AN ASSESSMENT OF WATERSHED MANAGEMENT PRACTICES IN LOWER GUDER MICRO-WATERSHED, SOUTHERN ETHIOPIA

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ACRONYMS AND ABBREVATIONS

AAU: Addis Ababa University
CSA: Central Statistical Authority
DA: Development Agent
EPA: Environmental Protection Authority
FGD: Focus group Discussion
FAO: Food and Agricultural Organization of the United Nations
FDRE: Federal Democratic Republic of Ethiopia
GDP: Gross Domestic Product
GIS: Geographic Information System
GTP: Growth and Transformation Plan
MoARD: Ministry of Agriculture and Rural Development
MoFED: Ministry of Finance and Economic Development
NGO: Non-Governmental Organizations
PASDEP: Plan for Accelerated and Sustainable Development to End Poverty
SNNPRS: South Nations Nationalities and People's Regional State
SPSS: Statistical Package for Social Science
SWC: Soil and Water Conservation
UNEP: United Nation Environmental Program
WFP: World Food Program of the United Nations

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School of Graduate Studies

This is to certify that the thesis prepared by Bereket Darebo entitled: An assessment of watershed management practices in the Lower Guder micro watershed, *Lemo District, Haddiya Zone, Southern Ethiopia* and submitted in partial fulfillment of the requirement for the Degree of Masters of Art (Development studies) complies with the regulation of the university and meets the accepted standards with respect to originality and quality.

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DEDICATION

Dedication to my beloved brother Ato Teshele Darebo, whom I lost forever, let my God rest his soul in peace!

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ABSTRACT

Watershed degradation effects have represented a serious threat not only to the environment but also to the survival of millions of people living in upland as well as downstream areas. Although different types of watershed management technologies have extensively been introduced and implemented over the past decades in Ethiopia, implementations of the measures were not attractive. This study was conducted to assess watershed management practices in accordance with preventing soil erosion in Lower Guder micro-watershed, Lemo District of Hadiya zone. A purposive sampling procedure was used to identify study micro-watershed. The data were collected from 118 sample household's selected using simple random sampling technique. Qualitative data were generated using focus group discussions, key informant interviews and field observation using checklists, while quantitative data were collected using structured household interview. Descriptive statistics, chi-square analysis, and independent sample t-test were used to analyze the data collected from sample households and qualitative data were narrated. The results indicate that, age, educational status, and size of farm holdings are among the major factors that significantly affect implementation of watershed management practices. When the economic condition of a community deteriorates, it leads to over exploitation and degradation of watershed resources. It is necessary for people to understand the relationship between their poverty and the degradation of watershed they live. Environmental regeneration is possible only when the concerned people realize a need for it and are empowered to have control over the process of resource utilization, management and conservation.

Keywords: watershed, management practices, perception, factors, challenges, opportunities, and Lower Guder Micro-Watershed

CHAPTER ONE

INTRODUCTION

1.1 Background

Watershed degradation has emerged in recent decades in different parts of the world with negative environmental and socioeconomic consequences, particularly in developing countries (Mazvimavi, 2002). The drivers of watershed degradation are largely institutional and socioeconomic including; lack of clear prices for natural resources, lack of focus from government structures, and lack traditional land use management processes. In many cases country lacks the technical capacity and financial resources to properly implement and enforce legalization. Population growth is results in pressure on the land base in excess of its carrying capacity, resulting in natural resource degradation. Demographic and economic pressures often drive domestic livestock stocking rates above the carrying capacity of the relevant area, leading to overgrazing. This causes to a reduction in vegetation cover and compaction of soils through trampling, which leads to reduction in water infiltration rates, an increase in runoff, and an acceleration of soil erosion, with potentially serious consequences on dry season low flows (Carson, 1992).

Primarily the emphasis of watershed management has been on managing the upstream areas or watersheds for water benefits, water yields, water quality and flood prevention. When watershed management was later extended to developing countries, the concept and the nature of the work focused on land management, erosion control, as well as sedimentation and flood control. In recent decades, greater attention has been given to the watershed inhabitants and their environment (Sheng, 2000).

Planning for watershed management in Ethiopia started in the 1980's. Before these years, conservation practices in Ethiopia were not watershed based, but gave emphasis only on forest protection, soil and water conservation activities. These approaches were not efficiently and effectively successful implemented because of top down approach with respect to the designed goals throughout the country. However, as a community based participatory watershed

development program was designed and started pilot projects with the support of Non Governmental Organizations (NGOs) such as GTZ and SOS Sahel (Lakew *et al.*, 2005).

In Ethiopia previous five-year economic development plan, the Plan for Accelerated and Sustained Development to End Poverty PASDEP, (2005/06–2009/10), the government invested in a series of watershed management activities with the goal of augmenting agricultural production. These activities included piloting and implementing locally appropriate, community-based approaches to watershed management practices, scaling up successful models for watershed conservation, and strengthening natural resource information through monitoring and evaluation of ongoing and planned land and watershed management programs. In recent five-year plan, the Growth and Transformation Plan (GTP), 2010/11–2014/15, the government outlines the need to promote and invest in soil and water conservation infrastructure that takes into account the unique conditions of varying agro ecological zones (MoFED, 2010).

As in many districts of Ethiopia, watershed degradation and unsustainable natural resource base is still continuing in Lemo District, of Hadiya Zone, Southern Ethiopia. Watershed degradation, frequent droughts, and other biotic and abiotic limitations worsen agricultural productivity in the area. Sustainable watershed management practices are essential for conserving and enhancing land productivities. Thus, leads researcher come up to assess the intended objective in the study area.

1.2 Statement of the Problem

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). Specifically, land degradation due to soil erosion, nutrient depletion and deforestation has become a serious environmental issue. The situation of land degradation has negatively affected the agricultural sector to a larger extent and the overall economy, as well as the livelihood of its people (Aklilu, 2001). Therefore, the country is facing serious problems of watershed degradation.

In Ethiopia, natural resource degradation has been going on for centuries in different parts of the country (EPA, 1997). Watershed degradation process such as land and water degradation is as old as human settlements and land use history. Moreover, population pressure in many areas has

accelerated these processes (Ludi, 2002, cited in Hurni, 1993). Pressure on arable land is growing forcing people to convert more marginal lands to arable land and this leads to further soil erosion.

Like other parts of the country population pressure and overgrazing are identified as the main factors of land degradation presently observed in the Southern Region. Excessive deforestation often as function of growing demand for fuel wood and cultivation land have had another equally significant implication on the soil erosion, land degradation and disturbance in hydrologic regime (RCS, 2003).

Farmers' decisions to conserve natural resources generally and soil and water particularly are largely determined by their knowledge of the problems and perceived benefits of conservation (Aklilu & Giraf, 2004). The responses, commitment and responsibilities required for the success of formulation of appropriate resource management depend on perception of the problem by small holder farmer (Ayalneh, 2002).

In practice, meaningful participation on watershed management is difficult to achieve when communities are unorganized, unaware of their legal rights and responsibilities, and lack the information, education, and confidence necessary to interact with other more powerful stakeholders (Johnson *et al.*, 2007). Lack of well functioning institutions is one of the recognized challenges for ecologically desirable watershed management practices (Heathcoat, 1998).

Majority of the research works that have been done on the issue related to farmers perception and attitude towards land degradation and management focuses either at national level or specific areas particularly in different part of the country. And the so far identified socio-economic, institutional biophysical and cultural factors toward land degradation and management were done by other researchers. In this regard, one of the main reasons for conducting of this research in *Lemo* District is that to identify watershed management practices in accordance with preventing soil erosion, factors that affect watershed management practices, and perception about watershed degradation in the study area.

Therefore, the primary focus of this research is to assess the perception of the farmers towards watershed degradation and management practices. Secondly, to assess the types of watershed management practices implemented focusing on preventing soil erosion, as well as challenges

and opportunities in the implementation. Thirdly, to analyze some of socio-economic factors (sex, family size, age, education, land size, off farm activity and livestock holding) that affects watershed management practices.

1.3 Objective of the Study

The major objective of this study is to assess watershed management practices focusing on preventing soil erosion in Lemo District, focusing on Lower Guder micro-watershed.

The specific objectives are:

1. To assess the existing challenges and opportunities of watershed management practices in the study area
2. To assess the perceptions of farmers about watershed degradation in the study area
3. To assess the factors that affect watershed management practices in the study area

1.4 Research Questions

1 What are the existing challenges of watershed management practice in the study area?
2 What are the existing opportunities of watershed management practices in the study area?
3 What are the types of implemented watershed management practices in the study area?
4 What is the perception of farmers about watershed degradation in the study area?
5 What are the factors that affect watershed management practices (focusing on preventing soil erosion) in the study area?

1.5 Significance of the Study

Watershed management should ensure better resource use and promotes sustainability of watershed resources. As agricultural land management is the actual practice of the use(s) and management of watershed by the users, understanding of the watershed users' watershed management system is indispensable to implement sustainable watershed management practices. The paper add important points to watershed management literature by assessing challenges and opportunities of watershed management practices, factors that affect watershed management practices (in accordance with preventing soil erosion), and perception of farmers about watershed degradation.

1.6 Scope and limitation of the Study

Though, many factors may affect the implementation of watershed management practices due to time and budget constraints this study focused on local-level micro-watershed management in terms of challenges and opportunities faced, farmer's perception about its degradation, and factors affecting watershed management practices (focusing on preventing soil erosion). In addition, the study was confined to one micro watershed and surveyed within *Lemo* District, Hadiya Zone of the Southern Nations Nationalities and People's Regional State. Finally, the institutional scope is limited to local level that corresponds with watershed management activities.

This study was focused on assessment of watershed management practices in accordance of preventing soil erosion. Available secondary data such as reports (Government and NGOs), and socio-economic surveys papers may have information gaps and may not reflect the current situation. The data for this study came from a single survey using a sample of 118 farm households' from one micro-watershed due to shortage of time and fund. This will hinder from investigating farmers' watershed management practice behavior overtime.

1.7. Organization of the Study

This thesis is organized in five chapters and related topics under each section. Chapter one deals with the background, problem statement and objective of the study. Chapter two present literature review focusing on both theoretical and empirical studies. Chapter three focuses on the study area and its selection for the study, methodologies persuade in identifying sample households, data collection, analysis and presentation. Chapter four presents results and discussion. Finally, chapter five presents conclusions and recommendations.

CHAPTER TWO

REVIEW LITERATURE

2.1 Concepts and Definitions

Watershed is a drainage basin or catchment area and is defined as an area in which all water flowing into it to a common outlet. People and livestock are the integral part of watershed and their activities affect the productive status of watersheds and vice versa (Wani *et al.*, 2008). The idea of watershed-based environmental protection efforts is not new. In 1878, first director of the U.S. Geological Survey (USGS) urged that communities needed to collectively control their own water and land resources through watershed commonwealths (Powell, 1879).

Size is not a factor in the definition, and watersheds vary from a few hectares to thousands of square kilometers (Black, 1991). Micro-watersheds are generally defined as falling in the range 500-1000 hectares. A macro-watershed is equivalent to a river basin and may encompass many thousands of hectares (Farrington *et al.*, 1999).

A watershed may be only a few hectares as drainage area for filling small ponds or hundreds of square kilometers for rivers. A suitable watershed size is required for effective planning for conservation and maximum production. Efficient management of watershed resources is possible through an appropriate unit so that the resources are managed and handled effectively, collectively, and simultaneously. The maximum size of the watershed that should be taken as a planning unit is suggested to range from 200 to 500 ha (Lakew *et al.*, 2005).

Watershed degradation is the long-term reduction of the quantity and quality of land and water resources in a watershed. Watershed degradation may be caused by a range of natural and anthropogenic factors, such as changes in farming systems, overgrazing, deforestation, roads construction, and the invasion of alien plants are among the most common causes of watershed degradation. Changes in farming systems in the watershed are commonly a very significant contributor to watershed degradation. These changes come about through pressures on the typically poor farming systems that prevail in uplands in developing countries (World Bank, 2007)

Watershed management is the process of formulating and carrying out a course of action involving manipulation of natural, agricultural and human resources on a watershed to provide resources that are desired by and suitable to society, but under the condition that soil and water resources are not adversely affected (FAO, 1986). Watershed management can be regarded as both a science and an art of managing watershed (Swallow *et al.*, 2001). Broadly; it is "the process of guiding and organizing land and other resources use in a watershed to provide desired goods and services without adversely affecting land and water resources (Brooks *et al.*, 1991).

Watershed management planning is a process of action formulation involving manipulation of natural resources, agricultural and human resources by considering the socio-economic and institutional factors to achieve its objectives (Brooks, 1985). Therefore the common challenges in watershed planning is how to synchronize the actions, and activities of watershed management to produced the optimal mix products or services without affecting watershed conditions.

Integrated watershed management (IWM) which emerged in the 1980s can be defined as a comprehensive multi-resource management planning process, involving all stakeholders within the watershed, who together as a group, cooperatively work toward identifying the watershed's resource issues and concerns, as well as developing and implementing a watershed plan with solutions that are environmentally, socially and economically sustainable (UNEP, 2004).

Integrated watershed management (IWM) is a process of formulating and carrying out a course of action to managing human activities in an area defined by watershed boundaries in order to protect and rehabilitate land and water, and associated aquatic and terrestrial resources, while recognizing the benefits of orderly growth and development. It is an integrated and holistic approach to the development of an area with the ultimate objective of improving the quality of the live of the people who dwell within it (FAO, 2000).

Participatory watershed management has been defined as a process "which aims to create a self-supporting system, which is essential for sustainability". The concept of participatory watershed management emphasizes an inter-disciplinary, inter-sect oral and multi institutional mechanism (Wani *et al.*, 2005). According to Johnson *et al.*, (2001), participation implies that stakeholders work together to set criteria for sustainable management, identify priorities, constraints, evaluate possible solutions, recommend technologies and policies and monitor and evaluate impacts.

Community participation is recognized as an essential part of equitable and sustainable watershed management. Stakeholders play a vital role in ensuring that land use in the upstream does not affect the quality and quantity of water that flows to downstream communities. In theory, stakeholder participation in watershed management can be a solution to these challenges. Participatory watershed management provides opportunities to the stakeholders to jointly negotiate their interests, set priorities, evaluate opportunities, implement and monitor the outcomes (Johnson *et al.*, 2007).

2.2. Watershed Degradation in Ethiopia

FAO (2006) has stated that inappropriate watershed management may creates many problems, such as deforestation, improper hillside agricultural practices and overgrazing, all of which may increase runoff, prevent the recharging of upland sources, and generate seasonal torrents that spoil the downstream fields. Badly engineered watersheds may not be able to stand heavy rains, and water courses are also very good vectors for biological and industrial chemical pollution.

Throughout Ethiopia, soil loss is a critical problem on agricultural land and without careful land management; erosion rates are likely to increase (Awulachew *et. al.*, 2008). A study conducted by Kebede (2009), in Ethiopia's Gilgel Abbay Catchment concerning hydrological response to land cover change, using integrated remote sensing data and GIS techniques, for year 1976-2001 showed that forest cover decreased from 51 to 17% and agriculture increased from 28 to 62%. Following this land cover change, an increasing trend of peak flow (during rainy season) and a decreasing rate of base flow (during dry season) have been recorded. The result of this study implies that during the rainy period the observed increase in flow rate results in a high rate of sediment transport to reservoirs. Thus, he recommended that watershed management practices should be taken to sustain river flow during the dry periods; reduce surface runoff and sediment load during the rainy season; and overall, increase ground water recharge.

A study done in the eastern highlands of Ethiopia by Wogayehu (2003) indicates deforestation, overgrazing, limited application of sustainable land management practices, and decline in the use of fallow are some to be the proximate cause of land degradation. In degraded watersheds, forms of degradations can be physical, biological and chemical. If watersheds are not managed

properly then the natural resources (soil, water, fauna-vegetation and flora) are degraded rapidly thereby resulting in poor productivities (Lakew *et al.*, 2005).

Regardless of the income level or stage development, any economic activity would alter the state of environment in one way or another and has a potential to cause a number of negative effect in the form of unsustainable depletion of resources and deterioration in the quality of resources and the environment. For example, agricultural activities for producing food and generating employment and income in rural areas are the major causes of over grazing, deforestation, soil erosion, soil pollution, river and lake water pollution and the like (EPA,1997).

In rural poor the sources of energy for the household are mostly from the forest and residuals of plants and animals. This in turn reduces the productivity of the land (MOFED, 2002). As scholars agreed, the population growth and demand for food, home, water, livestock and other asset to meet their needs would destroy forests in order to get farm land without taking any preventives and conservation measures (Ibid).

2.2.1 Perceptions' of Farmers about Watershed Degradation

According to Hurni (1993), "low perception of local peasants" about the problem of land degradation is a problem that needs to be circumvented for SWC efforts in the country. On the other hand, in his study in southern Ethiopia, Belay (1992) concluded that farmers have a good perception of the problem of soil erosion, but a "wrong perception of topsoil depth" (farmers thought that it was deeper than it actually was).

A study of Ethiopian farmers' attitudes to land degradation and conservation by Admassie and Gebre (1985) indicated that farmers were aware of the problems of land degradation. Erosion was identified as the main cause for land degradation, followed by drought, deforestation, rainfall, and improper farming practices. Although farmers are often more acutely aware of the condition of their land than is sometimes assumed by experts, they may not be fully aware of land degradation, its causes, or consequences (Ervin and Ervin, 1982). As a result they are reluctant for implementation of watershed management practices. Farmers' perceptions and attitudes can have a major relevance to watershed management and use. Researchers argue that local people's perception of environment, their interests and priorities constrain their action to prevent land degradation (Belay, 1992). By its nature watershed degradation is often a very slow

and long term process and may be almost invisible. Farmers thus may not observe ongoing erosion or nutrient depletion problems, or perceive them as immediate problems. While they do observe low or declining yields, farmers often attribute deterioration of crop yields to declining rains.

The perception of farmers' about the causes and consequences of land degradation plays a vital role in watershed management practices. According to Aklilu (2006), assessments of farmers view of soil erosion problems and their conservation knowledge in Beressa watershed in the north central highlands of Ethiopia. The study revealed that 72% of the respondent farmers' perceive soil erosion problem in their farm land and express for the inevitability of land management practices. More perceived farmers better assess the impact of soil erosion on long-term productivity of their farmland and adopt practices that help resolve the problem of soil degradation (Traoré *et al.*, 1998).

2.2.2. Factors that Affect Watershed management Practices

2.2.2.1 Socio-economic Factors

There are many demographic and socio-economic factors that determine farmers' perception and attitude toward implementing watershed management practices. Among the factors the focus of this study is some of socio-economic factors.

The socio-economic elements and characteristics of a watershed involve population, farming systems, social setups, economics, vulnerability profile, gender, and the like. Watershed planning embraces the views of categories of people in the watershed development, specific attention is required to address problems of resource poor and vulnerable families and promote the empowerment of women (Lakew *et al.*, 2005)

According to (Itana, 1985), education influences farmers' decision to adopt technologies by enhancing farmers' ability to obtain, understand and utilize the practice, and by improving overall managerial ability of farmers. Many studies indicated that educational attainment affects conservation measures adoption decision positively. This finding supported by the view of Morgan (1995) that education can increase the capacity and ability to obtain and apply relevant information concerning the use of land conservation practices. Similarly, Ervin and Ervin (1982)

found that education was significantly related to conservation efforts. According to them, farmers, who are more educated, are more likely to use contouring, minimum tillage and hay or pasture rotation to control soil loss. Ervin and Ervin (1982) found that education was significantly related to conservation efforts.

Age is believed to influence adoption decision because of its influence on planning horizon (Long, 2003). Conservation measures such as terrace are long term investments (Lee and Stewart, 1983). On the contrary, older farmers usually have short planning horizon and they may be less interested on long term negative effects of resources depletion (Bromley, 1980). This implies that they have higher discount rate and this reduces the present value of long term return from conservation based agriculture (Gould *et al.*, 1989). Goulson and Dillman (1983) found negative association between age and adopting erosion control practices. Bekele (1998) and Wagayehu and Lars (2003) in their study in different parts of Ethiopia found negative association between existence of conservation structures (implementation) and age of household heads.

Woldeamlak (2003) identified lack of interest in soil and water conservation measures to be explained by shortage of labor. This was supported by Geoffer (2004), who found that household size was associated negatively with adoption of no conservation practice and positively with adoption of conservation practice. Yet, other studies conducted in Ethiopia indicated the reverse. Bekele (1998) and Wagayehu and Lars (2003) found negative and significant association between household size and adoption of conservation measures. They indicated that in the large families with greater number of mouth to feed, immediate food need is given priority and labor is diverted to off-farm activities that generate food.

2.2.2.2 Institutional Factors

Institutional factors are ones that can be used to assess the success and failure of watershed management activities. How effective a watershed management is in a country depends on national policies, people's awareness, local government structure, laws on land use and watershed management, nature of community culture and the people's levels of education (Satterlund, 1972 and Eren, 1977). Lack of well functioning institutions is one of the recognized challenges for ecologically desirable watershed management. Institutions should be able to

address the requirements of resource qualities incorporating the watershed community needs and aspirations.

According to Karki and Sharma (1999), the past approach to watershed management consisted of top-down planning, implementation, and monitoring of watershed management activities. Targets were fixed based on the budget available and the programme was entirely guided by the government. Finally programme personnel abandoned the users once programme support was withdrawn. Similarly, a study in western highlands indicates weak economic development strategies, unstable institutional frameworks, and weak link between research and extension have been found as a root cause of land degradation (Gete, 2000)

Nowak (1987) pointed out that contact with extension personnel increases the amount of variance explained in conservation tillage. The study conducted in Ethiopia indicated that if a farmer receives better information (advice) from extension agents, the farmer will be willing to construct new conservation measures and to maintain the existing ones (Wagayehu and Lars, 2003). According to Gete *et al.*, (2006) promotion of sustainable land management in Ethiopia is constrained by the overwhelming strategic problem of the extension system. Quick solutions rather than sustainability, quantity rather than quality area coverage rather than impacts, and seemingly commanding control system rather than participation are identified as the most determining constraints. Therefore, accurate and timely information has a positive impact on farmers' implementation of conservation practices.

2.2.2.3 Biophysical Factors

Biophysical factors are necessary for estimating the magnitude of watershed capacity to meet the demands for goods and/or services. These Biophysical factors include: Climate, vegetation, soil type, topography, drainage pattern and stream systems. Data of this kind are basic information in preparing watershed management plans. Watershed management plan should be prepared on the basis of topographic, soil and land-use capability, land-use, slope interval, erosion and site degradation, vegetation cover and other information from aerial photo/maps, and so on. Overlapping and matching these maps, many information can be obtained that is, drainage pattern, stream system, soil types, depths, and other details with slope degrees and soil management intensity, degree and stages of degradation/erosion, types of native vegetation

(Permanent, perennial and annual crops), potential land development and so on. Formulation of watershed is drawn up from this information (Satterlund, 1972 and Eren, 1977).

The factor that play a greater role in planning and development process of a watershed are size, shape, physiographic, slope, climate, drainage, geomorphology, soils, soil erosion zones, land use/land cover and groundwater (Wane *et al.*, 2008). Biophysical factors that affect the promotion of sustainable watershed management practices are free grazing, the nature of topography, climate variability, and the associated run-off (Dagnew, 2007). According to Kassie *et al.*, (2008), deforestation due to farmland expansion and energy needs, as well as fragile soils, undulating terrain, and heavy seasonal rains make the highlands of Ethiopia highly vulnerable to soil erosion and gully formation.

2.3 Watershed Management Practices in Ethiopia

Management of watersheds can be made possible by using a variety of technologies such as vegetation conservation like grass contours, alternative tillage techniques and physical structures like terraces, stone bunds, gabion box. The World Bank has given more importance to vegetative measures in watershed management practices. This supports the global trend that favors choosing technologies that are low cost and more farmers friendly "Successful adaptation of this technology in the World Bank projects was achieved by involving farmers in the choice of technologies, a strategy that helps to implement technologies that are more compatible with existing land uses and surrounding environments and that meet farmer's needs" (World Bank, 2001).

There are three basic principles through which biological soil and water conservation practices to protect watershed degradation. The first principle is prevention of direct impact of rain drop through the provision of adequate vegetation cover. The second principle is the prevention of concentration of surface flow of water in order to prevent the formation of heavy volume of water that cause run-off. To this effect, any vegetation (alive or dead) uniformly cover the ground, spreads out the surface flow thinly so that it doesn't concentrate in one spot to form bigger volume of water that eventually create erosive rainfall. In addition physical barriers and organics increase the infiltration rate of water in the soil due to increasing the contact time of water to soil and improving physical structure of the soil respectively. The third principle is

increasing resistance of the soil to erosion. With the improvement of soil organic matter content, the percentage of water stable soil aggregates substantially increases, thereby increasing its resistance to detachment by direct impact of rain drops or run-off. When the soil is rich in organic matter content, its elasticity increases and it absorb the kinetic energy of rain drops without being disintegrated into pieces (Betru, 2003)

Different empirical studies have also revealed that there are different efforts of sustainable land management practice undertaken by Ethiopia farmers at household and supra-household levels in different parts of the country. In Beressa watershed, northern Ethiopia, farmers are using contour plowing, drainage ditches, stone terraces, waterways; trees grass strips, and soil bunds to arrest the problem of soil erosion (Aklilu, 2006). In east Gojjam, traditional ditches, manure through animal parking, crop rotation, contour plowing, traditional vegetative fences, traditional waterways, traditional check dams, traditional stone terraces, unplowed grass strips, weed heaping, artificial waterways, modern cut-off drains, modern stone terraces, area closures, artificial fertilizer and compost are widely practiced (Michael, 2002 and Yilikal, 2007).

In Tigray Region, traditional terraces, grass strips, and hillside terracing are the commonly used practices by the farmers (Dagnew, 2007). In Konso, southern Ethiopia, stone terraces, tied ridges, trash lines agro forestry, intercropping fallowing, manure, kraal shifting, burning of debris, and minimum tillage by farmers to arrest the problem of soil erosion and maintain its fertility (Tesfaye, 2003)

2.4. Challenges and Opportunities of Watershed Management in Ethiopia

The challenges of watershed management practices in Ethiopia especially soil and water conservation programs are lack of a holistic approach. Sustainable land management practices through biological measures such as organic matter management, maintenance of vegetative cover, improved fallow practices and the livestock management practices are not well integrated. The rehabilitation of hill sides, which had incredibly great success in terms of environmental rehabilitation and creation of assets, was over looked (Betru, 2003)

Most of the times planning for soil and water conservation programs are promoted with standard technical solutions such as terracing, contour bunding. On the assumption that soil conservation measures are universally applicable and local farmers are unaware of soil erosion and ignorant of

its causes and consequences (Johnson *et al.*, 2001, MoARD, 2005: cited in Pretty and Shah, 1999). However, these measures, which were often forced on the people, may cause more erosion than their own indigenous practices, either because the new conservation works are not maintained or are technically less well adapted than existing practices (Kerr *et. al.*, 1996).

There are several possible reasons for the failure of past management interventions to meet users' expectation. The successful promotion of watershed management practices can be challenged due to technological related challenges. The innovated management measures did not consider local management practices, the interventions require high cost which cannot be afforded by the local people, and the intervention did not consider the local agro-ecological and socioeconomic variations (Aklilu, 2006).

The study also noticed the inflexibility, non-integrity, and specific functionality of sustainable land management practices retarded the promotion of sustainable land management practice in the area. Another real challenge to participation in watershed management groups or organizations is that many people do not think in terms of a "watershed." This is hard for them to visualize, or else hard for them to place their own place of residence in this broader context (Reed, 2002).

Ethiopia has made commendable efforts in developing its policy and strategic response to land degradation (Asfaw, 2003). One of the most important umbrella polices is the Environmental Policy of Ethiopia (EPE), approved by the Council of Ministers in 1997. The policy addresses a wide variety of sectoral and cross-sectoral environmental concerns in a comprehensive manner. Its major aim is to ensure sustainable use and management of natural and cultural resources and the environment (Asfaw, 2003). The need for genuine participation by communities at all levels of the decision-making process is a key requirement of successful sustainable watershed management undertakings. Although different approaches to participatory watershed management raise issues that need careful scrutiny, there are very good experiences with a range of approaches in the country. Recently the government has recognized the need for participatory watershed management. Ministry of Agriculture and Rural Development developed a national guideline on community- based participatory watershed development (Lakew *et al.*, 2005) that describes high-potential procedures drawn from selected approaches in Ethiopia. The major advantages of integrated watershed management approaches in Ethiopia are involvement of

those most affected by the decisions (i.e. the stakeholders) in all phases of the development of their watershed and holistic planning that addresses issues which extend across subject matter disciplines (biophysical, social, and economic sciences) and administrative boundaries (village, woreda) (UNEP, 2002).

2.5. Conceptual Framework

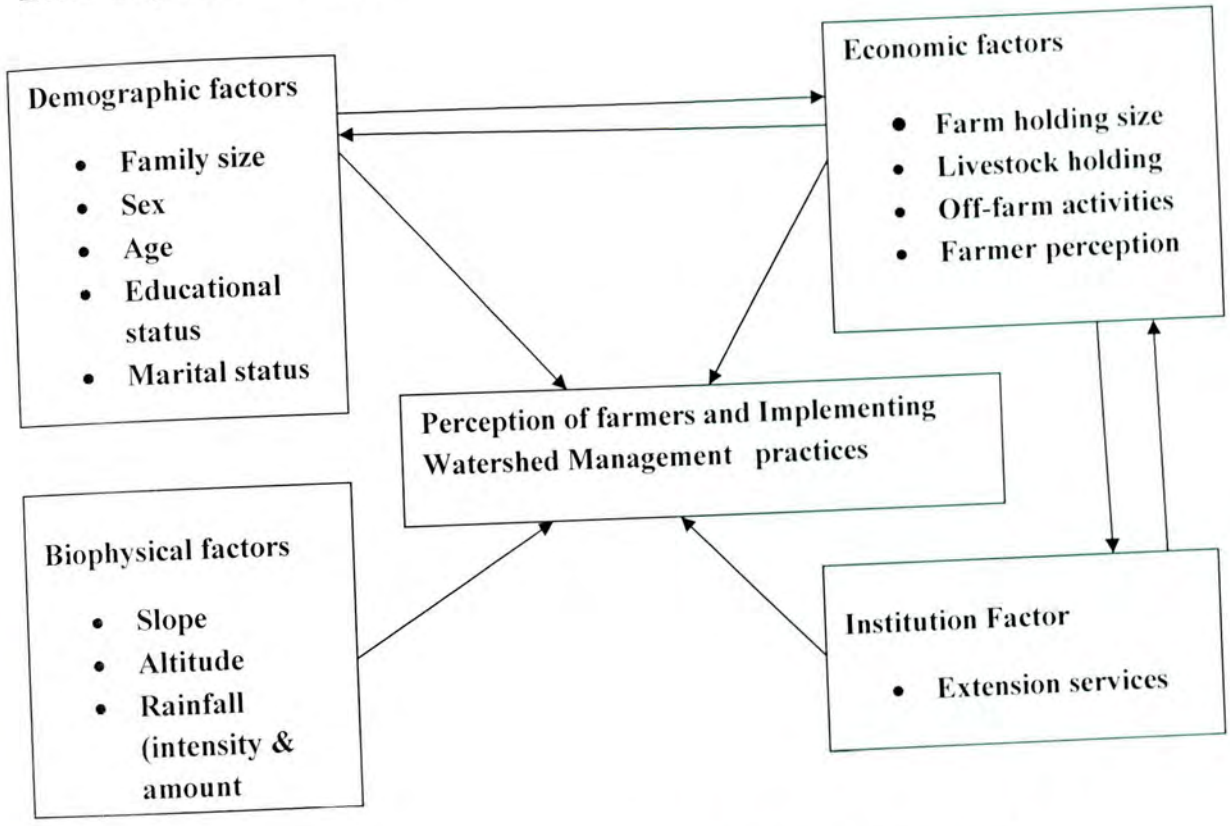

Figure 1: Conceptual Framework (Source: Own construction based on literature)

The conceptual framework, which consists of two key concepts of variables, is shown in Figure-1. The dependent elements that include the frame work for this study are farmers' perception about watershed degradation and implementation of watershed management practices. Farmers' perception about watershed degradation and management practices are being influenced by their status of demographic and economic characteristics. The socio-economic factors (sex, age, and marital status, and educational background, house holding size, land size, livestock holding size and extension services) and biophysical factors are independent variables which are factors that affect the dependent variables.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 General Description of the Study Area

Lower Guder micro-watershed, is located in Lemo Woreda, Hadiya Zone of the Southern Nations, Nationalities and Peoples Region (SNNPR) at about 236km south-west of the capital Addis Ababa. It is 6 km from Hosanna town. Geographically, it is located between 7^0 22' and 7^0 45' North latitude and 37^0 40' and 38^0 East longitude. It is bordered with Hossina town in the north, Angacha Worada in the south, Upper Kode Kebele in the east and Lareba Roma Kebele in the west.

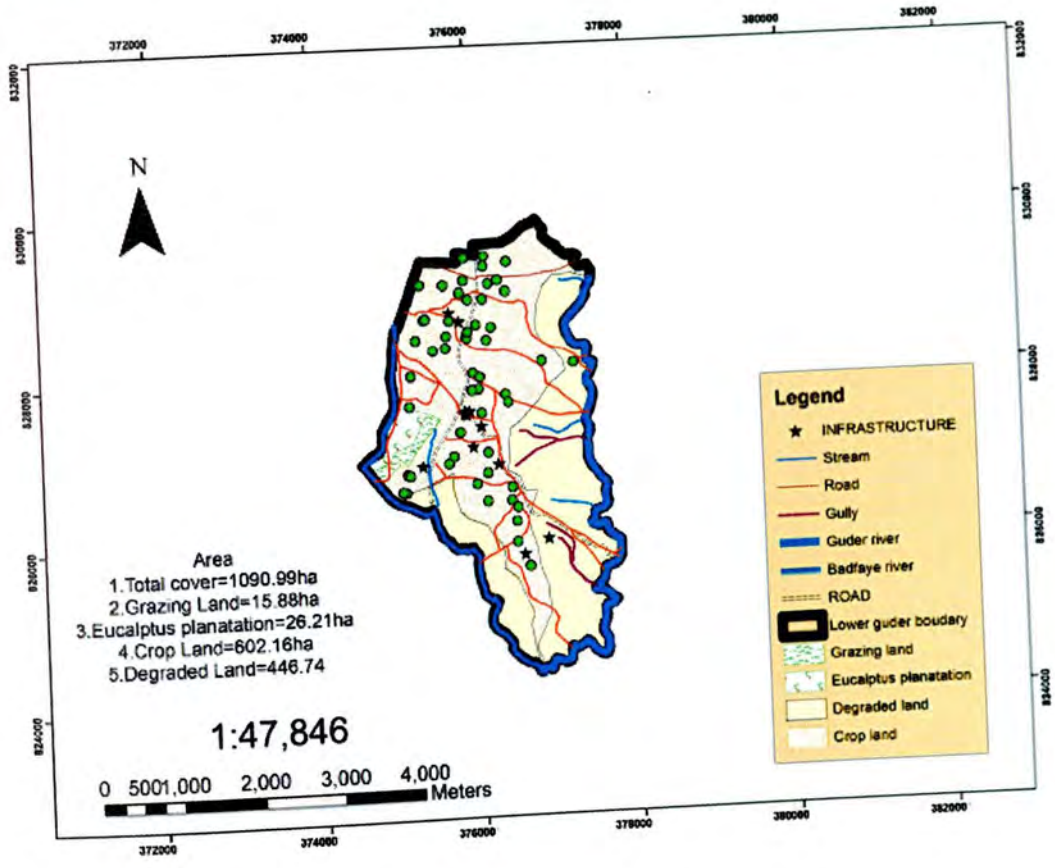

Figure 2: Maps of Lower Guder Micro-watershed

3.1.1 Agro-ecology

The micro-watershed has homogeneous agro ecology. The altitude range is from 2100 to 2300 masl. The average annual rainfall is 1200-1600 mm, and the average annual temperature range is 15.0°C-19.9°C. The farming system of the watershed is a mixed farming system where crop husbandry is the most important component of the livelihood of the farmers. Crop husbandry is characterized by the cultivation of annual crops, cereals and pulses. Livestock production is another component of the watershed mixed farming system. From the total Livestock production, cattle and small ruminants are the dominant. In addition beekeeping is traditionally practiced the district (Lemo Woreda Agricultural Offices, 2012).

3.1.2 Climate

Most of the rainfall falls during the (*Kremt)* season from June to September (it is most intense during July and August). There is short rainy season called "*Belg*" which falls during the months of mid February-March. However, the short rains are highly variable and since they often fail, farmers claim they are relying on them for grain production less and less (Lemo Woreda Agricultural Office, 2012).

3.1.3 Vegetation

The area displays a substantial presence of eucalyptus and *enset*, which together with crop covered fields give the impression that the land is overwhelmingly green especially during the pre-harvest season. The natural vegetation is almost removed due to rapid population growth and expansion of agricultural land particularly field crop cultivation.

3.1.4 Population

The total household head residing in the micro-watershed is 802. The total population in the micro-watershed is 3519 from this 1772 of them are males and1749 of them are females. The average arable land holding is 0.48 hectares per household, varying from 0.25 ha to 2.0 hectares.

The relation between population pressure and watershed degradation appears to be strongly associated with the extremely over utilization of resources and resulted in degradation of the

watershed. More peoples are living in rural as farming community and highly depend on agriculture to survive.

3.1.5 Economic Activity

The study area is characterized by crop-livestock based mixed farming systems. Agriculture is the principal economic activity and livelihood source in the study area, though some people derive additional income from seasonal migration to nearby towns. It is characterized as a small-scale subsistence farming area where crop and livestock production interacting in the system. The principal agricultural activity is crop cultivation, which is entirely rain-fed with livestock rearing as a secondary activity. The major cultivated crops include wheat, maize, barely, *teff*, sorghum, pulses and vegetables, while perennial crops cover of land area (Lemo Agricultural Office, 2012).

Livestock production is the second most important economic base supporting the livelihood of farmers. It plays a significant role in the farming system and economic activity as a source of draught power and milk, meat, shoat (income and meat) and means of transportation. It provides dung that is important for both fuel and manuring crop fields. The micro-watershed has an estimated population of 1002 cattle, 630 sheep, 1035 goats, 7 horses, 426 donkeys, and 1764 chickens. Donkeys are the most common pack animal. Communal grazing areas, private pastures and crop residues are the principal sources of feed (Lemo district Agricultural Office, 2012)

According to district report documents (2012) the land use pattern of the area is such that about 55.19% (602.16 ha) is cultivated for annual and perennial crops, 1.45 % (15.88 ha) is grazing land, and 23.78% (259.5 ha) is bush & wood land, 16.84% (183.75 ha) unproductive land including, 9.16% (100ha) covered with natural forests, and others constitute 2.02% (22.13 ha).

3.2. Research Design

In this research study, a cross sectional research design was employed. This research combines quantitative and qualitative research techniques. Its goal was not to replace either of this approach, but to derive from the strengths and minimize the weakness of both.

3.3. Sampling Procedures

The study was conducted in Lemo District, in one micro-watersheds purposively selected due to the fact that in the Lower Guder micro-watershed, extensive watershed management practices has been undertaken to prevent soil erosion since the beginning of 1980's. Lists of all farm household head within the micro-watershed were prepared with the cooperation of development agents working in this micro-watershed. A total of 802 household heads residing in the micro-watersheds were taken as the sample frame for this study. After getting the total number of households in the selected micro-watersheds, the total sample size of the survey was determined using sample size determining technique (Cochran, 1977).

$$n_o = \frac{Z^2 * (P)(1-P)}{d^2} \longrightarrow n = \frac{n_o}{(1 + \frac{n_o}{N})}$$

Where;

n_o = the desired sample size when population is greater than 10000

n =sample size of finite population correction factors, when population is less than10000

Z = Z statistics for a level of confidence 95% i.e.1.96

P = 0.1 proportion of population to be included in sample i.e. 10%

N = Total number of population

d = margin error or degree of accuracy desired (0.05)

Following this, a total of 118 sample households were taken as targeted sample for the household survey from 802 households residing in the micro watershed. The targeted households for the survey study were selected by using simple random sampling technique. For the qualitative part of the study, purposive sampling technique was employed. Respondent who were regarded as key informants interview and participants for focus group discussions was selected purposely.

3.4. Sources and Methods of Data Collection

3.4.1 Types and Sources of Data

In this study, both quantitative and qualitative data were collected from primary and secondary data sources. Data from primary source was collected using semi-structured interview questionnaires, key informant interviews, focus group discussion and field observation. In order to ensure the reliability and validity of the data collected, triangulation was employed by using qualitative data. Finally, primary data were supplemented with secondary data in order to bridge information gap from primary sources. Secondary data used for this study was collected from published and unpublished materials such as office records and relevant reports, journals, research papers, books, censes records and data files from internet/web pages.

3.4.2. Methods of Data Collection

For such interweave research issues a combination of methods was used to collect relevant data. These include semi-structured interview (individual interview), focus group discussions, key informant interviews, and field observation methods were applied to collect detailed information on the challenges and opportunities of watershed management practices, perception's of farmers about watershed degradation factors that affect implementation of watershed management practices.

3.4.2.1 Household Survey

Questioners were prepared to gather the necessary data from the selected households. Both closed and open ended questions were used to get answers from the respondents. Household survey was conducted on 118 using structured questionnaire. The questionnaire was pre-tested by administering on selected 8 respondents. On the basis of the results obtained from the pre-test, necessary modifications were made on the questionnaires. The questionnaires were handled by six enumerators, those who have first degree in agriculture profession. As farmers in the area are speaking *Hadiyisa*, bilingual enumerators and those that know the area well was recruited for the enumeration. Enumerators and supervisors were trained on basic concepts in interview technique and respondent handling and for their clarity on the questionnaire. Enumerators and supervisors was given one day intensive training on how to conduct the interview and procedure to be followed to manage the whole field survey task.

The questionnaire covered a wide range of information which includes household socio-economic characteristics, farming system, institutional, biophysical issues from the micro-watershed. Attempt was made to make the process of interview more effective by making the process of interview two ways interactions. This was made by getting not only interviewer but also interviewee can also ask question. The data was collected from November 9-23, 2013 for ten days. Finally, the response of the farmers fitted to possible lists of alternative answers, which were worked out carefully during the initial period of the fieldwork.

3.4.2.2 Focus Group Discussion (FGD)

It is one of the most important research tools used to collect qualitative data. Additional qualitative information, such as activities attributes, benefits of watershed management practices, community participation in planning, implementation, monitoring, and evaluation in implemented watershed management practices, role of local level institutions in the promotion of watershed management practices, its management practices were collected through two focus group discussions to supplement interview schedule. Focus group discussions were conducted in confidential environment with two groups 12 of farmers selected purposefully from elders, women, and youth and model farmers. An additional discussion was held with watershed committee within the micro-watershed. This was useful to cross-check the data and information gathered from sampled household. A checklist was prepared prior to discussion and researchers facilitated the discussion. These techniques were useful to acquire detailed information, which have been difficult to collect through the questionnaire survey.

3.4.2.3. Key Informant Interview (KII)

It is one of the other methods used to collect qualitative data. It was used to complement and supplement the data collected from individual households through semi-structured questionnaire and to have a detailed in sight in to watershed management practices in the area, a discussion covering different topics with 12 key informants including, eight woreda agricultural experts such as agronomist, animal husbandry, soil and water conservation, agro-forestry, extension communication, irrigation, agricultural input supply and coffee and spice experts, three development agents (agronomist, natural resource and animal husbandry), who are working in the micro-watershed and kebele administrators were interviewed. This was helped to know the

opinion, interest, short coming and commitment in the use and management of watershed. A checklist was developed and used to guide the interview.

3.4.2.4 Field Observation

This was done with the purpose of getting guidance to modify structured questionnaire at the beginning stage of the survey and also in order to verify the consistency of gathered data and to ensure the validity of information. In addition to field observation a number of informal discussions with individual farmers and the extension workers were conducted to cross-check and verify additional some information of interest.

Moreover, personal observations done through transect walk at field work and visit to individual farm plot gave good opportunities to become acquainted with watershed management practices. In this regard, about 60% of the respondents' fields were observed in order to assess what they did on management practices installed on their fields.

3.5 Data Analysis

The data analysis was carried out during and after field investigation. The data gathered through different instrument was analyzed using quantitative and qualitative data analysis technique. Firstly, the surveyed data through structured questionnaire was checked for accuracy usefulness and completeness. Secondly, the data was post coded. It was followed by analysis employing, descriptive statistical tools using Statistical Package for Social Science (SPSS) for widow 17. Frequency and percentage tables, descriptive statistics, cross tabulations, chi-square and t-test analysis method were used to see if there is any systematic association between different nominal variables. The study relied for qualitative analysis on the tools of group discussions, discussions with development agents and experts at different level (woreda and Zonal level). Secondary data from Kebele, Woreda has also served for same purpose. Maps and photos were also used to support the result of analysis. Collected information was analyzed and presented in varying degrees of detail, such as summary tables, figures and interpreted using descriptive methods.

CHAPTER FOUR

RESULTS and DISCUSSIONS

The results and discussion section identify the challenges and opportunities of implemented watershed management practices, farmer's perception about watershed degradation, and factors affecting watershed management practices in the study area. Watershed management practices that used are selected in accordance with preventing soil erosion, of their wider application and economic as well as ecological importance's.

4.1 Socio-economic Characteristics of Households

4.1.1. Sex

The majority of the sampled households about 83.1% were male head household while the remaining 16.9% were female head household (Table 1). Due to many socio-cultural values and norms, males have freedom of mobility and chance of participation in different meetings and consequently have better access to information on improved watershed management practices and technologies. Therefore, due to more number of male head households they have more information about implementing watershed management practices.

4.1.2. Age

Conventionally, three age groups for the respondents are identified (Table 1), most of the respondent household heads (90.65%) are in the age categories from 18-65 years. Farmers in this age group are assumed to have a good understanding and awareness of watershed management practices and as a result, usually more interested to implement it. Results indicate that the mean age of the respondent's household heads was 48.79 years (Table 15). This is considered as one of the existing opportunity to promote and implement watershed management technologies.

Based on the key informant interview with DA's and relevant experts from the office regarding the relationship between age of the farmer and the state of implementing of types of watershed management practices was positive for both younger and older farmers. Younger farmers are good in implementing the types; since they do have longer planning horizon and labor access as well as probably could have better education opportunities than older farmer since primary

education expanded now days in rural kebels. The above groups of the professionals also agreed that, well experienced farmers are sensitive about the resource degradation within the watershed and they are better to implement the types of watershed management practices to alleviate or stop the watershed degradation.

Table 1: Sex and Age of the Respondents

Background of the respondents	Responses	
Sex of respondent	Frequency	Percent %
Male	98	83.1
Female	20	16.9
Total	118	100.0
Age category of respondents		
18-45 years old	36	30.6
46-65years old	71	60.05
>65 years old	11	9.35
Total	118	100.0

Sources: Field Survey, 2013

4.1.3. Education and Marital Status of Respondents

Regarding educational status, a high proportion of the respondents (73.7%) had completed primary (1-4 grade) education and above and the rest 26.3% were illiterate (Table 2). Since adequate education enhances farmers' perception about watershed management practices. The educated farmers would be expected more to implement watershed management practices. Therefore, the high proportion of educated percent of respondents considered as an existing opportunities for implementing watershed management practices.

Discussion with development agents also showed that, the illiteracy of farmer's restrains the implementing skill of farmers and less promotes the types of watershed management practices. They indicate that implementing of watershed management practices is sensitive to the level of education. That is, as education level increases the more is the implemented types of watershed management practices.

Regarding marital status of households about 85.6% respondents were married (Table 2). Marital status of respondents was crucial because it determines the rate at which a household rely on the local environment. This indicated that watershed management practices are very much implemented by married people to make ends meet and cater for their children. All widowed sampled household were female.

Table 2: Educational and Marital Status of Households

Educational status of the respondents	Responses	
	Frequency	Percent %
Illiterate	31	26.3
1-4 grade	36	30.5
5-8 grade	33	28.0
9-10 grade	16	13.6
10+3	2	1.7
Total	118	100.0
Marital status of the respondents		
Married	110	85.6
Single	1	0.8
Widowed	1	0.8
Divorced	15	12.7
Total	118	100.0

Sources: Field Survey, 2013

4.1.4. Household Size

The total population of the sampled respondent is 969, of which 459 were males and 510 were females (Table 3). From the total population children constitute 40.14% (between 0-18), adult constitute 54.07% (between 19 and 64 years), and old age constitute 2.41% (>64 years) of the total population's. The female population exceeds in numbers than that of male population giving a sex ratio of 111.1%. The total family size in the study ranges from minimum 1 to maximum 16 and with an average of 8.08 people per household, which is above the national

average of 4.9 per household (CSA, 2008). Thus, family size and active labor forces influences the decision of farmers to undertake the watershed management practices. Because of given household labor is the whole supplier of the required labor for undertaking the farming and watershed management practices. Therefore, the existences of more productive age group (54.4%) and the family size can be considered as an opportunity for implementing watershed management practices in the study area.

Table 3: Household Size Distributions of Respondents

Age Categories' of respondents	Household size of the respondents					
	Male		Female		Male and Female	
	Frequency	Percent (%)	Frequency	Percent (%)	Frequency	Percent (%)
0-18	206	44.88	150	35.88	325	40.14
19-64	239	52.06	358	62.25	628	54.07
>65	14	3.05	8	1.56	22	2.27
Total	459	100	510	100	969	100

Sources: Field Survey, 2013

4.1.5. Land Holding Size

Land is the component of natural resources which has various elements on it, and each element has various uses for humans. The land holding of farmers in the study area varied from less than 0.5 hectare to more than 2 hectare. Depending up on the farm size, they use the land for various purposes whether it is for cultivation, grazing, wood lots and homestead. The result shows that average land holding size per household was 0.48. The survey result revealed that more than 68.7% respondent farmers have less than or equal to 0.5 hectare of land (Table 16). Thus, average farmers are small-scale farmers. Moreover the land is fragmented into a number of small separate plots, often located at distant from each other. This can negatively affect agricultural and watershed management practices because, travel to and from home requires longer time and effort. Farmers were forced to cultivate the small land size frequently without fallowing to feed his household. This action can aggravate watershed degradation process and influences the management practices. This also gives little opportunities to be flexible in their decision making

and to adopt more watershed management practices because; they use the land for crop production in the contrary of using this land to implement watershed management practices. According to (Nowak, 1987), higher levels of conservation practice adoption are expected on larger farms, as farmers should have more flexibility in their decision making, greater access to discretionary resources, more opportunity to use new practices on a trial bases and more ability to deal with risk. Regarding ownership and sources of farm land, the survey result showed that more than 83.8% of the plots are inherited from their family (Table 4).

Table 4: Land Size and Its Characteristics

Sources of Farming Land	Responses	
	Frequency	Percent %
Inherited from parents	83	83.1
Allocated by the kebele	59	50
Renting	1	0.8
Share cropping	1	0.8
Total	118	100.0

Sources: Field Survey, 2013

4.1.6. Livestock Holding

Livestock is an integral part of farming. The average size of livestock of the study area in TLU is 5.09 (Table 5). Traditionally livestock in the study area have been kept for different purposes. They are kept to provide food, as draft and transport, as a means of asset because farmers regard livestock as a safeguard for sudden cash requirement as a considerable capital resource. These animals are sold in time of need for, credit for taxes and others.

Table 5: Types and Size of Livestock Size in (TLU)

Types of Livestock's	Average livestock holding per sampled household		Total livestock holdings of sampled household	
	Frequency	TLU[1]	Frequency	TLU[1]
Calves	0.91	0.22	107.38	26.84
Cows	1.55	1.55	170.5	170.5
Heifers	1.61	1.20	189.84	142.38
Oxen	1.38	1.38	162.84	162.84
Poultry	5.88	0.076	693.84	9.01
Goats	0.41	0.053	48.38	6.28
Sheep	0.35	0.045	41.3	5.36
Donkey	0.77	0.53	90.86	63.6
Horses	0.03	0.033	3.54	3.89
Mule	0.008	0.0088	.94	1.03
Total		5.09		591

Source: Field Survey, 2013

Conversion factor used into TLU was: calf 0.25; cows and oxen 1.00; poultry 013; Sheep and goats 0.13; Horse and mule 1.10; and Donkey, 0.7 Source: Strock *et al.*, (1991)

4.1.6.1. Feeding System and Sources of Feed

The dominant livestock feeding system in the study area are free grazing, zero grazing, and rotational grazing. Survey revealed in Table 6 that, 96.6% respondent used free grazing and 44.9% respondent used zero grazing/cutting and carrying system to feed their livestock, while the rest 10.9% respondent used rotational grazing to feed their livestock (Table 6).

According to FGD's discussion, free and unregulated grazing of livestock damage physical and biological soil and water conservation practices implemented in the area. When livestock are trying to cross the structures, they are destroying the embankments, hedges and ditches in the crop field and bulls and oxen dig down the embankments by their horns. As vegetation cover declines under heavy stocking rates, the water infiltration decrease and sediment production increase. The other negative effect of livestock to watershed management practices is physical

damages of conservation structures such as fanya-juu and soil bunds. Livestock has been blamed for watershed degradation in the study area. Therefore, this is considered to be challenges of watershed management practices in the study area.

In the study area Table 6 show that, 99.15% respondents used crop residue as source of feed for their livestock, while the rest used hay, straw, free grazing, and industrial bi-product 25.54%, 48.30%, and 13.55% respondent respectively used as sources of feed for their livestock. The removal of crop residue for livestock feed subsequently exposes the farm land and aggravated erosion hazard. Using crop residue as a source of animal feed can also affect the overall productivities of farm land. This result is concede with the study conducted by Tilahun (1996), finds that farmers removing all crop residues from their fields in Areka area and using for their livestock feed, made the land degraded, increased soil erosion and destroyed SWC structures. This was also investigated by Berhanu *et al.*, (2002) that biological conservation practices such as grass strips and tree plantations are also being destroyed or trampled, reducing the chance for establishment and regeneration by freely grazing livestock.

Table 6: Feeding Systems and Sources of Feed for the Livestock's

Livestock's feeding systems and major sources of feed	Responses	
Livestock feeding systems	Frequency	Percent %
Free and unregulated grazing	114	96.6
Zero grazing (cutting and carrying)	53	44.9
Rotational grazing	20	11.9
Total	118	100.0
Major sources of feed for the livestock		
Hay	30	25.54
Straw	57	48.30
crop residue	117	99.15
Industrial bi-products	16	13.55
Total	118	100.0

Sources: Field Survey, 2013

Discussion with farmers and development agents revealed that crop residue from cereals (wheat, barley and teff) are transported from the crop field to the home compound and stored for animal feed due to chronic feed shortage. In addition to that maize and sorghum stalk are used mainly for fuel wood and fencing. Therefore, feeding system and sources of feed that used by the farmer

considered as challenges of watershed management practices. Thus, the government and famers must give attention to solve or minimize the impact of livestock on watershed management practices as well as to increase the animal product and productivity in the area.

Photograph taken by the author, 2013

Figure 3: Impact of Free Grazing On Watershed Management Practices

4.1.7. Off-Farm Economic Activities

Involvement of famers in off-farm economic activities is common in the study area. Farmers in the study area engaged in different types of off-farm activities like, selling of fire wood, petty trade, daily laborer, hand crafts, preparing and selling of local drink, and selling of stone. From the total respondents about 69.3 % of respondents were involved in at least one off-farm economic activity (Table 7). This results in low implementation of watershed management

practices because, it compete for time and labor. That is, adoption of watershed management practices is influenced by the engagement of the household members in off-farm activities. When the farmer and its family members are more involved in off-farm activities, the time spent on watershed management practices will be limited. Therefore, as the household members involves more in off-farm activities the less the implementation of watershed management practices and vice versa. In these cases, off-farm economic activities can be considered as one of the existing challenges of watershed management practices. On the other hand, off-farm activities can be a source of income and might encourage investment in farming and watershed management practices.

Table 7: Participation in Off-Farm Economic Activities across Household Members

Types Off-farm economic activities	Family member's participation					
	Men		Women		Others family member's	
	Frequency	Percent %	Frequency	Percent%	Frequency	Percent%
Selling of fire wood	11	10.4	4	3.7	14	13.3
Petty trade	1	.8	1	.8	6	5.7
Daily laborer	3	2.8	-	-	4	3.8
Hand craft	1	0.8	-	-	1	.8
Preparing and selling of local drinks	-	-	4	3.7	2	1.9
Selling of stone	2	1.9	1	.8	5	4.8
Remittances	3	2.8	--	-	11	10.5
Total	21	19.5	10	9	43	40.8

Sources: Field Survey, 2013

4.2 Institutional Characteristics

4.2.1 Extension Service

Table 8 shows that, about 94.91 % and 59.47% respondents used development agents and experts working in the district natural resources management section respectively as the major sources of extension services regarding watershed management practices. By and large, extension services on watershed management practices provided by DAs and experts are believed to be important and reliable sources of information about improved technologies to sustainable watershed management practices. Similar study indicated that, if a farmer receives

better information (advice) from extension agents, the farmer are usually willing to construct new conservation measures and to maintain the existing ones (Wagayehu and Lars, 2003)

The survey indicated that almost all of the respondents have received extension advice regarding watershed management practices. About 97.47% respondents have got the information through training, while the rest farmers have got the information through attending field visit, demonstration, and material supports 9.32%, 16.94%, and 10.16% respectively on how to undertake watershed management practices (Table 8). It is an acknowledged truth that the dissemination of information on better technological alternatives is an important aspect that contributes positively for the implementation of watershed management interventions.

Table 8: Extension Services Delivery about Watershed Management

Did you get extension services about watershed management practices?	Responses	
	Frequency	Percent %
Yes	117	99.2
No	1	0.8
Total	118	100
What is the name of institution that you used to get extension services about watershed management?		
DA`s	112	94.91
Neighbors	11	9.32
Mass Media	41	34.74
NGOs	3	2.54
District agriculture offices expert	69	58.47
Total	118	100.0
How did you get information or support?		
Training	115	97.47
Field visit and technical support	11	9.32
Demonstration	20	16.94
Material support	12	10.16
Total	118	100.0

Sources: Field Survey, 2013

4.3. Farmers' Perception about Watershed Degradation

The perceptions' of farmers about the existences, extent, causes, and consequences of watershed degradation is critical determinant to implement watershed management practices on their farm and non farm land. In order to formulate a successful policy and strategy to sustainable watershed management practices, investigating the perception of farmers to the extent, causes, and consequences of watershed degradation of in their farmland is the foremost step.

An attempt was made to understand respondents' perception on the existence, extent, causes, and consequences of watershed degradation in the area. The survey report revealed that almost all of the respondents agree on the existence of watershed degradation in the study area. The survey report revealed in Table 9 that, about 35.6% and 32.2% of the respondent perceive the existence of watershed degradation was moderate and sever respectively. Based on the survey result Table 9, the major causes of watershed degradation, about 65.25% of the respondents agree the causes of watershed degradation were non optimal utilization of natural resources, and 57.62% respondent agree that, deforestation was the cause of watershed degradation. The other part of the respondents 82.2%, 30.50%, 53.38%, and 34.74% agreed soil erosion (wind and water), burning of organic material (harvest residue, bush fires), overgrazing, and limited use of sustainable land management practices were respectively the others causes of watershed degradation in the study area.

In the study area farmers perceive the existences of watershed degradation in differently. According to FGD's, discussion farmer perceived the presences of watershed degradation in terms of yield reduction, gulley formation, loss of endemic plant species, decrease or losses of river base flow, and loss and decrease of spring and underground water level.

Table 9: Extent and Causes of Watershed Degradation

Extent, major causes, and consequences of watershed degradation	Responses	
How do you see the extent of watershed degradation in the area?	Frequency	Percent (%)
I Don't know	1	0.8
Slightly	37	31.4
Moderate	42	35.6
Sever	38	32.2
Total	118	100.0
What are the major causes of watershed degradation in your view?		
Non optimal utilization of natural resources	77	62.25
Deforestation	68	57.62
Soil erosion (wind and water erosion)	97	82.2
Burning of crop residues	36	30.50
Overgrazing	63	53.38
Limited use of sustainable land management practices	41	34.74
Total	118	100.0

Sources: Field Survey, 2013

What households perceive the consequences and livelihood impacts of watershed degradation to be is in support of the watershed management practices. Therefore, these are vital for programming watershed management practices. Table 10 shows that, responses from the sampled households about 96.61 % perceived the consequences of watershed degradation as loss of soil fertility, 92.37% perceived decrease of crop productivities, 71.18% perceived decrease of livestock productivities, 64.4% perceived shortage of livestock feed, 46.61% perceived desertification, and 5.08% perceived the consequences of watershed degradation is drought and famine. The overall consequences of watershed degradation as loss of land productivity with reduced farm income which directly affects the livelihoods of the rural population with in the area.

Table 10: Consequences of Watershed Degradation

What are the major consequences of watershed degradation in your view?	Responses	
	Frequency	Percent (%)
Loss of soil fertility	114	96.61
Loss of crop productivities	109	92.37
Loss of animal productivities	84	71.18
Shortage of livestock feed	76	64.4
Desertification	55	46.61
Drought and famine	6	5.08
Total	118	100.0

Sources: Field Survey, 2013

There is a close relationship between the environment and the human community living within for its livelihood. When the economic condition of a community deteriorates, it leads to over exploitation and degradation of natural resources.

4.4 Types of watershed Management Practices (Focusing on Preventing Soil Erosion)

4.4.1. Agronomic Practices

Farmers in the study area have implemented agronomic practices on their land holdings, like mulching, crop rotation, intercropping, fallowing, and crop residue management. About 86.44% of respondent, who implemented the practices, believed that investments on agronomic measures are advantageous which led to improve soil fertility and increase productivity (Table 11). From the types of agronomic measure the respondents implemented mulching, crop rotation, intercropping, fallowing, and crop residues management, 49.1%, 13.72%, 20.58%, and 6.86%, and 9.8% respectively being implemented on their own farm land (Table 11).

Table 11: Statistical Association between Implementing Watershed Management Practices and Types of Agronomic Practices

Participation in watershed management practices						
Types of agronomic practices	Yes	%	No	%	Ch-sq	P-value
Mulching	50	49.01	2	12.5		
Crop rotation	14	13.72	3	18.75		
Inter cropping	21	20.58	1	6.75		
Fallowing	7	6.86	8	50		
Crop residue management	10	9.8	2	12.5	4.076	0.043**
Total	102	100	16	100		

Sources: Field Survey, 2013 **significant at 5%

The statistical association between types of agronomic practices and implementing of watershed management practices is significant (x^2=4.076, p=0.043). This shows that type's agronomic practices determine implementation of watershed management practices. Farmer selectively implements the agronomic practices because they use crop residue to feed their livestock, land size also determine not to practice fallowing.

Based on FGD's they used crop residue management as agronomic measure to prevent exposure of bare soil and to protect the soil from rain between crop-growing seasons. This includes techniques such as leaving crop residue in the soil after harvesting or planting temporary crops and grasses. Mulching used to cover the soil surface with crop residues is another potential measure to reduce watershed degradation. Through it, the hydraulic force of the raindrop on the soil particle will be reduced, thereby soil detachment is minimized.

4.4.2. Physical Soil and Water Conservation Practices

To overcome the watershed degradation farmers implemented different types of physical soil and water conservation practices. The statistical association between types of physical soil and water conservation and implementing of watershed management practices is significant (x^2=11.076, p=0.073). Among the farmers who adopt physical soil and water conservation practices 44.76%

preferred to implement fainya juu methods (Table 4). This is because the majority of the practicability and adaptability of the technology in the study area is very great. A significant proportion of farmer construct soil bund, check dams, and diversion ditches. The results indicate that fainaya juu and cutoff drains are more used physical soil and water conservation practices. The types of physical soil and water conservation technologies implemented in the study area depend on the bases of the material used for constriction and adaptability of technologies.

According FGD's discussion, check dams were constructed in the area where gullies are widely observed. They used it to rehabilitate gullies formed by potent run-off. They also adopt the diversion ditches to protect their cultivated land against run-off from slopes up and run-on from the farm plot itself.

Table 12: Association between Watershed Management Practices and Types of Physical SWC

	Participation in watershed management practices					
	Yes	Percent %	No	Percent %	Ch-sq	P-value
Types of physical practices						
Soil bund	5	4.76	1	12.5	11.076	0.073
Fainya juu	47	44.76	8	7.69		
Cut off drain	13	12.38	-	-		
Stone bund	21	20	3	61.53		
Check dams	19	18.09	1	23.07		
Total	105	100	13	100		

Sources: Field Survey, 2013 **significant at10%

4.4.3. Biological Soil and Water Conservation Practices

The farmers implement different types of biological soil and water conservation practices in the study area to stabilize and maintain constructed physical soil and water conservation practices. The results indicate that live fencing and crop cover are more used biological soil and water conservation practices. Association between implementing watershed management practices and types of biological SWC is significant(x^2=9.076,p=0.053). This show implementing biological SWC practices depend on the types of technology to be implemented. A significant proportion of farmers implement contour planting, grass strip, and agro forestry.

Based on FGD's discussion, contour planting and grass strip are practiced to retain narrow pieces of land along the contour during plowing period for several seasons. Grass strip with desho help farmers either to reduce surface run-off/run-on, as a boundary between different crop plots or as sources of forage for their cattle.

Table 13: Implementing Watershed Management Practices across Biological SWC Practices

	Implementing watershed management practices					
	Yes	Percent %	No	Percent %	Ch-sq	P-value
Types of Biological practices						
Contour planting	13	12.87	1	5.88	9.076	0.053**
Grass strip	15	14.85	2	11.76		
Crop cover	23	22.17	3	17.64		
Live fencing	39	38.61	2	11.76		
Agro forestry	11	10.89	9	52.94		
Total	101	100	17	100		

Sources: Field Survey, 2013 **significant at 10%

4.5 Factors Affecting Watershed Management practices

4.5.1 Sex and Implementing of Watershed Management Practices

So, sex was hypothesized to influence implementation of watershed management practices positively in favor of male headed households. However, the result of chi- square analysis (χ^2 =1.971, P=0.160) revealed that there is no association between sex of household and implemented watershed management practices (Table 14). This implies that both female and male households are likely to implement watershed management practices.

Table 14: Association between Sex and Implementing Watershed Management Practices

Variable	Implementing watershed management practices					
Sex	Yes	Percent %	No	Percent %	X2	p-value
Male	95	84.07 à 3		60	1.971	0.160
Female	18	15.93	2	40		
Total	113	100	5	100		

Sources: Field Survey, 2013

4.5.2 Educational Status and Implementing Watershed Management Practices

In this study the literacy was extended from read and write to attending regular school education. Out of the total participant households, 32.18% of them are illiterate, 22.98% from grade 1-4, 28.75% them from grade 5- 8 and 35.63% from grade 9-10, and the rest are 0.03% 10+3 while non- implementer households, 25.8% of them are illiterate, 0% from grade 1- 4, 38.7% of them are within grade 5- 8, 29.03% of them from grade 9-10, and 6.45% of them from grade 10+3 education level (Table 14).

Result of chi-square test shows (x^2=17.05, P=0.045) showed that there is significant association between education status of household head and implementation of watershed management practices (Table 14). This provides support for the hypothesis that better education levels are associated with greater information on conservation practices and in turn results in a greater implementation of watershed management practices. This implies that the effect of education is the positive on implementation of watershed management practices among sample farmers. It means an increase in awareness about issues related land management practices with increasing level of education. Therefore, types of watershed management practices depend on educational status of farmers. This study is consistent with Long (2003), reported a positive and significant relationship of education with adoption of improved soil and water conservation technology but, not consistent with the findings of Shiferaw and Holden (1998).

Table 15: Association between Educational Status and Watershed Management Practices

	Implementing watershed management practices					
Education al status	Yes	Percent %	No	Percent %	X^2	P –value
Illiterate	28	32.18	8	25.8	17.05	0.045**
1-4 grade	20	22.98	-			
5-8 grade	25	28.75	12	38.7		
9-10 grade	31	35.63	9	29.03		
10+3 grade	4	0.04	2	6.45		
Total	87	100	31	100		

Sources: Field Survey, 2013 **significant at 5%

4.5.3 Land holding size and Implementing Watershed Management Practices

Among implementer farmers about 27.27% had land holding size ≤0.5 hectare, 42.42% had between 0.51-1 hectare, 12.72% had between, 12.75% had 1.1-1.5 hectare, 1.51-2 hectare, and 0.45% had ≥2 hectare farm land. Among non-implementer had about 12.5% had holding size ≤0.5 hectare, 37.5% had between 0.51-1 hectare, 12.5% had between, 0.9% had 1.1-1.5 hectare, 1.51-2 hectare, and 12.5% had ≥2 hectare farm land.

The result of chi-square test (x^2=9.45, P=0.048) shows a statistically significant association between land holding size and implementation of watershed management practices at 5% significance level. This indicates that as land holding size increases, the higher the likelihood of implementation of watershed management practices by farmers. This result is in line with the finding of Amsalu and de Graaff (2006) found out that farm size has a positive and significant influence on the farmers' decision to adopt physical soil conservation measures.

Table 16: Association between Land Holding Size and Implementing Watershed Management Practices

Land size	Implementing watershed management practices					
	Yes	Percent%	No	Percent %	X^2	P-value
≤0.5ha	50	63.98	1	12.5		
0.51-1ha	22	20	3	37.5		
1.1-1.5ha	13	11.81	1	12.5		
1.51-2ha	12	10.90	2	0.9		
≥2ha	5	0.45	1	12.5	9.45	0.058**

Sources: Field Survey, 2013 **significant at 10%

4.5.4 Relation between Age and Implementing Watershed Management Practices

As indicated in Table 15, the mean age of implementer and non implementer household was 48.79 and 44.51 with a standard deviation of 11.04 and 10.81 respectively. Age was hypothesized to influence the implementing capacity of farmers either positively or negatively. The result of t-test shows that there is significant mean age difference among the age categories between implementer and non implementer household (t=2.01, P=0.056). The effect of farmer's age on practicing watershed management is positive. This shows that implementing watershed management practices is majorly determined by age of the farmers. Therefore, implementation of watershed management practices is dependent on the age of farmer. This is similar with other studies have found that as age of farmer's increases, and then the level of adoption of conservation technologies also increases (Amsalu and Graaf, 2006). Inconsistency with Wagayehu and Lars (2003) in their study found negative association between existence of conservation structures and age of household heads; they predicted positive association between age and non-adoption of conservation measures. The other studies have found that there is negative relationship between adoption of natural resources management technologies like soil conservation structures and the age of the farmer (Shifaraw and Holden, 1998).

.5.4 Relation between Family size and Implementing Watershed Management Practices

Family size in this study is considered as the number of individuals who reside in the respondent's household, share the dwelling unit and cooking common food. Family size of the household was hypothesized to influence the adoption of watershed management practices either positively or negatively. The result revealed in Table 15, the mean age of family size of practitioner household's and non-practitioner was 8.08 and 8.8 persons with standard deviation of 2.77 and 3.73 respectively.

To check whether there is a significant mean difference in family size between implementer and non-implementer, t- test statistics was run. The result of independent sample t-test (t= 0.294, P= 0.430) shows a statistically no significant mean difference between implementer and non-implementer at 5% significance level (Table 18). This implies that a household with a larger family size are less likely involved in watershed management practices. The possible explanation is that as family size increases more family members involved in short term income or benefit generating activities to secure food demand of the household. The result of this study is consistent with the past findings of Amsalu (2006) who found out that, in the Beressa watershed in the Northern highlands of Ethiopia, farmers with a larger family size are less likely to continue using stone terraces.

Table 17 : Relationship between Socio-Economic Characteristics of Household Head and Implementing of Watershed Management Practices

	Implementing watershed management practices					
Variable	Yes		No		T-value	p-value
	Mean	SD	Mean	SD		
Age	48.79	11.04	44.51	10.81	2.01	0.056**
Family size	8.08	2.77	8.88	3.73	0.294	0.430
TUL	2.9	8.29	3	4.08	1.97	0.151

Sources: Field Survey, 2013 **significant at 10%

4.6. Benefits of Watershed Management Practices

The survey study revealed that in the study area almost all farmers were benefited from the watershed management practices adopted within their own farm and non farm land. The benefit obtained from the adopted watershed management practices considered as opportunities to implement, replicate, maintain, and manage the existing and newly introduced watershed management practices (technologies). As shown in the table 18, major benefits obtained from implemented watershed management practices were 88.13% respondent agree on the reduction of erosion, flood, and overflow, 71.18% respondent agree on the maintenance and increment moisture holding capacity, 28.81% respondent agree increment of underground water recharge, 65.25% respondent agree increases the forest coverage of the area, 63.55% respondent agree maintenance and increment of the land productivity, 39.83% respondent agree on the increment the crop productivity / crop production, and 25.42% respondent agree on the increment of livestock productivity / livestock production.

Table 18: Benefits Obtained From Implemented Watershed Management Practices

Implementing watershed management practices		
Benefits of watershed management	Frequency	Percent %t
Reduction of erosion, flood overflows	104	88.13
Maintenance and increasing of moisture holding capacity of the soil	84	71.18
Increasing the amount of water recharge	34	28.81
Increasing the forest cover	77	65.25
Maintaining and increasing land productivity	75	63.55
Increase productivity or crop production	47	39.83
Increasing of animal productivity or production	30	25.42
Total	118	100

Sources, Field survey, 2013

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Although watershed management activities have contributed significantly to reducing watershed degradation and improving the quality of life and livelihood opportunities for many people throughout the world, the real potential of watershed management practices has yet to be realized.

The free and unregulated grazing of livestock inhibit the growth of unplowed strip, and damage physical and biological soil and water conservation technologies implemented in the area during grazing and animal walk. Feeding of animal with crop residue can also affect the overall productivities of farm land. The removal of crop residue for livestock feed subsequently exposes the farm and aggravated erosion hazard. Feeding cattle through free and unregulated grazing can affect the natural regeneration capacity of grazing land, increasing grazing land area by decreasing farm land and can also affect the amount of crop production, this in turn affect the food consumption of the farm household. Therefore, the feeding system for animals and sources of feed they used in the study area can be one existing challenges in watershed management practices.

Off-farm or non-farm activity activities may have a negative effect on the implementing watershed management practices due to reduced labor and time availability. When the farmer and its family members are more involved in off-farm activities, the time spent on their farmland will be limited and hence the family is discouraged from being involved in components of watershed management practices. In this cases off-farm economic activities considered as one of the existing challenges in watershed management practices.

By and large, extension services on watershed management practices provided by DAs and experts are believed to be reliable sources of information about improved technologies to sustainable watershed management practices. Extension education is center to adopt and use agricultural technologies and information which in turn enhance farmers' implementing capacity,

awareness, and skill to watershed management practices. The result of the study showed that access to extension service has positive effect on the implementation of watershed management practices suggesting the need for more targeted and continued extension services.

The empirical results revealed that variables such as land holding size, education, and age, were significantly influenced farmers' implementation of watershed management practices (technologies).

5.2 Recommendations

Based on the findings of this study, the following recommendations are proposed:

- It is necessary for people to understand the relationship between their poverty and the degradation of watershed they live. As human beings and their activities are the primary cause of watershed degradation, they can restore the health of the watershed they have ruined by resetting their ways and activities towards watershed based, to do in the way in suggesting the need more targeted and continued extension services with DAs'.

- It is an acknowledged truth that the dissemination of information on better technological alternatives is an important aspect that contributes positively for the sustainability of implemented watershed management practices in the way district agriculture office should facilitate alternate technologies.

- The development and implementing of locally appropriate and low cost technology by the community and facilitation and provision of credit by micro-finance institutions could be important to implement types of watershed management practices by themselves.

- The community should manage their livestock in an integrated way so as to reduce the impact of free and unregulated grazing on implemented watershed management practices.

- The development of local bylaw by the community for grazing management and introducing improved breed and forages to the area by Woreda Agriculture Offices is needed to meet nutritional and feed requirements of livestock.

- In order to increase the income of farm house hold by practicing off-farm (non-farm) economic activities in general and farmer participation in watershed management practices in particular Woreda Agriculture Offices should facilitate environmentally friendly off-farm activity opportunities and watershed based income generating activities such as beekeeping, forestation of indigenous tree , livestock fattening, poultry, is needed.

- The quantitative way of planning and implementation of watershed management practices alone does not bring sustainability. Therefore, all the stakeholders should consider the qualitative integrity and sustainable watershed management practices.

- What households perceive the consequences and livelihood impacts of watershed degradation to be is in support of the watershed management practices. Therefore, the development agents assigned to the area and the experts at district level are willing to mobilize the farmers and community to tackle the causes of watershed degradation.

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APPENDICES

Appendix I. Semi-structured household survey questionnaires

Household survey assessment of watershed management practices, the case of Lower Guder, Lemo District, Hadiya Zone, SNNPRS

Instruction: use 'X' mark for answers of questions with various alternatives in the space provided and write the specific issue when required in its appropriate place.

I. General Information about the respondent

1	Questionner Code		
2	Name of Interviewer		
3	Name of Superviser		
4	Date of interview: Date _____Month _____ 2013		
5	Name of the Micro-watershed		
	I. Personnel data		
6	Name of HH head (respondent): _____		
7	Sex of the household head (respondent):	1. Male 2. Female	
8	Age of the household head (respondent): _____ Years		
9	Marital status of the respondent	1. Single 2. Married 3.Divorced 4. Widowed	
10	What is the educational status of the household head (respondent)?	1. Illiterate 2. 1-4 grade 3. 5-8 grade 4. 9-10 grade 5. Preparatory (11-12) 6. 10+1 7. 10+2 8. 10+3 9. 10+4 10. Diploma (old curriculum) 11. Other	
11	Ethnicity	1. Hadiya 2. Kanbata 3. Gurage 4. Silite 5. Others	
12	Main activities of the household members	1. Crop production 2. Livestock rearing 3. Off-farm activities 4. Mixed farming (crop and livestock) 5.Others,specify	

13. Family size, age and sex composition of household member

Age group	Male	Female	Total
0-14			
15-64			
>65			

II. Landholding and farm plot characteristics

14	Do you own farm land?	1. Yes 2. No	
15	If Your answer to Q. 16 is yes, what is the size of landholding of the household in local unit: timad?	1. ≤ 2tim(≤ 0.5ha) 2. 2-4 tima (0.51-1ha) 3. 2-4 tim (1.1-1.5ha) 4. 4-6 timad (1.51-2ha) 5.Above 8 timad (≥2ha))	
16	If Your answer to Q. 14 is yes, How could you get access to the land you are using currently?	1. Inherited from the parents 2. Allocated by the Kebele 3. Through renting 4. Renting and Inherited 5. Through share cropping 6. Share cropping and inherited 7. Renting and allocated by kebele 8. Others	
17	In which slope position your farm plot located?	1. Flat (0-2%) 2. Steep (3-12%) 3. Steeper (12-30%) 4. Very steeper (>30%)	

III. Livestock Production

17. Do you have livestock? 1. Yes 2. No

18. If your answer to Q.17 is yes, indicate type and numbers of livestock you have

Type of livestock	Numbers	Type of livestock	Number
Calves		Sheep	
Cows		Donkeys	
Heifers		Horses	
Oxen		Mule	
Poultry		Other specify	
Goats			

19	What is the feeding system for your livestock?	1.Free and unregulated grazing 2.Zero grazing (cutting and carrying) 3.Rotational grazing 4. others, specify	
20	Where is the source of feed for your livestock?	1 Hay 2. Straw 3. Crop residue 5. industrial bi-product 6.Others specify	

IV. Off-farm activities

21	Do you or your household member participate in off-farm economic activities?	1. Yes 2. No	
22	If the response for Q 21 is Yes, Which household members engaged in off-farm activity?	1. Men 2, Women 3. Children 4. All	
23	If your answer to Q.21 is yes, in which type's off-farm economic activities do you and your household member participates?	1. Petty trade 2.Selling of fire wood 3.Daily laborer 4. Hand crafts 5. Preparing and selling of local drink 6.Sell of stone 7. Others, specify	

V. Farmers' perception on the existence, cause and consequences of watershed degradation

24	Do you observe (perceive) the existence of watershed degradation within the micro-watershed?	1) Yes 2) No	
25	If your answer to Q. 24 is yes, in your perception what is the extent of watershed degradation in the area?	1. I don't know 2. Low 3. Moderate 4. Severe	
26	If your answer to Q 25 is yes, what are the major causes of watershed degradation in your micro-watershed in your perception?	1.Non optimal utilization of natural resources 2.Deforestation 3.Soil erosion(wind and water) 4. Burning of organic material (harvest residue, bush fires) 5.Overgrazing 6. Limited use of sustainable land management practices 7.Others, specify	
27	According to your perceptions what are the consequences of watershed	1. Loss of soil fertility	

	degradation in the area?	2. Decrease of crop productivities 3. Decrease in livestock productivities 4. Shortage of livestock feed 5.Desertification 6.Drought and famine 7. Others, specify	
VI.	**Types of watershed management Practices**		
28	Did you implement watershed management practices in your own farm and communal land?	1. Yes 2. No	
29	If the response for Q 28 is Yes, what are the types of agronomic practices implemented in your farm land?	1. Mulching 2. Crop rotation 3. Intercropping 4. Fallowing 5. Residue management 6.Others, Specify	
30	If the response for Q 28 is Yes, what are the types of physical (structural) soil and water conservation practices implemented in your farm land?	1. Soil bund 2. Fainya juu 3. Cutoff drains 4. Check dams 5.stone bund 6.Others, specify	
31	If the response for Q 28 is Yes, can you mention the types of biological soil and water conservation technologies implemented in your farm land to control/ reduce erosion hazard and to stabilize the physical structure?	1. Contour planting 2. Grass strip with Desho grass 3. Crop cover 4. Live fencing 5.Agroforestry practices 6. Others, specify	
31	If the response for Q 28 is Yes, Which family members implement watershed management (practices) activities?	1. Men 2.Women 3. Other family members	
32	If the response for Q 28 is Yes, Who enforced you to implement watershed management practices	1. Myself 2. Watershed management committee 3. Kebele administration 4. Development Agents	

	implementation?	5. District Agriculture officials 6. Others, specify	
33	Have you get benefit from the implemented watershed management practices?	1. Yes 2. No	
4	If the response for Q 33 is Yes, what are the benefits obtained from implemented watershed management activities?	1.Reduction of erosion, flood overflows 2. Maintain and increase the moisture holding capacity of the soil 3. Increase amount of water recharge (yields) 4.Increase Fodder and grass supply 5. Increase the forest coverage 6. Maintains and increase land productivity 7. Increase productivity / Crop production 8. Increase animal productivity / production 9. Others, specify	

VII. Extension services towards watershed management practices

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35	Did you get extension services (information) about watershed management practices?	1.Yes 2.No	
36	If the response for Q 35 is Yes, from where Did you get extension services (information) about degradation and management of watershed from the following institutions?	1. From DA's 2. From neighbors 3. From mass media 4. From NGO's 5.From District agricultural experts 6. Other, specify	
37	Have you attend any training regarding watershed management practices and related issues by agricultural experts or other experts at your area?	1. Yes 2) No	
38	If your answer to Q. 37 is yes, What are the methods used to transfer the intended information or support?	1) Training 2) field visit and technical support 3) demonstration 4) materiel supply 5) others, specify	

Declaration

I, the undersigned, declare that the thesis is my ordinal work, has not been presented for a degree in any university and that all sources of material used for the thesis have been duly acknowledged.

Bechaye Tesfaye Tessema

Date ----------

Signature----------