category	F	%		Category	F	%
Sex	Male	31	100	Education	Cannot read and write		
					Can read and write	12	39
					Primary	15	48
					Grade 10/12th		
	Female				Diploma		
	Total	31	100.0		Ba/BSc Degree	4	13
Age	18-25year				Total	31	100.0
	26-33years			Land size	0.1-0.5ha		
	34-41 year				0.51-0.75ha	15	48
					o.76-1ha	12	39
	42-49 year	31	100		Above 1ha	4	4
					Total	181	100.0
	50-57 year			Annual Income	2000-5000Bir		
					5001-7000Bir		
					7001-10000Bir	31	100
					Above 10000Bir		
	Total	31	100.0		Total	31	100.0

4.2. Data analysis with regard to practice of soil management in study area.

In this section data was collected and analyzed by categorizing the section into three subsections like traditional soil management, modern physical soil management and modern biological soil management.

4.2.1. Traditional soil management practice

As indicated in Table 5 below 47(31.1%) of the respondents said that they always practiced contour farming traditionally to manage the soil while the remaining 71(47.0%) and 24(15.9%) of the respondents replied that they sometimes and rarely practiced contour farming traditionally to manage the soil respectively.

As shown in Table below 55(36.4%) of the respondents replied that they always practiced contour farming traditionally to manage the soil while 72(47.7%) of them responded that they sometimes practiced contour farming traditionally to manage the soil and the rest 23(15.2%) and 1(0.7%) of the respondents replied that they rarely and never practiced ridge terrace channel is formed on the contour by excavating the mud respectively.

In Table 5 below , 37(24.5%) of the respondents replied that they always practiced traditional waterways (feses) as the soil management while 92(60.9%) of the respondents said that they sometimes practiced traditional waterways (Fesesa) as the soil management. Finally, 22(14.6%) of the respondents responded that practiced traditional waterways (Feses) as the soil management.

According to interview responses of agricultural office experts:

*"**…………**Traditional physical land management practiced in our locality were traditional water drainage ways (mefesesha) along farm field, stone band at hillside, traditional cutoff drain."*

As indicated in Table 5 below 29(19.2%) of the respondents said that they always practiced traditional check dams (kiter) traditionally to manage the soil while the remaining 102(67.5%) and 20(13.2%) of the respondents replied that they sometimes and rarely practiced traditional check dams (kiter) traditionally to manage the soil respectively.

As shown in Table 5 below 30(19.9 %) of the respondents replied that they always practiced traditional cut-off drains (tars- boy) traditionally to manage the soil while 91(60.3 %) of them responded that they sometimes practiced traditional cut-off drains (tars- boy) traditionally to manage the soil and the rest 30(19.9 %) of the respondents replied that they rarely practiced traditional cut-off drains (tars- boy). This implied that cut-off drain was practiced by some farmers. Beside to this, during the transect walks with the key informants, several rills were seen between farm boundaries that were started from the cutoff drains. Soil and water conservation technicians and farmers believe that a better traditional way of layout and construction can improve the performance of the cut-off drains. Since traditional practices were planned and implemented by family member and labour; lacks to integrate with the adjacent fields for a safe outlet. Consequently, the runof]]oof discharging out was seen as a cause of conflict. The respondents mentioned the seasonal nature of traditional farm ditches as a drawback they cannot use it sustainably (Adinew, 2014).

Figure 3.Traditional stone terraces

In Table above, 35(23.2 %) of the respondents replied that they always practiced Traditional stone terraces (Erken) as the soil management while 93(61.6 %) of the respondents said that they sometimes practiced Traditional stone terraces (Erken) as the soil management. Finally, 23(15.2%) of the respondents responded that practiced Traditional stone terraces (Erken) as the soil management.

As indicated in Table above, 45(29.8%) of the respondents said that they always practiced contour ploughing (agidem mares) traditionally to manage the soil while the remaining 86(57.6%) and 19(12.6 %) of the respondents replied that they sometimes and rarely practiced contour ploughing (agidem mares) traditionally to manage the soil respectively.

Figure 4. Traditional vegetative fences

As shown in Table 5 below 51(33.8%) of the respondents replied that they always practiced traditional vegetative fences traditionally to manage the soil while 91(60.3 %) of them responded that they sometimes practiced traditional vegetative fences traditionally to manage the soil and the rest 9 (6.0%) of the respondents replied that they rarely practiced traditional vegetative fences.

As can be seen from the Table 5 below , 32(21.2%) of the respondents said that they always practiced residue management traditionally to manage the soil while the remaining 22(14.6%) and 97(64.2%) of the respondents replied that they sometimes and rarely practiced residue management traditionally to manage the soil respectively.

Furthermore, the results of interview confirmed that crop residue management was practice was low like

"……………..It is one of the physical land management practices applied by farmers in both middle altitude and low land areas of the study Woreda. Crop straw, Maize and sorghum stalks

are among crop residues used as soil mulch in protecting soil moisture lose during dry season, intercepts rain drops impacts from striking soil surface and contribute in reducing run off. These add organic matter to the soil through decomposition of its litters and improve physical structures of the soil. Until the recent years returning crop residues to soil were not common practices for most farmers, who prefer to use for livestock feed, fuel and construction materials or to burn or remove from the fields".

This implied that residue management was practiced at low level but (CAB International, 1997) stated that residue management is an act of leaving crop residue on the field after harvest mainly for the purpose of animal feed, fuel and construction materials in the study area. Despite its uses as animal feed, fuel and construction purpose crop residues are very important for crop land improvements by enhancing water availability to crops and increasing the soils water retention capacity.

Moreover, Agele et al., (2000) crop residues also reduce the soil temperature by some degrees in the upper centimeters of the topsoil and provide better moisture conservation by reducing the intensity of radiation, wind velocity, and evaporation. The limitation of practicing residue management emanate from soil management itself. For instance the findings (Mulugeta Demelash and Karl, 2010) said that increases crop production by improving soil chemical and physical properties and crop residues uses for animal feed, and it helps full filling the nutritional need of livestock as it is the most part to get the economic benefit obtained for the livestock (Dubale, 2001).

In Table 5 below , 15(9.9%) of the respondents replied that they always practiced minimum tillage as the soil management while 116(76.8%) of the respondents said that they sometimes practiced minimum tillage as the soil management. finally, 20(13.2%) of the respondents responded that practiced minimum tillage as the soil management.

Minimum tillage is also the other traditional physical land management practice in which soil disturbance is reduced. This practice was mostly done at the area where soil compaction is less and the soil is light, such type of soil is found at the low land areas of the Woreda. Furthermore, in the study area particularly at the middle altitude 6-5 time's tillage and packing of the fine seedbed by animals is a common practice for teff. This intensive tillage practices reduces infiltration, smoothens the land surface and consequently low surface water storage and leading to high runoff and soil loss. The finding was found to be in agreement with the works (Teklu

Erkossa and Gezahegn Ayele, 2003) who observed that high rate of erosion is caused mainly by vegetation clearance and intensive tillage. In the region, 7-9 times tillage and packing of the fine seedbed by animals is a common practice for teff in Digga Leeqaa district. This reduces infiltration, smoothens the land surface and consequently low surface storage leading to high runoff and soil loss.

During the FGD, farmers have pointed out that their indigenous soil management relies on locally developed skills (without the help of development agents), locally available materials, and hence constructed by individual labor. Moreover, since they are practiced for generations, the local people were familiar with them. These advantages coupled with their requirement of little or no cost were believed to be practiced with courage and were found to be more effective. In addition to that, these practices enabled farmers to effectively use the small plots, and it does not take much space (Engdawork and Bork, 2014).

Table 5.Traditional soil management practice

s/n	Items	Level of practice							
		VH		H		M		N	
		F	%	F	%	F	%	F	%
1	Contour farming	47	31.1	71	47.0	24	15.9	9	6.0
2	Ridge terrace channel is formed on the contour by excavating the mud	55	36.4	72	47.7	23	15.2	1	0.7
3	Traditional Waterways (Feses)	37	24.5	92	60.9	22	14.6		-
4	Traditional Check Dams (Kiter)	29	19.2	102	67.5	20	13.2		-
5	Traditional Cut-off Drains (Tars- boy)	30	19.9	91	60.3	30	19.9		-
6	Traditional stone terraces (Erken)	35	23.2	93	61.6	23	15.2		-
7	Contour ploughing (Agidem mares)	45	29.8	87	57.6	19	12.6		-
8	Traditional Vegetative Fences	51	33.8	91	60.3	9	6.0		-
9	Residue management	32	21.2	97	64.2	22	14.6		-
10	Minimum tillage	15	9.9	116	76.8	20	13.2		-

Source: sample survey 2022 (VH=very high, H= high, m=medium ,L=low,VL=very low

As can be seen from the Table 5 below , 49(32.5%) of the respondents told that they practiced bench terraces to manage their soil while the remaining 102(67.5%) of the respondents said that they didn’t practice bench terraces to manage their soil.

Figure 5. Practice of funaju terraces

In Table 6 below item 2, most 128(84.8%) of the respondents practiced fan jue terraces to manage their soil but the remaining 23(15.2%) of the respondents not practiced fan jue terraces to manage their soil.

As shown in Table 6 below 63(41.7%) of the respondents practiced contour bund to manage their soil. In contrast to this, 88(58.3%) of the respondents not practiced contour bund to manage their soil.

As can be seen from the Table 6 below , 99(65.6%) of the respondents told that they practiced silt fences to manage their soil while the remaining 52(34.4%) of the respondents said that they didn’t practice silt fences to manage their soil.

Table 6 below item 2, few 12(7.9%) of the respondents practiced Surface mates to manage their soil but the remaining most 139(92.1%) of the respondents not practiced Surface mates to manage their soil.

As shown in Table 6 below 89(58.9 %) of the respondents practiced contour ploughing to manage their soil. In contrast to this, 62(41.1%) of the respondents not practiced contour ploughing to manage their soil.

As can be seen from the Table 6 below , 91(60.3%) of the respondents told that they practiced stone faced soil bund to manage their soil while the remaining 60 (39.7%) of the respondents said that they didn't practice soil bund to manage their soil. According to FGD, the improved SWC measures for example stone-faced soil bunds were advantageous over the stone bund because it can be planted with economically important or animal fodder seedling. Therefore, it has a dual function for maintaining soil and economic benefits such as animal feed and crop production improvement which was also supported by (Mulat et al. , 2019).

On the other hand, the interview results showed that the improvement on traditional management to modern one took their farm land. "Modern soil management measures take larger farm land because we have small farm size so that it consume more of our farm land but it help us benefit animal feed and crop production improvement". This indicated the internal desire of farmers to get immediate benefits and to increase production from treated lands. Amsalu (2006) ascertain that immediate benefit gives energy for farmers in order to continue the practical application of the improved and new technologies.

In the study area, about of the respondent farmers (60.3%) practiced stone bund and it is widely practiced in the area next to crop rotation and traditional drainage ditch. Similar to this study, Amsalu (2006) found that stone bund was widely practiced by 73% of farmers in the Beressa watershed, highlands of Ethiopia. In contrast to this, Habtamu (2014) pointed that stone bunds are not widely practiced by all farmers of the Wuchale district North Shewa Zone of Oromia region. The main reason for this is the problem of the availability of larger stones around their farm plots, labor-intensive and lack of awareness. In the same way, the most practical reasons obtained from the study area farmers themselves during the discussion were the labour-intensive nature for the construction and maintenance of the structure and lack of awareness. From field observation, bunds were found poorly maintained especially on rented lands. Farmers do not give attention to the maintenance of the already constructed traditional bunds due to their interest in immediate return coupled with a fear of a decrease in the farm size. During FGDs with key informants, the function of stone bunds, as perceived by farmers as a means to slow down run-off and it helps to clear the land from the stones. According to most respondent farmers (89.2%), terracing is effective in erosion control, and has the potential to improve land productivity, although it is labor-intensive, hosts rodents, and returns investment only gradually, this is similar with Amsalu (2006) result.

In Table 6 below item 8, most 53(35.1%) of the respondents practiced micro basin to manage their soil but the remaining 98(64.9%) of the respondents not practiced micro basin to manage their soil.

As can be seen from the Table 6 below , 69(45.7%) of the respondents told that they practiced Ibrobasin to manage their soil while the remaining 82(54.3%) of the respondents said that they didn't practice Ibrobasin to manage their soil.

Table 6..Modern physical soil management practice

s/n	Items	Responses			
		Yes		No	
		F	%	F	%
1	Bench terraces	49	32.5	102	67.5
2	Fan jue terraces	128	84.8	23	15.2
3	Contour bund	63	41.7	88	58.3
4	Silt fences	99	65.6	52	34.4
5	Surface mates	12	7.9	139	92.1
6	Contour ploughing	89	58.9	62	41.1
7	Stone faced Soil bund	91	60.3	60	39.7
8	Micro basin	53	35.1	98	64.9
9	Ibrobasin	69	45.7	82	54.3

As can be seen from the Table 7 below , 20(13.2%) said that they always practiced intercropping as one of soil management practice while the rest 107(70.9%) and 24(15.9%) of them replied that intercropping was sometimes and rarely practiced as soil management measures. This implied that intercropping was practiced as one of soil management practice in study area.

As indicated in Table 7 below , most 84(55.6%) of the respondents replied that use compost for soil management was sometimes practiced and similarly 28(18.5%) of them use compost as the soil management was rarely practiced in study area and few 39(25.8%) of them reported that use compost for soil management was always practiced in study area. And as the same interviewee:

(…………Traditional biological land use practiced in study area were mulching(covering the soil with straw of maize,wheat,banna) , traditional hip compost(compost collected in the same place),residue management(example residue of coffee management).

As shown in Table 7 below more than half 80(53%) of the respondents said that they practice crop residues cover as one of soil management measure and similarly 37(24.5%) of the respondents rarely practiced crop residues cover to manage their soil while the rest 29(19.2%) of the respondents always practiced crop residues cover as soil management measure. On the other hand few 5(3.3%) of the respondents never practiced crop residues cover as soil management measure.

In Table 7 below 34(22.5%) of the respondents always practiced use of manure such as farm yard and green manures for soil management while 91(60.3%) and 26(17.2%) of the respondents replied that they practiced manure such as farm yard and green manures to manage their soil sometimes and rarely respectively.

As shown in Table 7 below more than half 105(69.5%) of the respondents said that they sometimes practiced planting of leguminous crops as one of soil management measure and similarly 25(16.6%) of the respondents rarely practiced planting of leguminous crops to manage their soil while the rest 21(13.9%) of the respondents always practiced planting of leguminous crops as soil management measure.

In Table 7 below 24(15.9%) of the respondents always practiced crop rotation for soil management while 116(76.8%) and 11(7.3%) of the respondents replied that they practiced crop rotation to manage their soil sometimes and rarely respectively.

Similarly, as indicated in Tollera (2011) finding, crop rotation was practiced by almost all sampled households (98.3%). Almost all of the sampled farmers' fields were cultivated for annual crops with a common rotation sequence; Crop rotation was widely practiced in the area where wheat, sourgam and teff rotated with bean in Homa Keble while at mugnija Kebele maize was rotated with teff, zinger , as common sequences. Teff and wheat are considered as soil-depleting crops while bean, are legumes that enrich soil fertility by improving the nitrate content of the soil (Yilkal, 2007). Major cereals after legumes or oil crops are rotated mainly for soil fertility maintenance, weed, and disease control (Teklu and Gezahegn, 2003). Moreover, a study in Konso area showed that to improve soil fertility, farmers use alternating high residue producing crops with the growing low residue producing crops thereby improved crop yield (Yeshambel, 2013).

As can be seen from the Table 7 below ,30(19.9%) said that they always practiced tillage practices as one of soil management practices while the rest 102(67.5%) and 19(12.6%) of them replied that tillage practices was sometimes and rarely practiced as soil management measures. This implied that tillage practices was practiced as one of soil management practices in study area.

As indicated in Table 7 below , most 108(55.6%) of the respondents replied that growing trees and shrubs together with food crops for soil management was sometimes practiced and similarly 14(9.3%) of them growing trees and shrubs together with food crops as the soil management was rarely practiced in study area and few 29(19.2%) of them reported that growing trees and shrubs together with food crops for soil management was always practiced in study area.

As shown in Table 7 below more than half 118(78.1%) of the respondents said that they sometimes practiced agroforestry as the soil management as one of soil management measure and similarly 18(11.9%) of the respondents rarely practiced agroforestry as the soil management to manage their soil while the rest 15(9.9%) of the respondents always practiced agroforestry as the soil management as soil management measure. During FGDs, farmers explain that the primary objectives of agro-forestry were improving soil fertility, used as shade, and control erosion. This was also confirmed with previous study conducted by (Bifarin, et al 2013) that said practicing agroforestry as the soil management used as fodder for livestock; rehabilitate the degraded areas, and alleviating adverse environmental effects.

Agro forestry has been promoted in the lowland areas in recent years where tree and field crops are grown together in the same field. Mango trees are often grown in narrow strips, often on the contour, and are usually used for intercepting raindrop and decreases run off which is in agreement with (Sanders, 2004) who reported that, Agro-forestry practices are used in many ways to protect the soil. They are particularly effective as windbreaks and are frequently used to control erosion and reclaim badly degraded land. It is also a valuable traditional practice which plays an important role in maintaining ecological stability.

In Table 7 below 52(34.4%) of the respondents always practiced relay cropping for soil management while 93(61.3%) and 6(4%) of the respondents replied that they practiced relay cropping to manage their soil sometimes and rarely respectively.

As indicated in Table 7 below , most 94 (62.3%) of the respondents replied that multiple cropping for soil management was sometimes practiced and similarly 18(11.9%) of them multiple cropping as the soil management was rarely practiced in study area and few 39(25.8%) of them reported that multiple cropping for soil management was always practiced in study area. FGDs and key informant interviews also confirmed that ISWC practices are multifunctional. For example, crop rotation can control weeds and pests, improve soil fertility and crop production at the same time. A previous study in South Wello (Belay, 2000) has also supported this finding. Traditional ditches were multi-purpose including protecting the soil from erosion, drain excess water, and reduce waterlogging problems on-farm plots. The other multipurpose practice was agro-forestry system that protects the environment. In the study area as well as in other studies (Adinew, 2014) it is a source of food for livestock, their leaves decompose and increase the nutrient content of the soil, and increases productivity.

Table 7.Biological soil conservation practice

s/n	Items related to biological soil management	Frequency of practice							
		A		S		R		N	
		F	%	F	%	F	%	F	%
1	Intercropping	20	13.2	107	70.9	24	15.9		
2	use compost for your soil	39	25.8	84	55.6	28	18.5		
3	crop residues cover for the soil	29	19.2	80	53	37	24.5	5	3.3
4	use of manure such as farm yard and green manures	34	22.5	91	60.3	26	17.2		
5	planting of leguminous crops	21	13.9	105	69.5	25	16.6		
6	crop rotation	24	15.9	116	76.8	11	7.3		
7	Tillage practices	30	19.9	102	67.5	19	12.6		
8	Growing trees and shrubs together with food crops	29	19.2	108	71.5	14	9.3		
9	Agroforestry as the soil management	15	9.9	118	78.1	18	11.9		
10	Relay cropping	52	34.4	93	61.6	6	4.0		
11	Multiple cropping	39	25.8	94	62.3	18	11.9		

Source: sample survey 2022 (A=always, S= sometimes , R=rarely, N= never)

4.3. Data analysis with regard to effects of soil management

In this section the effects of soil management was analyzed by frequency to know farmers response towards the effects of soil management on agricultural productivity, biophysical aspects of land, erosion protection and incomes of farmers. To check the tendency of response from midpoint, one sample T-test was used.

As can be seen from the Table 8 below 14(9.3%) and 81(53.6%) of the respondents agreed with the statement that said crop yield increased due to soil management while 24(15.9%) of the respondents disagreed with the same statement and the remaining 32(21.2%) of the respondents were refrain to say crop yield increased due to soil management. In line with this finding, Abebe (2015) found an improvement in crop yield of adopter households as compared to non-adopter in Adwa and Amba Alagie district in Tigray region. Yenealem (2013) also indicated that there is additional crop production value equal to 1,510.42 birr for adopter households than non-adopter in west Harareghe, Oromia region. Another finding from Hadush (2015) revealed that crop production increase to 0.673ton/ha in smallholder farms who adopted SWC measures in Adwa district, Tigray region. According to Benin (2006), stone terraces had significant positive impacts (42%) increase on average crop yields for lowerrainfall parts of the Amhara region. In addition, Pender and Gebremedhin (2006) indicated higher crop yields from plots with stone terraces (an average yield increase of 23%). Another study conducted by Tugizimana (2015) in Nyamasheke District, Rwanda has shown that SWC measure has significantly improved a bean yield.

In contrary, different experimental and survey results indicated that SWC measures reduce crop yields in high rainfall area or because of medium to long term benefits of the practices. For instance, Kassie and Holden (2006) reported that physical conservation measures (Fanya juu) resulted in lower yield in a high rainfall area of the Ethiopian highlands in western Amhara region. Menale et al. (2007) reported low crop yields in the fields with conservation structures and insignificant mean crop production value in high rainfall area of Amhara region and the finding was supported by Baptista et al. (2015) who reported crop yield decline in the fields with SWC practices in the high rainfall watershed of Ribeira Seca Watershed, cape verde.

As indicated in table above 41(27.2%) and 73(48.3%) of the respondents agreed with the statement that said soil erosion prevented due to soil management while 12(7.9%) of the respondents disagreed with the same statement and the remaining 25(16.6%) of the respondents were abstain to say soil erosion prevented due to soil management.

. Figure 6.soil water retention improvement

As shown in Table 8 below 7(4.6%) and 88(58.3%) of the respondents agreed with the statement that said soil-water retention improved due to soil management while 10(6.6%) of the respondents disagreed with the same statement and the remaining 46(30.5%) of the respondents were cease to say soil-water retention improved because of soil management.

As can be seen from the Table 8 below 43(28.5%) and 76(50.3%) of the respondents agreed with the statement that said productivity of land enhanced due to soil management while 6(4.0%) of the respondents disagreed with the same statement and the remaining 26(17.2%) of the respondents were refrain to say productivity of land enhanced due to soil management.

As indicated in Table 8 below 32(21.2%) and 79(52.3%) of the respondents agreed with the statement that said biophysical aspect of land improved due to soil management while 11(7.3%) of the respondents disagreed with the same statement and the remaining 29(19.2%) of the respondents were abstain to say biophysical aspect of land improved due to soil management.

Figure 7.income of farmer's improvement

As shown in Table 8 below 25(16.6%) and 71(47.0%) of the respondents agreed with the statement that said Income of farmers increased due to soil management while 7(4.6%) of the respondents disagreed with the same statement and the remaining 48(31.8%) of the respondents were cease to say Income of farmers increased because of soil management. The survey results show that sample house households in DMW and Sholit watershed had a mean income of 12175.20 ETB and 11292.29 ETB per year per household respectively with mean difference of 882.91 ETB while the mean annual income of the total sampled households was found to be 11793.94 ETB per annum per household. This means that households in DMW are better in terms of livelihood condition (Table 8.). The study conducted by Yenealem Kassa et al. in 2013 on the impact of integrated soil and water conservation program on crop production and income in West Harerghe Zone, Ethiopia using propensity score matching method, found that there is annual income difference between soil conservation participants and non-participants. But in this study, even though there is a mean income difference in the two watersheds the t-test indicates that the difference is not statistically significant (Table 8.).

As can be seen from the Table 8 below 28(18.5%) and 79(52.3%) of the respondents agreed with the statement that said fodder for animals obtained due to soil management while 12(7.9%) of the respondents disagreed with the same statement and the remaining 32(21.2%) of the respondents were refrain to say fodder for animals obtained due to soil management.

Rehabilitating degraded land by soil management practice can addressing livestock nutritional constraints. Gully treatment with different rehabilitation measures results generating of different livestock feed specious. Forage plants such as Elephant grass and Sesbania sesban were planted as stabilizers of conservation structures reduced soil losses, improved the availability of organic inputs for soil improvement, and offered animal feed and consequent increase in cash income (Tilahun Amede, 2003). These forage plants are fast growing and the farmers harvested frequently and fed their cattle. The farmers who have these forages at their homestead could not suffer from the shortage of feed as those who had not planted. The plant species also greatly contributed to the stabilization of the soil conservation structure. Sesbania sesban, legume plant species, besides being used as bund stabilizers and feed, it was chopped and incorporated in to the soil for improvement of soil fertility (Tilahun Amede, 2003).

Figure8 .Addressing livestock nutritional constraints

As indicated in Table 8 below 60(39.7 %) and 81(53.6%) of the respondents agreed with the statement that said soil fertility improved due to soil management while 2(1.3%) of the respondents disagreed with the same statement and the remaining 8(5.3%) of the respondents were abstain to say soil fertility improved due to soil management.

The improved crop yield was possibly due to the effect of soil conservation techniques on soil fertility which was also reported as the advantage of SWC techniques. This is in agreement with Abdul-Hanan et al, (2014) who reported that the adoption of soil and water conservation increased Maize yield in Ghana as the result from soil fertility improved by SWC techniques. Hailu et al, (2012) also confirmed that SWC increase soil fertility and consequently improved crop yield.

According to farmers during focus group discussion, erosion was a critical problem in DMW. It removes the tope soil, which is fertile, and reduces the productivity of land year to year. After SWCP implementation the situation is changed. The conservation structure helps to reduce erosion. As a result most of rain water percolates down rather than runoff and it helps to conserve soil and water in the area. Reduction of soil loss due to SWCP contributes to manage soil fertility. That is why; crop productivity is increasing in time since SWCP was started in DMW. As agricultural development agents of sampled kebele:

(……Traditional Soil fertility improvement techniques that practiced in study area were mulching, compost preparation, farmyard, and waterways along farm field, counter ploughing and agroforestry.)

This result was also supported by Shimeles Damene (2013) that conducted a research on effectiveness of soil and water conservation measures for land restoration in Wello area, Ethiopia and he found that physical soil and water conservation structures help to maintain soil fertility and crop yield improvement. SWCP not only increase crop productivity but also helps to increase access of forage and resulting improvement of livestock production.

Table 8.effects of soil management

s/n	Items related to effects of soil management	Responses									
		SA		A		N		DA		SDA	
		F	%	F	%	F	%	F	%	F	%
1	crop yields increased	14	9.3	81	53.6	32	21.2	24	15.9		
2	soil erosion prevent	41	27.2	73	48.3	25	16.6	12	7.9		
3	soil-water retention improved	7	4.6	88	58.3	46	30.5	10	6.6		
4	productivity of land enhanced	43	28.5	76	50.3	26	17.2	6	4.0		
5	Biophysical aspect of land improved	32	21.2	79	52.3	29	19.2	11	7.3		
6	Income of farmers increased	25	16.6	71	47.0	48	31.8	7	4.6		
7	Fodder for animals obtained	28	18.5	79	52.3	32	21.2	12	7.9		
8	Soil fertility improved	60	39.7	81	53.6	8	5.3	2	1.3		

Source: sample survey 2022 , It= soil management, SA=strongly agree, A=agree, N=nutral, DA= disagree,SDA=strongly agree

Table 9 below indicated the 8 items on the effects of soil management and the sub-scale mean values were statistically significant from the expected mean value of 3.00 at p< .005. This entails that household heads in study area had favorable beliefs on the effects of soil management like It made crop yields increased, soil erosion prevented ,soil-water retention improved, productivity of land enhanced, biophysical aspect of land improved, income of farmers increased, fodder for animals obtained and soil fertility improved.

Table 9.One sample t-test results on the effects of soil management

s/n	Test Value = 3	Mean	MD	Df	T	P
1	It crop yields increased	3.5629	0.56291	150	7.964	.000
2	It soil erosion prevent	3.9470	0.94702	150	13.374	.000
3	It soil-water retention improved	3.6093	0.60927	150	10.964	.000
4	It productivity of land enhanced	4.0331	1.03311	150	16.137	.000
5	It biophysical aspect of land improved	3.8742	0.87417	150	12.988	.000
6	It income of farmers increased	3.7550	0.75497	150	11.850	.000
7	It fodder for animals obtained	3.8146	0.81457	150	12.091	.000
8	It soil fertility improved	4.3179	1.31788	150	25.449	.000

Source: sample survey 2022

As can be seen from the Table 10 below 5(3.3%) of the respondents said that lack of coordination of key stakeholders very highly challenged soil management. Similarly, 29(19.2%) of the respondents replied that lack of coordination of key stakeholders highly challenged soil management. On the other hand most 106(70.2%) of the respondents said that lack of coordination of key stakeholders posed medium challenge soil management while the remaining 11(7.3%) of them responded lack of coordination of key stakeholders had low challenge soil management.

As indicated Table 10 below 12(7.9%) of the respondents said that Limited technical assistance from agricultural office experts very highly challenged soil management. Similarly, 28(18.5%) of the respondents replied that Limited technical assistance from agricultural office experts highly challenged soil management. On the other hand most 65(43.0%) of the respondents said that Limited technical assistance from agricultural office experts posed medium challenge soil management while the remaining 46(30.5%) of them responded Limited technical assistance from agricultural office experts had low challenge soil management.

According to agricultural office experts:

*"**…………..**Limitations of traditional land use management practice in study area was lack of scientific specifications /standard, limited stabilizations of physical soil conservation practice. The strength of traditional land management in study area farmers practices it whenever they want."*

As shown the Table 10 below 38(25.2%) of the respondents said that conservativeness of farmers to adopt additional advice than their indigenous knowledge very highly challenged soil management. similarly, 85(56.3%) of the respondents replied that conservativeness of farmers to adopt additional advice than their indigenous knowledge highly challenged soil management. on the other hand most 23(15.2%) of the respondents said that conservativeness of farmers to adopt additional advice than their indigenous knowledge posed medium challenge soil management while the remaining 5(3.3%) of them responded conservativeness of farmers to adopt additional advice than their indigenous knowledge had low challenge soil management.

In contrary to this, according to the information from an elderly informant, the local people make it suitable to stabilize the soil, fit with their own knowledge, and become flexible. The flexibility was revealed through changing the position of traditional farm ditches to avoid a gradual widening and deepening over time so that they will not develop into a gully. Besides, the gradient, number, spacing, depth, and width are differing from farmer to farmer. the above strengths exhibited in the study site were supported by a previous study (shiferaw, 2002).

As can be seen from the Table 10 below 13(8.6%) of the respondents said that Declinations of farmland size to adopt their indigenous knowledge very highly challenged soil management. Similarly, 88(58.3%) of the respondents replied that Declinations of farmland size to adopt their indigenous knowledge highly challenged soil management. On the other hand most 35(23.2%) of the respondents said that Declinations of farmland size to adopt their indigenous knowledge posed medium challenge soil management while the remaining 15(9.9%) of them responded Declinations of farmland size to adopt their indigenous knowledge had low challenge soil management.

In Table 10 below 20(13.2%) of the respondents said that the dominance of modern land use management practice technically over traditional land use management very highly challenged soil management. Similarly, 101(66.9%) of the respondents replied that the dominance of modern land use management practice technically over traditional land use management highly challenged soil management. On the other hand most 25(16.6%) of the respondents said that The dominance of modern land use management practice technically over traditional land use management posed medium challenge soil management while the remaining 5(3.3%) of them responded The dominance of modern land use management practice technically over traditional land use management had low challenge soil management.

As the response of agricultural development agents:

*"**……….**Technically most of traditional land management that categorized as physical soil conservation were not suitable with respect to land escape and climate because it lack scientific design so that easily exposable to wearing down soil."*

As shown in Table 10 below 28(18.5%) of the respondents said that high labour cost originate from lack commitment of family members very highly challenged soil management. Similarly, 88(58.3%) of the respondents replied that high labour cost originate from lack commitment of family members highly challenged soil management. On the other hand most 23(15.2%) of the respondents said that High labour cost originate from lack commitment of family members posed medium challenge soil management while the remaining 12(7.9%) of them responded High labour cost originate from lack commitment of family members had low challenge soil management.

As can be seen from the Table 10 below 41(27.2%) of the respondents said that flooding very highly challenged soil management. Similarly, 98(64.9%) of the respondents replied that flooding highly challenged soil management. On the other hand most 12(7.9%) of the respondents said that flooding posed medium challenge soil management.

As shown the Table 10 below 69(45.7%) of the respondents said that inadequate technical knowledge among farmers and extension service providers very highly challenged soil management. Similarly, 74(49.0%) of the respondents replied that Inadequate technical knowledge among farmers and extension service providers highly challenged soil management. On the other hand most 8(5.3%) of the respondents said that Inadequate technical knowledge among farmers and extension service providers posed medium challenge soil management.

As can be seen from the Table 10 below 27(17.9%) of the respondents said that Limited information flow and networking very highly challenged soil management. Similarly, 29(19.2%) of the respondents replied that Limited information flow and networking highly challenged soil management. On the other hand most 104(68.9%) of the respondents said that Limited information flow and networking posed medium challenge soil management.

These explain that the limiting factors of non-adoption of soil and water conservation techniques were related to poverty and limited knowledge. These are in agreement with Barbier, (1990) who reported that lack of money is the main factor limiting the adoption of SWC techniques in Java. Bizoza and De Graaff (2012) and Bidogeza et al., (2008) reported that most of SWC techniques are costly hence less adopted in Rwanda by poor resources farmers. The poor knowledge about the benefits of SWC could be the limiting factor to adopt such techniques (Okoba and de Graaff, 2005).

Table 9. Challenges of soil management

s/n	Items	Level of challenge on soil management							
		VH		H		M		L	
		F	%	F	%	F	%	F	%
1	lack of coordination of key stakeholders	5	3.3	29	19.2	106	70.2	11	7.3
2	Limited technical assistance from agricultural office experts	12	7.9	28	18.5	65	43.0	46	30.5
3	Conservativeness of farmers to adopt additional advice than their indigenous knowledge	38	25.2	85	56.3	23	15.2	5	3.3
4	Declinations of farmland size to adopt their indigenous knowledge	13	8.6	88	58.3	35	23.2	15	9.9
5	The dominance of modern land use management practice technically over traditional land use management	20	13.2	101	66.9	25	16.6	5	3.3
6	High labour cost originate from lack commitment of family members	28	18.5	88	58.3	23	15.2	12	7.9
7	Flooding	41	27.2	98	64.9	12	7.9		
8	Inadequate technical knowledge among farmers and extension service providers	69	45.7	74	49.0	8	5.3		
9	Limited information flow and networking	27	17.9	104	68.9	20	13.2		

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATION

5.2. Summary of Major Finding

The following section provides a brief summary of the findings related to the basic research questions raised in the study and the findings were listed under each guiding research questions in order to assemble similar findings to make conclusion with respect to specific objectives.

- Traditional soil management practices such contour farming, ridge terrace channel is formed on the contour by excavating the mud, traditional waterways (feses), traditional check dams (kiter), traditional cut-off drains (tars- boy), traditional stone terraces (erken), contour ploughing (agidem mares), traditional vegetative fences, residue management and minimum tillage.
- Physical soil management practices like bench terraces, fan jue terraces, contour bund, silt fences, surface mates, contour ploughing, soil bund, micro basin and ibrobasin were practiced in study area.
- Biological soil management practice intercropping, use compost for your soil, crop residues cover for the soil, use of manure such as farm yard and green manures, planting of leguminous crops, crop rotation, tillage practices, growing trees and shrubs together with food crops, agroforestry as the soil management, relay cropping and multiple cropping.
- The effects of soil management in study area were crop yields increased, soil erosion prevent, soil-water retention improved, productivity of land enhanced, biophysical aspect of land improved, income of farmers increased, fodder for animals obtained and soil fertility improved.
- the challenges of soil management practice in study area were lack of coordination of key stakeholders, limited technical assistance from agricultural office experts, conservativeness of farmers to adopt additional advice than their indigenous knowledge, declinations of farmland size to adopt their indigenous knowledge, the dominance of modern land use management practice technically over traditional land use management, high labour cost originate from lack commitment of family members, flooding, inadequate technical knowledge among farmers and extension service providers and limited information flow and networking.

5.3. CONCLUSIONS

This particular section provides the generalizations made based on major findings of the study. The finding of the study showed that the majority of farmers in the study area have a good perception of the problem of soil erosion because of this they use different indigenous and improved soil management practices on different land uses to sustain their livelihood. Common indigenous soil management practices in the area were traditional cutoff drain, traditional waterway, traditional ditch, and stone bund, agro-forestry, crop rotation and un-ploughed grass strip. Indigenous soil management measures have strengths such as flexibility, dependence on local resources, having multiple benefits and functions, the farmer can work easily, it doesn`t take much space, and so on. However, the limitations of indigenous land management practices have a design problem, which did not consider the soil type and the amount of runoff to be produced. Improvements on their own traditional soil management practices play a significant role in reducing soil loss and improving cropland productivity. More critically, it helps to accept some modern interventions in their practices. On the contrary, farmers were unwilling to use most introduced improved practices since they feel they are labor-intensive, space taking, and not fitting to their knowledge

It was generalized traditional land management was practiced in a better way in Mugunga and Homa Kebeles of Hadero Tunto Zuria Woreda. Both physical and biological traditional land management were practiced in study area. The type of physical traditional management practiced in study area were: contour farming, ridge terrace channel is formed on the contour by excavating the mud, traditional waterways (Feses), traditional check dams (kiter), traditional cut-off drains (Tars- boy) and traditional terraces built from stone (Erken).Biological traditional land management crop rotation, intercropping grass strip, agro forestry, alley cropping farmyard manure fallowing green manure cultivating leguminous crops.

It was concluded that contribution of traditional land management Soil erosion decreased due to application of traditional land management. Similarly crop production livestock product availability of forage forest cover wild life income was increased due to practice of traditional land management in study area. The effects of soil management in study area were crop yields increased, soil erosion prevent, soil-water retention improved, productivity of land enhanced, biophysical aspect of land improved, income of farmers increased, fodder for animals obtained and soil fertility improvement.

It known that practice traditional land management was not easy and straight forward but was challenged by lack of co-ordination of key stakeholders, limited technical assistance from agricultural office experts, conservativeness of farmers to adopt additional advice than their indigenous knowledge, declinations of farmland size to adopt their indigenous knowledge, the superiority of modern land use management practice technically over traditional land use management and high labor cost emanate from lack commitment of family members.

5.4. Recommendations

The finding of this study showed one of the challenges of Traditional land management was limitation with respect to technical facet in study area that exposed the tradition land management structures for destruction. Therefore, Hadero Tunto Zuria Woreda should make farmers to practice traditional land management together with modern land management to reduce the challenges of technical aspect.

Awareness should be created for farmers to practice land management practice land sidewise i.e. physical soil conservation should be constructed at far vertical interval and by focusing on stabilization conservational structures because land size in study area decreased from time to time.

It is better if biological traditional land management practiced traditional and physical traditional land management replaced by modern one because traditional physical structures not control high runoff during high rainy season.

The finding showed the challenges of traditional land management in study area were limited coordination between farmers and agricultural office experts that was told during interview traditional land management practice unable to consider slop type, climatic condition. Thus, farmers and agricultural office experts should work in a coordinated way.

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COLLEGE OF SOCIAL SCIENCE AND HUMANITIES

DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL STUDIES

GRADUATE PROGRAM

The rationale of these survey questionnaires is to prepare thesis on practices and challenges of soil management for rehabilitating degraded land, for the partial fulfillment of the requirement for the degree of Master of Art in geography. This study is purely for academic purpose and the response given by you will be kept secretly so that it cannot affect you personally or your organization security. Therefore, you are kindly requested to extend your cooperation honestly by providing your genuine view, frank opinion and timely response which are very valuable in determining the success of this study.

Thank you in advance for your cooperation.

I. Demographic characteristics' of respondents

1. Sex: Male ☐ female☐

2. Educational level: primary☐ 10th /12th☐ diploma ☐ degree ☐

3. Age **18**-25years ☐ 26-33years ☐ 34-41 ☐ 42-49 ☐ 50-57 ☐

4. Land holding size 0.1-0.5ha ☐ 0.51-0.75 ha ☐ 0.76-1ha ☐

5. Income in month 2000-3000 ☐ 3000-4000 ☐ 4000-5000 ☐

I. Questions related to the practice of soil management in study area

1. Is this area degraded before conservation practice done?

Yes ☐ No ☐

1.1.If you say 'Yes', how it is described?

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1. How do you see land management practices over time? i. Increase ii. Decrease iii. No change iv. Unknown
2. If your answer is 'increase' or 'decrease', what are the reasons? ______________

   ____

2. Do you practice managing the soil?

Yes ☐ No ☐

1.2.If you say 'Yes', how

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2. Do you practice traditional soil management?

Yes ☐ No ☐

2.1. If you say 'Yes',

Mention traditional soil management type

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Mention traditional soil management advantage

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____

____

Mention traditional soil management drawbacks

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3. Do you practice modern soil management as the conservation mechanism?

   Yes ☐ No ☐

   3.1.If you say 'Yes', why ?

____

____

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_____

4. Do you use crop cover for the soil?

   Yes ☐ No ☐

5. Do you use compost for your soil?

   Yes ☐ No ☐

   5.1.If you say 'Yes', what its advantage

____

____

____

6. What are traditional methods of soil and water conservation?

   A/Stone band B/ hill side terracing C/ cut of drown D/ all

II. Questions related to the effects of soil management in study area

1. What are the effects of land management practices in your area?

A/ Increase crop yields

B/ Prevent soil erosion

C/ Improved soil-water retention

D/ Assuring long term productivity of land

1. Soil conservation practice brought crop productivity

   A/ strongly agree B/agree C/neural D/disagree E/ strongly disagree

2. Soil conservation practice bring biodiversity improvement?

   A/ strongly agree B/agree C/neural D/disagree E/ strongly disagree

3. Livelihood of farmer's showed improvement due to soil conservation practice?

A/ strongly agree B/agree C/neural D/disagree E/ strongly disagree

4. Biophysical characteristics improved due to soil conservation practice?

   A/ strongly agree B/agree C/neural D/disagree E/ strongly disagree

5. Income of farmers increased due to soil conservation practice?

   A/ strongly agree B/agree C/neural D/disagree E/ strongly disagree

III. Questions related to the challenges of soil management practice in study area

1. Are your house holds members have motive to involve in land management practices?

   i. Yes ii. No

2. If your answer is 'No', what is the reason? ________________________________

   ____

A=always, S= Sometimes, R= Rarely, N= never

s/n	Types of challenge	A	S	R	N
1	lack of coordination of key stakeholders				
2	Limited technical assistance from agricultural office experts				
3	Conservativeness of farmers to adopt additional advice than their indigenous knowledge				
4	Declinations of farmland size to adopt their indigenous knowledge				
5	The dominance of modern land use management practice technically over traditional land use management				
6	High labor cost originate from lack commitment of family members				

Key informant interview

1. What are indigenous soil management practiced in your local community?
2. What are the restrictions regarding to traditional soil management practice?
3. What are modern soil management practices implemented in your area?
4. How you describe each soil management practice regarding to reduction in soil erosion?
5. What are the challenge for actual soil management practice and also what are the best remedies?
6. What are the sources of inputs required for soil management?

Focus Group Discussion

1. What are soil management practices you have been using to increase your production?

2. What are the criteria that you use to select soil management practice?

3. What are the major livelihood tactics in your area?

4. Do you really believe that soil management has effect on the livelihood of the community?

5. What are the challenges of soil management in your community?

ሐዋሳ ዩኒቨርሲቲ
የማህበራዊ ሳይንስ እና ሰብአዊነት ኮሌጅ
የጂኦግራፊያዊ እና የአካባቢ ጥናቶች ክፍል
የምረቃ ፕሮግራም

ውድ የጥናቱ ተሳታፊዎች፡-

የዚህ መጠይቅ ዋና ዓላማ በእነዚህ የዳሰሳ መጠይቆች መነሻነት የተራቆተ መሬትን መልሶ ለማቋቋም በአፈር አያያዝ ልምምዶች እና ተግዳሮቶች ላይ የመመረቂያ ጽሑፍ በማዘጋጀት በጂኦግራፊ ማስተር ዲግሪ መስፈርት በከፊል ለማሟላት ነው። ይህ ጥናት ለአካዳሚክ ዓላማ ብቻ ነው እና እርስዎ የሚሰጡት ምላሽ እርስዎን በግል ወይም የተቋምዎን ምስጢር ስለምጠበቅ ያለምንም ፍሪሀት መልስ እንድሰጡ እየጠየኩ የዚህን ጥናት ስኬት ለመወሰን በጣም ጠቃሚ የሆኑትን እውነተኛ እይታዎን, ግልጽ አስተያየትዎን እና ወቅታዊ ምላሽዎን በመስጠት ትብብርዎን በቅንነት እንዲገልጹ በአክብሮት እንጠይቃለን.።

ለትብብርዎ አስቀድሜ አመሰግናለሁ!!

<u>የመለሾች ግላዊ መረጃን በተመለከተ የተጠየቁ መጠይቆች</u>

የሚከተሉትን ጥያቄዎች በማክበብ ይመልሱ፡፡

1.ፆታ: ሀ. ወንድ ለ. ሴት

2. የትምህርት ደረጃ

ሀ. ያልተማረ/ች ለ. የመጀመሪያ ደረጃ ት/ት ያጠናቀቀ/ች ሐ. ሁለተኛ ደረጃ ት/ት ያጠናቀቀ/ች መ. ዲፕሎማ ሠ. ድግሪ ረ. ማስተርስ ድግሪና ከዛ በላይ

3. ዕድሜ: ሀ. 18-25 ለ. 26-33 ሐ. 34-41 መ. 42-49 ሠ. 50-57

4. የጋብቻ ሁኔታ: ሀ. ያላገባ/ች ለ. ያገባ/ች ሐ. የፈታ/ች መ. በሞት ያጣ/ች

4. የመሬት ይዞታ መጠን ሀ. 0.1-0.5ha ለ.0.51-0.75 ሄክታር ሐ. 0.76-1ሀ

5. ገቢ በወር ሀ.2000-3000 ለ. 3000-4000 ሐ. 4000-5000

I. በጥናት አካባቢ ከአፈር አያያዝ አሠራር ጋር የተያያዙ ጥያቄዎች

1. አፈርን ማስተዳደር ትለማመዳለህ?

አዎ ☐ አይደለም ☐

1.1. 'አዎ' ከተባለ፣ እንዴት

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2. አፈርን ለመንከባከብ የአፈርን ባንድ ይለማመዳሉ?

አዎ ☐ ይደለም ☐

2.1. 'አዎ' ከተባለ ምን ጥቅሙ ነው፡፡

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3. አፈርን ለመንከባከብ ፋኑግ ይለማመዳሉ?

አዎ ☐ ይደለም ☐

3.1. 'አዎ' ካልክ ለምን?

4. ለአፈር የሰብል ሽፋን ትጠቀማለህ?

አዎ አይደለም

5. ለአፈርዎ ብስባሽ ይጠቀማሉ?

አዎ ☐ አይደለም ☐

5.1. 'አዎ' ከተባለ ምን ጥቅሙ ነው።

6. ባህላዊ የአፈርና ውሃ ጥበቃ ዘዴዎች ምን ምን ናቸው?

ሀ/የድንጋይ ባንድ ለ/ ኮረብታ ላይ የእርከን ሐ/ የመስጠም መ/ ሁሉም

II. በጥናት አካባቢ ከአፈር አያያዝ ውጤቶች ጋር የተያያዙ ጥያቄዎች

1. የአፈር ጥበቃ ስራ የሰብል ምርታማነትን አምጥቷል።

ሀ/ በጣም እስማማለሁ ለ/ እስማማለሁ ሐ/የነርቭ ዲ/አልስማማም ኢ/ በጽኑ አልስማማም።

2. የአፈር ጥበቃ ስራ የብዝሃ ህይወት መሻሻል ያመጣል?

ሀ/ በጣም እስማማለሁ ለ/ እስማማለሁ ሐ/የነርቭ ዲ/አልስማማም ኢ/ በጽኑ አልስማማም።

3. በአፈር ጥበቃ ስራ የአርሶ አደሩ ኑሮ መሻሻል አሳይቷል?

ሀ/ በጣም እስማማለሁ ለ/ እስማማለሁ ሐ/የነርቭ ዲ/አልስማማም ኢ/ በጽኑ አልስማማም።

4. በአፈር ጥበቃ ልምምድ ምክንያት ባዮፊዚካል ባህሪያት ተሻሽለዋል?

ሀ/ በጣም እስማማለሁ ለ/ እስማማለሁ ሐ/የነርቭ ዲ/አልስማማም ኢ/ በጽኑ አልስማማም።

5. በአፈር ጥበቃ ተግባር የአርሶ አደሩ ገቢ ጨምሯል?

ሀ/ በጣም እስማማለሁ ለ/ እስማማለሁ ሐ/የነርቭ ዲ/አልስማማም ኢ/ በጽኑ አልስማማም።

III. በጥናት አካባቢ ከአፈር አስተዳደር ልምምድ ፈተናዎች ጋር የተያያዙ ጥያቄዎች

ሁ=ሁልጊዜ፣ አ= አንዳንድ ጊዜ፣አል = አልፎ አልፎ፣ በ= በጭራሽ

s/n	የፈተና ዓይነቶች	ሁ	አ	አል	በፍ
1	ቁልፍ ባለድርሻ አካላት ቅንጅት ማጣት				
2	ከግብርና ቢሮ ባለሙያዎች የተወሰነ የቴክኒክ ድጋፍ				
3	የገበሬዎች ወግ አጥባቂነት ከአገር በቀል እውቀታቸው በላይ ተጨማሪ ምክሮችን እንዲቀበሉ				
4	የአገር በቀል እውቀታቸውን ለመቀበል የእርሻ መሬት መጠን መቀነስ				
5	በባህላዊ የመሬት አጠቃቀም አያያዝ ላይ የዘመናዊው የመሬት አጠቃቀም አስተዳደር አሰራር በቴክኒካል የበላይነት				
6	ከፍተኛ የጉልበት ዋጋ የሚመጣው ከቤተሰብ አባላት ቁርጠኝነት ማጣት ነው።				

ቁልፍ መረጃ ሰጪዎች ቃለ መጠይቅ

1. በአከባቢዎ ማህበረሰብ ውስጥ ሀገር በቀል የአፈር አያያዝ ምን ምን ናቸው?

2. በባህላዊ የአፈር አያያዝ አሠራር ላይ ምን ገደቦች አሉ?

3. በአከባቢያችሁ ምን አይነት ዘመናዊ የአፈር አያያዝ ዘዴዎች ተግባራዊ ናቸው?

4. የአፈር መሸርሸርን ለመቀነስ እያንዳንዱን የአፈር አያያዝ አሠራር እንዴት ይገልጹታል?

5. ለትክክለኛው የአፈር አያያዝ ፈታኝ ሁኔታዎች እና እንዲሁም ምርጡ መፍትሄዎች ምንድ ናቸው?

6. ለአፈር አስተዳደር የሚያስፈልጉ የግብአት ምንጮች ምን ምን ናቸው?

የትኩረት ቡድን ውይይት

1. ምርትዎን ለማሳደግ ሲጠቀሙባቸው የቆዩ የአፈር አያያዝ ዘዴዎች ምን ምን ናቸው?

2. የአፈር አያያዝን ለመምረጥ የሚጠቀሙባቸው መስፈርቶች ምንድን ናቸው?

3. በአካባቢዎ ዋና ዋና የመተዳደሪያ ዘዴዎች ምንድን ናቸው?

4. በእርግጥ የአፈር አያያዝ በህብረተሰቡ ኑሮ ላይ ተጽእኖ አለው ብለው ያምናሉ?

5. በማህበረሰብዎ ውስጥ የአፈር አያያዝ ፈተናዎች ምን ምን ናቸው?