ASSESSMENT OF LAND MANAGEMENT PRACTICES AND ITS CONTRIBUTION TO LIVELIHOODS AT HOUSEHOLD LEVEL: ACASE OF EDO SUB- WATERSHED WONDO GENET WORED SIDAMA ZONE SNNPR, ETHIOPIA

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ASSESSMENT OF LAND MANAGEMENT PRACTICES AND ITS CONTRIBUTION TO LIVELIHOODS AT HOUSEHOLD LEVEL: ACASE OF EDO SUB- WATERSHED WONDO GENET WOREDA SIDAMA ZONE SNNPR, ETHIOPIA

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THESIS SUBMITTED TO

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DECLARATION

I hereby declare that the Dissertation entitled **LAND MANAGEMENT PRACTICES AND ITS CONTRIBUTION TO LIVELIHOOD AT HOUSEHOLD LEVEL**: **THE CASE OF WONDO GENET, SIDAMA ZONE, SNNPR, ETHIOPIA** submitted by me for the partial fulfillment of the M.Sc. in soil and water conservation engineering is my own original work and has not been submitted to any other institution for the fulfillment of the requirement for any course of study. I also declare that no chapter of this manuscript in whole or in parts is lifted and incorporated in this report from any earlier work done by me.

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LISTS OF ACRONYMS AND ABBREVIATIONS

AAFRD:	Alberta Agriculture, Food and Rural Development
ANRS:	Amhara National Regional State
CSA:	Central Statistic Agency
FAO:	Food and Agriculture Organization
FGD	Focus Group Discussion
HH:	Household
KII	Key Informant Interview
SAADSRD:	South Africa Agriculture Department and Scientific Research and Development
SNNPR	South Nation and Nationality People Region
SPSS:	Statistical Package for Social Science
WWAO:	Woreda Agriculture and Natural Resource Office

ABSTRACT

In Ethiopia land is a source of income and means of production on which the livelihood of 85 percent of the population depends. The study was undertaken in Edo sub-watershed Wondo Genet Woreda Sidama Region Ethiopia. The main objective of this study is to assess land management practices and its contributions to livelihoods at household level in the study area. For this study data were collected from 185households respondents from study area. The basic data used for this study were collected from sample households, focus group participants and key informants interview and field observation through structured questionnaire and semi-structured checklists. Descriptive statistics and binary logistic model were employed to investigate association between demographic, socio-economic and institution land management practices. The practiced land management in the study area include: manure application, traditional ditches, stone check dam, soil bund, sand bag check dam, tree planting, crop rotation, intercropping and mixed cropping for land management. Land management practices played a crucial role in arresting runoff, to improved wetlands to down stream and help to reduce erosion hazard. Land management practices had contribution to Environmental performance indicators like soil fertility, soil erosion and vegetation cover but not significant effect. Farmer application of land management practice could possibly be influenced by different factors. Among these factors most have significant association on the practice of management. Whereas other factors were no significant association on the land management practices. This includes age (P=0.034), sex ($P_{=}$0.005*), marital status ($P_{=}$0.000*), extension service ($P_{=}$ 0.002*), livestock (P=0.000*) and, educational status (P=0.040*) of household were significant factors in land management practices. However, family size (P=0.076**), farmer experience (0.849**), farm size (P=0.258**), farmer level of perception (P=0.675**) and income of household (P=0.222**) no significant factor on practicing land management in general. As a result, it is recommended that the woreda's soil and water conservation experts should create awareness to the local people about land management and its contribution.

Key words: *Land Management Practices, sub watershed, Livelihoods and Ethiopia*

CHAPTER ONE

1. INTRODUCTION

1.1. Background of the study

Land is defined as the ensemble of the soil constituents, the biotic components in and on it, as well as its landscape setting and climatic attributes. The most common indicator of the state of the land is its vegetation cover (Safriel, 2007).

The traditional management of land based resources, coupled with a growing interest and reliance on various products and services from those resources poses a challenge for managing the natural resources (Fikru, 2009).

Current global developments call for more thoughtful management of the land. These developments include: the increased demand for land-based agricultural products for rapidly growing world population; the increasing scarcity of water, fuel, and minerals; the impacts of global climate change, increased commodity prices in the agricultural sector, and growing competition for land resources. Globally, large areas of land are being affected by land degradation, partly resulting from unsustainable land use. This is particularly the case in developing countries, which are especially vulnerable to overexploitation, inappropriate land use, and climate change. In Ethiopia, the availability of natural resources as well as their dynamics and management vary considerably from area to area.

(Zeleke *et al*., 2005).

Ethiopia has been in continuous struggle to achieve the objectives of economic development and Environmental protection. However, a significant increase in agricultural productivity could not be attained where the land resource base is continuously degraded. Hence, sustainable land management is necessary for agricultural growth in Ethiopia (Birhanu, *et al.*, 2010). On farm soil preparations such as minimum tillage, mulching and tied ridging, as well as

large scale land management practices (e.g. terracing, soil/stone bund construction, use of grass/forage strips and other agro-forestation, watershed conservation, irrigation and drainage)(Getachew,2010).

1.2. Statement of the Problem

The renewable natural resources of many African countries have come under severe stress over the past three or four decades and most indicators point towards a continuation of this trend.

The rate of degradation and depletion of these resources has been accelerated in proportion to the increasing population pressure. Deforestation, loss of biodiversity and a high rate of land use change have degraded the environment so that the food security and economic development of many countries are threatened. In Africa, it is estimated that about 500 million ha, or about one quarter of its dry lands, are affected by different types of soil erosion. The rate at which arable land is being lost is increasing and is currently 30-35 times the historical rate (UNEP, *et al.*, 2007).In Ethiopia, the heavy dependence of people‟s livelihoods on agriculture and inappropriate use of natural resources resulted in fast and vast land degradation (Tsegaye, 2006). On the other hand, development of agricultural sector largely depends on land productivity. Farmers cultivate fragile margins on steep slopes previously used for grazing. Many households, particularly those owning little land or with large families, have reduced fallow periods. Consequently, more intensive farming and farming on steep slopes undermined soil fertility while increasing the incidence of soil loss from erosion (Yigremew, *et al.*, 2003).Preventing environmental degradation and alleviating poverty are the major challenges of sustainable development (Badege, 2009). This study was aimed at filling the information gap between land management practices and its contribution to livelihoods at household level.

1.3. Objectives of the Study

1.3.1. General Objective

The general objective of the study was to assess land management practices and its contributions to livelihoods at household level in Edo sub-watershed of Wondo Genet area.

1.3.2. Specific Objectives

The specific objectives of this research include:-

1. To identify biological and physical land management practices in the study area.
2. To assess the Contribution of land management practices to livelihoods at household level in the study area.
3. To assess the determinants of demography, socio-Economic and institutional factors with land management practices in the study area.

1.4. Research Questions

1. What type of existing biological and physical land management practices in the study area?
2. What are relationships exists between land management practices and it's the contributions to livelihoods at household level in study area?
3. What are the demographic, social – economic and institutional, factors affecting the land management practices?

1.5. Significance of the Study

The purpose of this study was to assess land management practice and its contributions to livelihoods at household level. The main purpose of this study was demographic, socio-economic and institution influence the investment of household commits and contribution of land management practices for livelihoods in order to enhance environmental restoration and sustainable livelihoods and thereby to draw possible conclusions that contribute to the future improvement of the design and implementation of conservation programs.

1.6. Limitations

All of the data were collected by interviewed all sample households and direct observation of land management practices. The other most important limitation of the study was lack of willingness by some of farmers to give genuine information on some issues, for example information on land management practices and their income. It has been tried to consider production and similar data required for this research. However, these were not fulfilled due to constraints of limited time, paucity of data resources and limited financial support and insecure of environment by conflict of two nations in the study area.

1.7. Organization of the Thesis

This paper is organized in to five different chapters dealing with different topics. Chapter one elaborates the introduction part of the study including background, problem statement, objectives, significance and limitation of the study. Chapter two presents literature review, which encompasses definition, different land management practices and its contributions to livelihoods at household level. Chapter three deal with the research methodology which includes both qualitative and quantitative approaches of the study area. Chapter four the results and discussions are presented and finally, Chapter five presents the conclusions and recommendations.

CHAPTER TWO

2. LITERATURE REVIEW

2.2. Concepts of Land Management Practices

According to Hurni (2000) described the concept of land management practice as the application of productivity enhancing farm practices such as terracing, fallowing, planting trees, organic manure, construction of soil and water conservation structures, fencing the farm land. Land management is a complex process, which is not only the result of will or act of land users. Its problems and achievements go beyond the households domain operation to include actors in the surrounding environment (Hurni *et al.*, 2007).Improvements in agricultural productivity require a more efficient and sustainable use of rural resources and it calls for the adoption of improved land management practices. It combines technologies, policies and activities that are aimed at integrating socio-economic principles with environmental concern so as simultaneously maintain production, reduce level of risk, protect the potential of natural resources and prevent soil and water degradation, be economically viable and be socially acceptable (Regassa, 2002). Land refers to natural resources such as soils, water, and living organisms which are available in pre- defined spatial unit (land unit) (Hurni, 2000).Land resource is very important to the livelihood of all people those who are dependent on agriculture and as the output of agriculture purely depends on land resource. Thus, lack of access to agricultural land increases incidence of poverty in rural areas and quality land has a direct bearing on the productivity of agriculture (Singh, 2008).

Natural resource management systems are core to sustainable development. Characterized by a high level of complexity, and shaped by unpredictable external and internal changes, these management systems aim to address sustainability conflicts, which we face from global to local scales. These conflicts reflect the urgent need to change our current modes of production, consumption patterns and technological choices to balance human wellbeing with ecological and social resilience. Overexploitation of natural resources, devastation of environmental services and an increasing number of social conflicts following the unsustainable use of natural resources demonstrate the wide gap between the objectives of sustainability and current resource management practices.

On the one hand, this gap results from the shortfalls of static approaches based on standard economic models like the maximum sustainable yield (Carpenter *et al.*, 2002)

2.3. Land Management Practices in Ethiopia

Agriculture is the dominant economic sector in Ethiopia that accounts for about 45% of the GDP, and 90% of the foreign exchange earnings, and supports about 85% of the employment. The vast majority of the population lives in rural areas and derives their livelihoods directly or indirectly from agriculture. The agricultural sector is predominantly subsistence in nature, in which the major part of farm production is for household consumption. A mixed farming system, involving both crop production(predominantly raid-fed) and livestock rearing activities, is the dominant type of production system (Medhin *et al.*, 2008; MOFED, 2010).

Land management in Ethiopia has involved into various farming systems with a different level of intensification (Wogayehu, 2006).

Gete *et al.*, (2006), classified the land management practices which have been applied in Ethiopia into two broad categories which is indigenous and introduced, with different degrees of acceptability, areal coverage and based on their benefits. The acceptance and implementation of these management practices are depends on farmers willingness, which in turn request continuous and effective activities from agricultural experts and researchers. In fact, it is not easy to put common criteria to categorize land management practices in to indigenous and introduced. As a result, this categorization is done based on the direct purposes of the management techniques why farmers apply on their farmlands (Tadesse, 2011).

2.4. Biological and Physical Land Management Practices

Land management includes maintenance of soil productivity. This requires the combination of soil treatment including application of mineral and organic fertilizers with soil and water conservation measures (implementation of agronomic, soil management, and physical measures such as contour ridging, terracing or providing ground cover through mulching, use of plants and leaving crop residue (Woodfine, 2009).

The practices including diversified cropping systems (strip cropping and mixed intercropping),integrated agronomic practice (multiple cropping, mulching, and strip cropping),

structural soil erosion practices (terraces both soil and stone bund),soil management practices (compost, green manure and fertilizer usage) and cultivation practices like minimum tillage and conventional tillage are the most sustainable land management practices and are a key mechanism for effective change in the sustainable use and management of land resources (Webb, 2004). Soil management in general soil nutrient management in particular is critical to successful agriculture. Soil management includes all activities that reduce nutrient loss and increase its availability in the root zone of crops (Namara, et al.2007).

Fail to take care of soil resources leads to poverty of agricultural land in losing its fertility because of erosion and soils become at risk in its macronutrients if fertilization takes place without suitable soil testing to assess the need of crop growth. Good soil management is a key to sustainable farming operation. In most cases, there is no conflict between good, profitable farming, improving or maintaining soil fertility and good environmental management, since they all require that soils are maintained and improved, since every soil related management always benefits all the economic production and at the same time the environmental quality. It is also clear that bad soil management can vary quickly reduce the value of land for agriculture and lead to environmental problems (Unilever, 2010).

2.4.1. Biological Land management practices

Applying organic matter improves soil structure, which in turn increases infiltration and soil water holding capacity also increases the nutrient level and increases the activity of soil organisms. This all includes the use of compost which is effective in improving depleted soils, the use of green manure legume crops which is important to improve soil fertility and applying the combination of manure and organic fertilizer to enrich soil in its fertility status (Kinyangi, *et. al.*, 2012).

Many of the farmers used crop rotation as a means to conserve soil fertility by planting legumes one year and non-legumes the following cropping season, e.g., bean or lentil, then barley or wheat. Farmers also incorporate legumes in their crop rotations approximately every four years. Other traditional soil conservation practices are contour pluoghing, grass strips and tree planting. The traditional way of pluoghing graded contours is used by nearly all farmers (Vagen, *et al.*, .1996).

Cultivation of proper crops: Cultivation of row crop in sloppy lands permits soil erosion. In this filed, the crops particularly cereals, fodder crop etc. should be broadcasted and the plants remain haphazardly in field. As a result, the movement of water gets obstacle and more water is absorbed in the soil, thus reducing soil erosion. Mixed and intercropping (Cowpea-Vigna catjang, with cotton – Gossipum Sp, maize – Zea mays with soyabean – Glycine max etc.) practice checks the soil erosion and avoids the risks of the crop failure.(Adimassu, *et al.*, 2012)

A forestation: means growing of forests where there were no forests before owing to lack of seed trees or due to adverse factors such as unstable soil, aridity or swampiness. Along with afforestation, reforestation should be undertaken which means replanting of forests at places where they have been destroyed by uncontrolled forest fires, excessive felling and lopping. Afforestation is the best means to check the soil erosion.Cited the following points in support of vegetation check erosion as follows :(Million, 2001)

Mulching: Mulches of different kinds such a leaves, straws, paper, stubbles, etc. minimize evaporation and increase the absorption of moisture and protect the surface of the land against the beating action of rain drops. Later on the decay to form humus which improves the physical condition of soil. Natural mulching also helps in the infiltration of water and the reduction of evaporation (Defra, 2005).

Organic manure: Organic manures improve the soil structure. The crumb and granular structure increases the infiltration and permeability in the soil and conserve the soil water. Consequently soil erosion decreases (Grande, *et al.*, .2005).

Good tillage: Tillage is the mechanical manipulation of soil by different kinds of implements. Tillage makes the soil loose and friable which helps in retention of water. The special method of tillage practices should be followed for the conservation purposes. Tillage may consist of several types of soil manipulation such as ploughing, harrowing, cultivation etc. (Nyssen, *et al.* 2000)

Agro forestry: Trees can be incorporated within a farming system by planting them on terraces, contour bounds and as ornamental around the homestead. This reduces soil erosion and provides additional needs to the farmers (Berhanu, 2000).

2.4.2. Physical Land management Practices

Conservation tillage is often confused with no-till described in vague terms, such as such as minimum tillage, mulch tillage, ridge tillage, strip tillage, and reduced tillage, where planting is achieved on specially prepared surfaces with various amounts of crop residue cover(Hobbs,2007).

Terracing: A terrace is an embankment of ridge of earth constructed across the slope to control run off and to minimize soil erosion. A terrace reduces the length of the hill side slope, thereby reducing sheet and rill erosion and prevents formation of gullies. According to MarcinK.*et al.*, 2011.there are different types of terraces as follows

Bench terracing: It consists of transforming relatively steeps land into a series of level or nearly level strips or steeps running across the slope. The soil materials that are excavated from the upper part of the terrace is used in filling the lower part and a small bund is also raised along the outer edge of the terrace to check the downward flow of rainwater and also soil erosion.(Sang, *et al.* ,2006)

Narrow based terrace: It consists of making a number of narrow based ridges or bunds at a distance of 1m to 2m across the slope of the land at suitable intervals in high rainfall areas (Van, 2003).

Broad based ridge terrace: It consists of making wide but low bunds on the contour lines by excavating soils from both sides of terrace. This is practiced in areas where the rainfall is relatively low

Contour trenching: It consist of making a series of deep pit (i.e. 2ft. wide and 1ft. deep) or trenches across the slope at convenient distance. The soil excavated from the trenches is deposited on the lower edge of the trenches where forest trees are planted.(Berhanu, 2000)

2.5. The Contribution of Land Management Practices

2.5.1. The Contribution of Land management in Livelihood

Land is the foundation for all life-sustaining processes on earth. Land supports the vast proportion of earth's biodiversity and underpins a wide range of ecosystem goods and services that humanity depends on for survival (Adams et al., 2000).

Land as one of the natural resources base plays a substantial role in the national economy of a country.

Particularly in Africa where the majority of the populations derive their livelihood from agriculture, land resource is the major source of household employment and income (Omiti et al., 2000).

The development challenge is therefore identification of the proper institutional arrangements that will prevent over exploitation of common resources by enhancing wise utilization of common resources. Therefore, designing a natural resource conservation mechanism to achieve sustainable development that fulfills both economic and social objectives remains a problem to be tackled (Aklilu et al., 2006).

2.5.2. The Contribution of Land management Practices to Resource Conservation

Terracing and several other land management practices can increase productivity fairly quickly by increasing soil moisture retention, and thus are profitable for farmers in lower-rainfall areas of the northern Ethiopian highlands (Pender et al.,2004).

Proper use and management of agricultural land implies improving land productivity through encouraging different conservation and rehabilitation mechanisms and rational utilization of the country's land resource. This strategy is targeted mainly to chronically food-insecure, moisture deficient and pastoral areas. The focus is on environmental rehabilitation to reverse the current trend in land degradation, and as a source of income generation for food insecure households. Watershed- based water harvesting and introduction of high value crops, livestock, and agro forestry development are new elements in the revised strategy (Demana, 2012).

In general, improving land management practices can reduce soil loss by erosion agents through increasing soil organic matter and moisture content and through different tillage operations especially on sloppy areas. (Oldeman,1992).

2.6. Livelihood System

The usefulness of livelihood based approaches to development has been recognized since late 1980s when the concept was popularized by international agencies such as; World Commission on Environment and Development (WCED). The growing popularity of livelihoods as analytical construct led shifts in development thinking towards participatory, people centered and holistic approach to development intervention. Livelihood approaches reflect the diverse and complex realities faced by poor people in specific contexts.

Livelihoods analysis can identify causal factors behind vulnerability and food insecurity (Devereux *et al.,* 2004). **.** Livelihood is sustainable when it can cope with and recover from shocks and stress and maintain and enhance its capabilities and assets both now and in the future, whilst not undermining the natural resource base (Rick, *et al.,* 2002).

2.7. Determinants of Land Management Practices

Government policies and programs, socio-economic and institutional factors, farmers local knowledge and practices, households‟ endowments of physical and human capital as well as topography, soil type and climate are the most important factors that could influence land management practices (Tadesse, 2011). Study conducted in Beressa watershed of Ethiopian by Amsalu (2006) identified that farmer‟ age, farm size, perceptions on technology, slope, livestock and soil fertility to have an influence in the adoption of stone terraces. Another study by Erito (2006) focused on the adoption of physical soil water conservation structures in Anna watershed of Hadiya Zone identified that perceptions about soil erosion problems, farmers‟ attitude towards a new technologies and participation on conservation training have significant positive influence on farmers decision to retain conservation structures.

CHAPTER THREE

3. MATERIALS AND METHODS

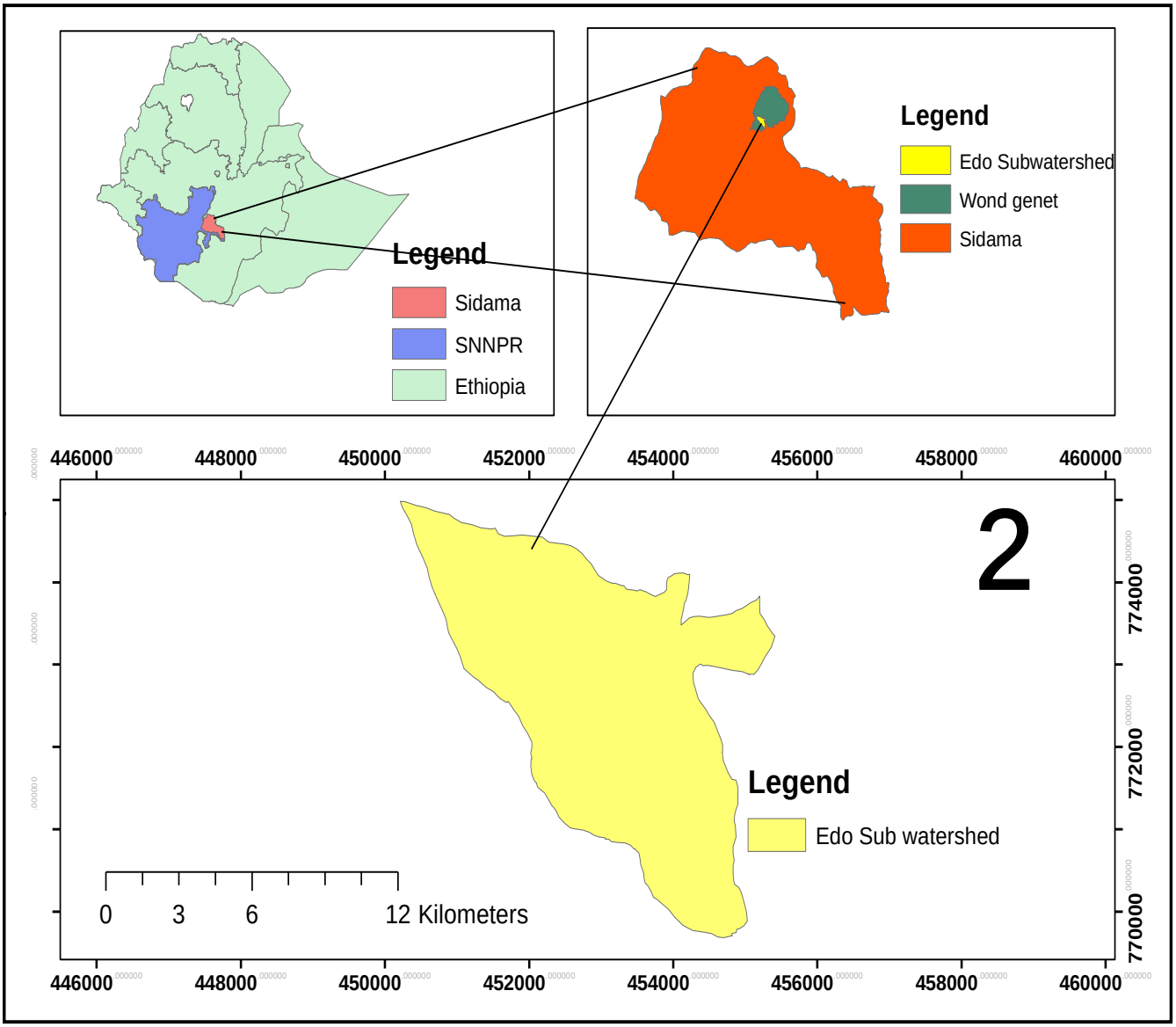
3.1. Introduction

Generally this chapter describes the methodology used to achieve the objectives of the study.This chapter also covered the descriptions of the study area, survey population, sampling size, sources of data, data collection techniques, data processing and analysis.

3.2. Description of the Study Area

The study was conducted at Wondo Genet Edo Sub-Watershed, in Sidama Region Ethiopia (Figure3.1). Wondo Genet is located 270 km South of Addis Abeba and 24km from Hawassa. Geographically lied from 6°54′0″ to 7°7′45″ N and 38°31′33″ to 38°41′20″ E and covers an area with an altitudinal range of 1600 to 1950 m. a.s.l.The site receives a mean annual rainfall of 1128mm with minimum and maximum temperature of 110C and 260C, respectively. The Woreda has 225.00 Square Km and it has 13 Kebeles (WANRO, 2019).

Figure 1



3.3 Population

The total population of the Woreda is 132,275, of whom 66,982 are males and 65,293 are females, from whom in the Edo Kebele, the total population are 12248, of whom 6250 are male and 5998 are female (1966 households) (WANRO, 2019).

3.4. Economic Activity

The economic activity is mixed farming (crop production and livestock rearing) and agriculture is the main source of income for the population and characterized by cash crop (chat) production and *"Enset"* as a major livelihood strategy. Trade and services activities are going on at the center of the Woreda. *"Enset"* is mainly used for household consumption purpose the major livestock managed in the area include cattle's, caw, horse, donkey, sheep, chicken and goat (WWAO, 2019).

3.5. Farming Systems

The focus of the farming systems in Edo sub-watershed is in sufficient household food production and surplus to market for income. Farmers practice mixed farming system where crops and livestock are produced by the same household. Due to land shortage, most crops are intercropped. Common intercropping systems include chat and coffee based system, maize intercropped with haricot beans, and a variety of horticultural crops (tomatoes, cabbage, carrots, potatoes, onions, fruits, spices, etc.).Land allocation to different crops is mostly influenced by the economic importance, food preference by individual farmers and seasons.

3.6. Sampling Procedure and Sampling Size Determination

Currently, Wondo Genet Woreda is divided in to 13 Rural Kebeles. The area of five Kebeles is under the Dega claster and eight Kebeles Woyna Dega claster agro ecologies. Edo sub watershed was selected using purposive sampling method because it was representative and it is model by land management practices in the woreda and Ecohydrology demonstration project site. The total number farmer household of Edo sub-watershed is 1966. However,since it is difficult to collect the data from such a large number of HHs population, the researcher determined a sample size by the use of a mathematical sampling technique:

n=

$$\frac{N}{1+N(e2)}$$

Where n = the desired sample size

N = Population size of the household head

α = the margin of error from 93% of confidence level (Miller, 2003)

$$\mathbf{n=} \frac{1966}{1+1966(0.07)2} \mathbf{=185}$$

3.7. Methods of Data Collection

For this study was used both primary and secondary sources of data. Primary data was be obtained through by observations**,** questionnaire, focus group discussions, and key Informant Interview. A secondary source of data was obtained through document review and analysis.

Questionnaire

Researcher used questionnaires as major instrument to collect primary data from the sample identified households of the Edo sub watershed. In this research, the researcher prepared open and close- ended types of questionnaire. The questionnaire consist different types which are related to the topics of the research. The questionnaire was administered to the randomly selected household heads.

Focus Group Discussion

Focus group discussions with six to eight discussants in each group were carried out on different issues of land management practices and its contribution for household level. These discussions were involved unstructured and generally open-ended issues of types of land management practices and its contribution that are intended to elicit views and opinions from the participants. The elderly farmers, village leaders, developmental agents and socially respected farmers who are known to have better knowledge on the present and past environmental, social and economic status of the study areas, to substantiate the data collected.

Key Informant Interview

Key informant interview is one of the other methods used to collect primary data. It was used to collect in depth information about land management practice of Edo sub-watershed. The information gathered through key informant interview was used to complement and supplement the data collected from household survey through structured questionnaire and other sources too. In this study, the key informants were development agents, Edo kebele soil and water conservation experts and Edo kebele agro forestry experts. Check lists were developed and used to guide the interview.

Field Observation

Field observation was started while writing the proposal and continued onto the whole process of data collection to make sure the validity of acquired information. It was aimed on understanding the local condition of the community in terms of their socio economic condition, current condition of land management practice, land utilization and natural resource etc. During the walk, the researcher took notes on the land management practice and its contribution to livelihood at household level, livelihood strategies and topography.

3.8. Method of Data Analysis

The collected data was analyzed using both quantitative and qualitative methods of data analysis. The quantitative data were analyzed using descriptive statistical techniques and econometric analysis (binary logistic regression model) provided by the Statistical Package for Social Sciences (SPSS version 21).Binary logistic regression model was used for the strength of relationship between independent and dependent variables influencing the land management practices. For the Household interviewed, focus group discussion, informal key informant interviews and field observation notes, a qualitative analysis was used. Qualitative data was analyzed in the form of narrative description. Individual ideas and some case stories are also presented and narrated thematically. Similarly, data collected using observation including pictures taken from land management practices.

3.9. Econometric analysis

Logit models give guarantee for the estimated probabilities but never lie outside (0, 1) interval and the relationship between probability of event (Pi) and the explanatory variable (Xi) is nonlinear (Gujarati, 2004). For this study the logistic distribution function (logit) model was selected based on previous study by (Yesuf et al., 2008; Deressa et al., 2010 and Temu, 2013) the determinants of land management practices adoption done by logit model. The dependent variable was dichotomous, and equals 1 if the ith household is adopt but becomes 0 otherwise in model. Following Gujrati, (1995) and Hosmer et al, (1989) the logistic distribution function for the adoption of land management practices can be specified as: Pi= 1 1+ $e{-}zi$……1

Where Pi is a probability of adopting a given practice by ith household head and zi is a function of explanatory variables (Xi). The odds to be used can be defined as the ratio of the probability that farmer adopts the practice Pi to the probability that he or she will not adopt is 1- Pi.

$$1- Pi. = 1\ 1+ ezi \text{……..……2}$$

$$pi\ 1- Pi= 1+ e\square i\ 1+ e-zi= ezi \text{…….....3}$$

$$pi\ 1- Pi= 1+ ezi\ 1+ e-zi=eBo+\sum BiXi \text{…….……4}$$

Taking the natural logarithm of the odds ratio of equation will result in what is known as the logit model as indicated below:

$$(1- Pi) = [eBo+\sum BiXi] \text{……5}$$

$$Z = Bo+\sum BiXi \text{…….……6}$$

Hence, the logit model for adoption of land management practice was a function of household heads' age, education level, sex, family size, land size, total income, and total livestock unit. Therefore, the model employed has the following form, with error term:

Pi (LMPA) = Z = β0+ β1Age + + β2income + β3 land size…+ β14x114+εi Here, β0 stands for the intercept term, while Xk are the hypothesized determinants of land management practice adoption and βk are the parameters to be estimated. Data was diagnoses before making the analysis to check the data whether they have defect that influence parameter estimates and helps to take measures. Variance inflation factors (VIF) technique have been employed to detect multicollinarity in continuous explanatory variables (Gujarati, 2004) and contingency coefficient (CC) for dummies and categorical variables. According to Gujarati (2004) VIF (Xi) can be defined as VIF (Xi) = (1/ 1−R2)

Where R2 is multiple correlation coefficients between x and other explanatory variables.

For continuous variables, according to Gujarati, (2004) if the value of VIF is 10 and above, the variables are said to be collinear. For dummies and categorical variables, if the value of Contingency coefficient is greater than 0.75, the variables said to be collinear. Contingency coefficient computed by:- CC = χ2 1+x2

Where: CC = Contingency coefficient, n= sample size. χ2= Chi-square value

CHAPTER FOUR

4. RESULTS AND DISCUSSION

4.1. Land Management Practices in the Study Area

Results of the focus group discussions and in-depth interviews indicated that land management practices have been started many years. According to participants in the focus group discussions, key informant interviews and personal observations, at Wondo Woreda Edo Sub-watersheds farmers used both biological and physical land management practices. From this management practices widely used from both land management methods at study area included: Application of in organic fertilizer, inter cropping, mixed cropping, crop rotation, tree planting, soil bunds, stone bund, check dam, Traditional ditches **(**boyi**).** According to (WWAO,2020) the land management practices at study area a total of manure application 256ha,325ha mixed cropping,125ha inter cropping,73 ha crop rotation 295h tree planting, 35ha soil bund,105 ha traditional ditches, 4ha Gabion,1.5ha stone check dam have been constructed over the degraded hillsides.

4.1.1. Biological Land Management Practices

4.1.1.1. Manure Application

As results indicated that application of manure is used by many farmers (37.83%) in order to improve the fertility of the soil and protect soil erosion. Manure consisting of animal dung and urine, is the best form of organic fertilizer. Farmers used manure mainly near the homestead. Manure application is the first used method of soil improvement next to mixed cropping and planting trees and inter cropping. Contrary to this finding, Shiferaw,*et al.* (1998) reported that farmers use manure to improve fertility of soil and protect soil erosion. Farmers in the study place had reported heavy dependence on cow dung for family fuel consumption that there would be no enough manure for soil improvement. Yet, during the FGD with key informants and DAs, farmers (especially, those who were poor) have increased the use of manure applied because of the high current price of inorganic fertilizers

4.1.1.2. Mixed Cropping

FGD with key informants and DAs as told mixed cropping is widely practiced in the study area. Farmers used to inter planting two or more crops together with some root edible plants. The great majority of the cases are a mix of Chat, Inset and Coffee. Mixed cropping in the area helped the potential to improve soil fertility by having a crop on the land for a longer period of the year. Also, it served for them to cultivate different crops at one time on a single farm land.

4.1.1.3. Crop Rotation

According to FGD, the use of crop rotation is another widespread phenomena in the study area where maize, potato, tomato and cabbage rotationally. The method was observed in 5.40% of the farms surveyed. Farmers also pointed out that this measure is effective in moderate to low slope conditions. Crop rotation is used by the farmers important for different reasons including soil fertility, there by improved crop yield. The farmers of the area know that as of the scientific method improved soil fertility can be achieved by alternating high residue producing crops with the growing low residue producing crops.

4.1.1.4. Tree Planting

Tree planting by itself improve land management. Only a minimal amount of soil is moved through pitting. Thus, the slope remains stable and resistant against erosion. Trees provide close canopy, improve infiltration of moisture in the soil, provide mulch and organic matter, recycle nutrients, and provide high protein manure or animal feed. They also produce wood and other products for various uses. As the survey result indicted that Respondents from Edo sub-watershed, reported as they planting trees around cropland areas and fruits like: Papaya, mango, Banana, and avocado plantations. This may be due to better accesses to information about the importance of agro forestry practices and accessibility of market opportunity. As a result of this, the informants in Edo sub-watershed reported that they were beneficial from such agro forestry practices to earn extra cash income. In this sub-trial two high value tree species, Avocado (Persia Americana) and gravillea robusta were evaluated for their performance to be integrated as boundary plants. Initially due to prolonged dry spell in thearea the survival and growth rate of both seedlings were affected. In additional used tree species in study areas has **Eucalyptus trees.**

Eucalyptus trees have grown widely and have become the dominant tree type in the area. The respondents in the focus group discussions indicated that the main reason for preferring eucalyptus trees was their fast growth and

tolerance of environmental stress. However, the peasants suggested that the eucalyptus trees have adverse effects on the ecology, especially on water resources by causing desiccation, and consequently the land may not be used productively in other ways. For this reason the farmers in the study area do not expand their croplands into the eucalyptus tree plantations, but keep reasonable distances in between. Despite their adverse impact, eucalyptus tree plantations have continued to expand rapidly. The respondents associated this with the trees‟ role in controlling the expansion of gullies and to removing excess water from wetland. It was reported that many people plant trees to stop the expansion of gullies into their cropland and grazing areas and thereby they also met their household needs for fuel wood, building and other necessities. In response the question „where do you plant trees?‟ the farmers (household heads) answered „along and inside gullies‟. There is a trend towards „more people, more trees‟ in the study area, which is in line with the reports made by Muluneh (2003; and unpublished data, 1994) and Woldeamlak (2002). This trend may be a result of the ongoing community a forestation programmed and private initiatives to check the expansion of gullies around croplands. The household level tree planting practice is a praiseworthy initiative because it could have ecological advantages. However, the increase in tree plantation coverage does not imply a favorable change towards sustainable land use and land cover because most of the newly planted areas are planted with eucalyptus trees (to check the expansion of gullies) which are known to have numerous negative ecological effects.

4.1.1.5. Inter Cropping

As household interviewed with observation, inter cropping patterns include food crops (i.e. maize and haricot beans) with cash crops (i.e. coffee and banana), (chat and coffee). Maize is normally intercropped with haricot beans, and sometimes coffee and banana, to make optimal use of limited landholdings. Some horticultural crops such as tomatoes, cabbage and potato are mono cropped. Information from KIIs and FGDs farmers practices intercropping mainly to ensure the availability of food from different crops and to obtain animal feed on continuous supply,

it also improves soil fertility through crop diversification and provides soil cover to protect the impact of rain drop on soil and minimize erosion. the same to result Ministry of Agriculture (2001) reported that, the aim of intercropping is to increase productivity of the land and to protect the soil against erosion. As household interview shows the drawback of intercropping was, during shortage of rain there was crop fall due to shortage of moisture.

Table1 Types of biological land management practices

No	Types of biological LMPs	frequency	percent(%)
1.	Application of manure	113	61.1
2.	Mixed cropping	128	69.2
3.	Crop rotation	70	37.8
4.	Tree planting	128	69.2
5.	Inter cropping	127	68.6

4.1.2. Physical Land Management Practices

At study area farmers next to the biological conservation measurements used physical conservation measurements. This physical measurements at study area are, soil bund, stone check dam, soil bag, gabion check dam and traditional ditch (boy).

4.1.2.1. Soil bund

During discussions with key informants in the study areas, the farmers mentioned that ineffective designs by the development agents are responsible for causing gullies. Farmers use mostly soil bunds that are impermeable intended to maintain all rainfall but when overtopped at one location was cause gullies unless they have specially designed spill ways.

Depth of the bund was in the range of 30-50cm, and spacing between successive furrows depends on slope and crop type. It requires little technical input and also minimal time and labor for construction especially when using oxen plow. However, the disadvantage of this structure as explained by the farmer at study area it requires a lot of maintenance in a short period due to being filled with soil immediately after heavy rainfall and did not allow oxen plough. It is mainly implemented on cultivated land with slopes in the range of 8% to25%, but also on grazing land with gentle slopes at wider intervals (Lakew *et al.* 2005).

It is constructed to control runoff and erosion from cultivation fields by reducing the slope length of the farm which ultimately reduces and stops velocity of runoff. These structures are effective in controlling soil loss, retaining moisture and eventually enhancing productivity of the land. These structures were installed at a vertical interval (VI) depending on the slope of land and the size of the ditch can be 0.5m deep by 0.5m wide at the beginning of the bund length are10m.

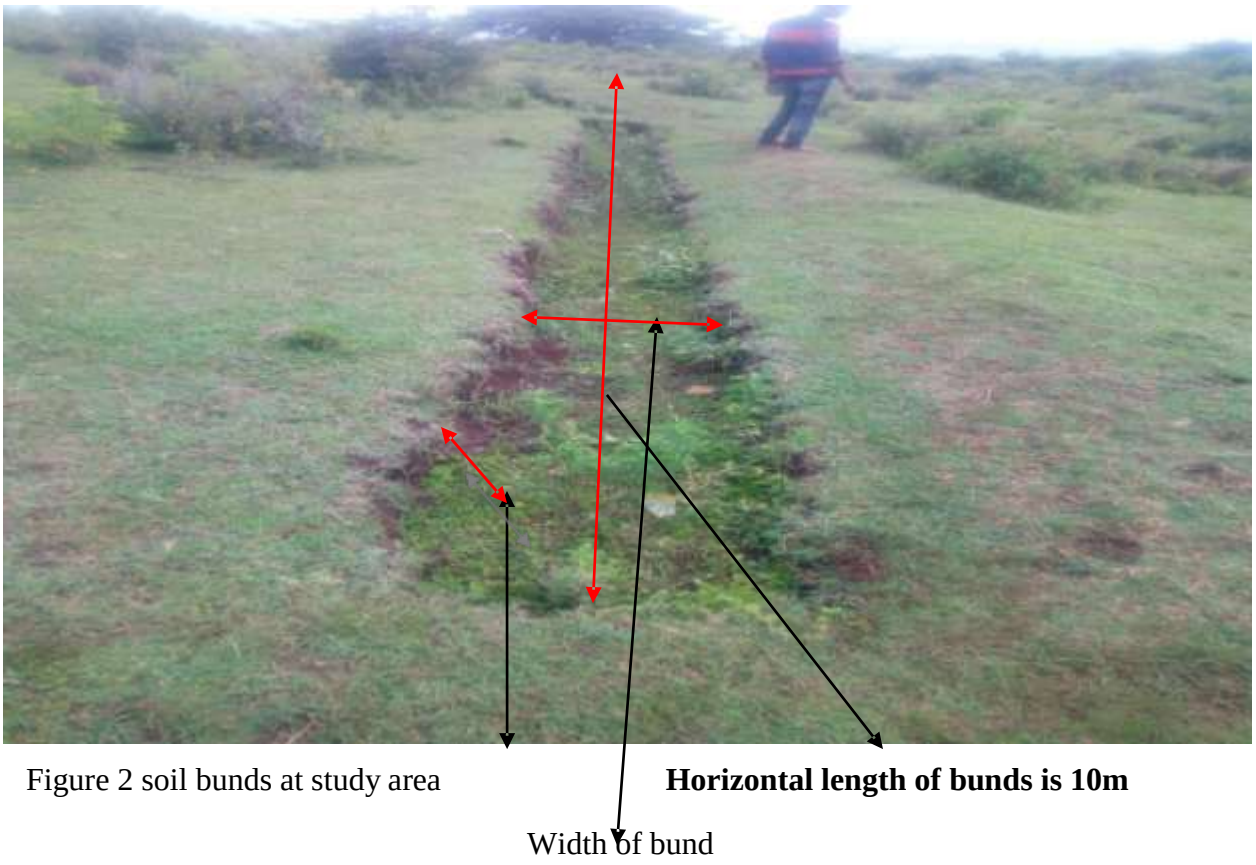


Figure 2 soil bunds at study area

4.1.2.2. Stone Check-Dam:

According to key informant and field work, the structures have similar characteristics in terms of Effect, purpose and time of construction with that of soil bunds. However, Stone check dam are permanent and less durable structures constructed on gentle and stepper slopes. Small and medium size stones are the main materials required for the construction of these structures. In the construction of Stone check dam the passage of water through a layer of stone is controlled by applying fine soil in between stones.

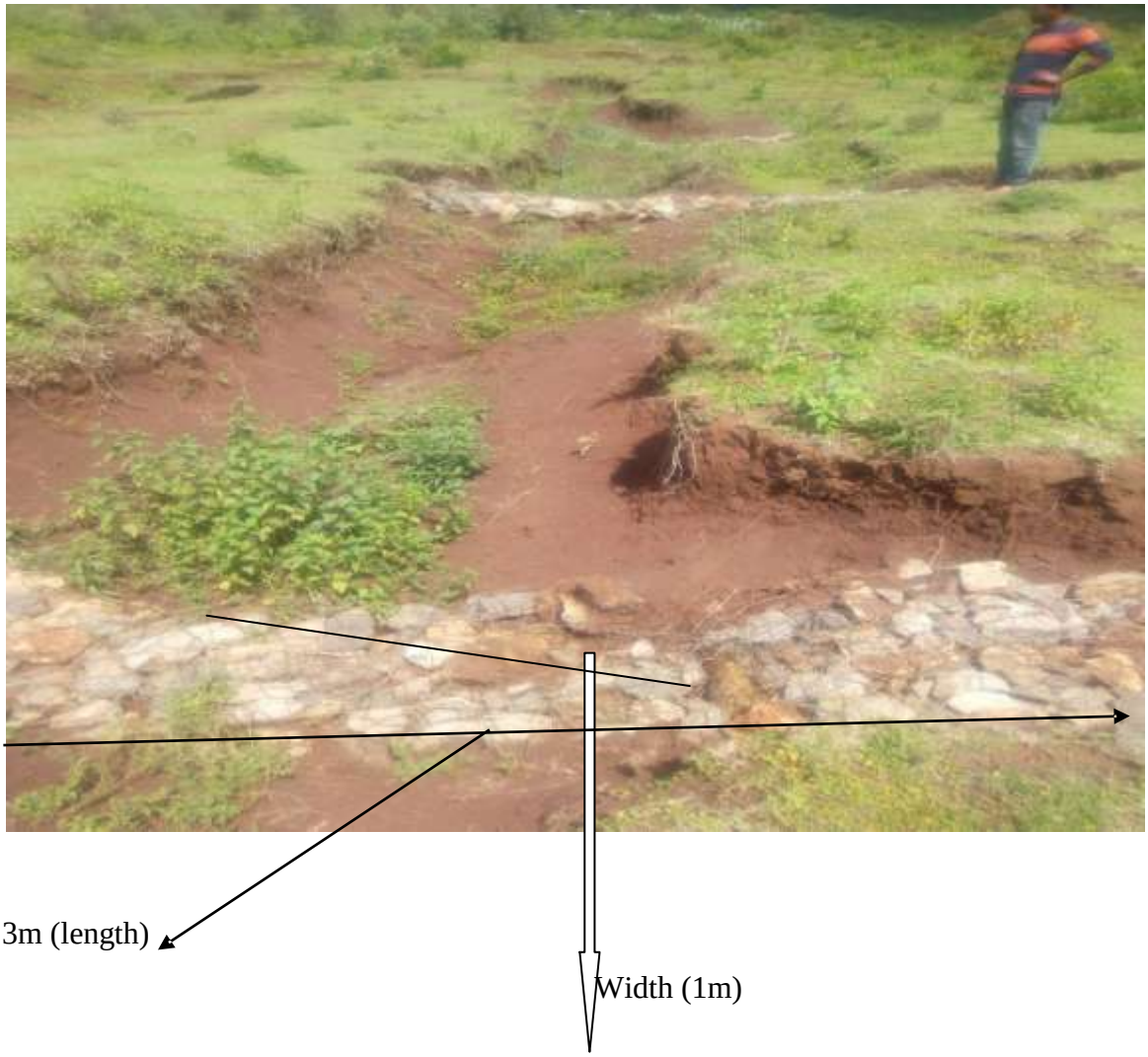


Figure 3 Stone check dam on land affected by soil erosion

4.1.2.3 Soil/sand bag Check-Dam

According to In FGDs with farmers and key informant interviews with reported that Sandbag check-dam was constructed two year ago in the study area. One bag contain (50 kg) filled with soil and the bags are piled up to a maximum of 2 layers to form a small check dam. This cheap technique is particularly useful in area with insufficient supply of stones for building ordinary check-dams. However, sandbag dams have not been controlled gully erosion in the study area, while they are not suitable for the treatment of large gullies.

Figure 4 Soil bag check dam

4.1.2.4. Traditional Ditches (Gadawe)

According to In FGD with farmers and key informant interviews with development agents reported that, this is the most important land management practice prevailing in the area. As to design of the structure, it is done by cutting ditches down the slope on both sides and sometimes also along the upper boundary. For its construction and maintenance simple local tools such as hoes and spade are used and also it requires little or no technical input. Are used to drain excess water from farmlands during high rain time especially in July and August and done most of the time by hoes and spade. The respondents reported that traditional ditches are constructed every cropping season and run diagonally over the cultivated land. Depending up on the slope gradient of the farm plots, farmers make ditches with certain interval. The distance between two consecutive ditches decreases with slope gradient. However, the distance is not based on scientific measurement and varies from plot to plot. The main purpose of traditional ditch is to protect the soil from water logging. Sometimes farmers make ditches to drain water from flat fields during long growing season. The main advantages of traditional ditches is that it takes less time and can be made by hoes and spade, hence, it requires less time and labor as compared to other conservation measures.

Figure 5 Traditional ditches

Table2 Types of physical land management practices

No	Types of physical LMPs	Frequency	percent (%)
1.	Soil bund	54	29.2
2.	Stone bund	52	28.1
3.	Soil bag	58	31.4
4.	Traditional ditches	61	33

4.2. Contribution of Land Management Practices to Livelihoods at Household Level

According to (Tadele, 2016) land management practices have significantly contributed to the improvement of income for adopters in the lowland agro-ecology. In particular land management practices useful for addressing challenges of livestock feed scarcity; combating soil erosion and moisture stress have played important roles in improving crop and livestock productivity for improved local livelihoods in the agro-ecology. In study area all respondents reported that, land management practices were bring in changing and important contribution towards livelihoods. As surveyed results in the study area all people were obtained benefits from land management practices, they have to realize tangible net benefits in terms of production and income as well as environmental improvements. According to (Jabbar, *et al.*2000) differences in livelihood strategies have also led to important differences in land management and in productivity, resource conditions and human welfare. Areas where non-farm employment is important have performed better than other areas in several respects, including improvement in crop yields, food availability, reduced erosion, and improved availability and quality of water. In study area households can earn significant contribution from the outcome of land management practices (on livestock production and productivity, apiculture, vegetable production and better ecosystem).

Figure 6 Contributions of Land Management Practices to Livelihoods at Household

4.2.1. Contribution of Land Management Practices to Crop Production at Household Level

The result indicated that a household was more dependants on crop production for their livelihoods invest more in land management. However, access to financial capital (indicated by the availability of farm income) was also seen to play a role. Farmers invested more in land management when they needed more cash income to pay taxes and to purchase services and competitive markets for selling crops were available and they could obtain good prices for the produces (Tenge *et al.*, 2004).KIIs and FGDs reported that the major economic activity in the study area is characterized by smallholder cultivation of food and cash crops, and agro forestry. Major food crops include maize, and tuber crops (sweet and round potatoes), banana and vegetables. Major cash crops are coffee, sugarcane, chat and fruit (Avocado).Most farmers use locally available varieties; in some cases, they recycle improved varieties after harvest by sorting seeds with good appearance and big size. Key informant reported that land management practices need to be stimulated by further emphasizing improved production and reduced costs. Production benefits are the primary interest of land users, and have direct consequences for livelihoods in small-scale subsistence farming. Small scale farming are major portion of the land used for agriculture, particularly in ecologically fragile areas, is cultivated by smallholder farmers. The same to result Conant, (2009) main benefit of implementing improved cropland management practices is expected to be higher and more stable yields, increased system resilience and, therefore, enhanced livelihoods and food security, and reduced production risk. In the study area, land management is the main source of income. As the result (168) 90% out of 185(100%) the households sales of crop production and.17 (10) % out of 185(100) of the households are sales livestock production. As the result of analysis have been the variations of the mean farm income and off-farm income by the households. The mean income of farm and off-farm households was 12013.50 and 6006 Birr. The both farm and off- farm households income variation shows that land management practices was improved sources of income for livelihoods household level. In study area with high agricultural potential that are more remote from markets, comparative advantage is likely to be greater in production of high value (relative to volume) cash crops such as chat. Even more than in areas of good market access, farmers. Ability to produce crops is likely to constrain their ability to expand production of such products.

4.2.2. Contribution of Land Management Practices to Environment

Findings of the study obtained through KIIs and FGDs with household indicated that, land management practices played a crucial role in arresting runoff, to improved wetlands to downstream and help to reduce erosion hazard. Land management practices had contribution to Environmental performance indicators like soil fertility, soil erosion and vegetation cover but not significant effect. In land management practice, local communities observed the natural resource rehabilitation. Landless community members to whom the treated land was allocated and getting economic benefit from selling grass and livestock husbandry. According to the respondents report and as confirmed by observation, land management practices can have a positive impact on increase water availability downstream, positive impacts by reducing sedimentation, runoff and flooding when water is not a limiting factor. In study area the farm households frequently depend on them to meet other needs, such as fuel, construction materials, to increase incomes sand supplemental foods. The soil erosion decrease and increase fodder, reducing the risk of flood and grass supply products are also another advantage mentioned by all respondents. The same to result Morelli, (2011) Environmental sustainability could be defined as a condition of balance, resilience, and interconnectedness that allows human society to satisfy its needs while neither exceeding the capacity of its supporting ecosystems to continue to regenerate the services necessary to meet those needs nor by our actions diminishing biological diversity. An improved land management practice in study area provides extensive downstream benefits in the form of "environmental services" such as hydrologic function, sediment control, nurseries for fisheries, and biodiversity conservation. As households mentioned that, the landless and young people have conserved the areas by different activities. The areas which were previously found bare are recently rehabilitated , and, the landless people whose means of living previously depending on fuel wood sales has started changing to the production of fruits, vegetables, fodder trees, and commercial timber trees like eucalyptus.

4.3. Demographic, Social – Economic and Institutional Factors with the Land Management Practices

4.3.1. Sex of House Hold

From the sample of 185HH, the result indicates that 145(78.4%) of the heads of household are male and 40 (21.6%) of the heads of household are female, who are single, widowed or divorced.

The chi- square test 25.723, P =0.005 there is strong relationship between sex and land management practice is significant at 95% of confidence level. As result indicated that male headed households have more often than female-headed households. This implies that sex could have influence in land management practices. The household survey results show that sex variation of respondents make significant effects for farmers to practices land management. The male head households more practices land management practices than female households head in study area. The same to result, group discussion with key informant mentioned that, land management practices were almost carry out by male members of the family and female were limited mostly to performing domestic activities. During discussions with women headed households the main reasons why all women headed households are not involved in the land management practices are that female heads have socio-economic issues related to traditional social barriers limit women‟s resources. Women are also more involved in regular household activities than men. In the area, a woman takes most of the household responsibilities (child care, food processing and harvesting, weeding and bringing water). Table 3 the HH survey of sex, age, and marital status of respondents

Sex	Frequencies	Percent
Meal	145	78.4
Female	40	21.6
Total	185	100
Educational level	Frequencies	Percent
Illiterate	46	25
Read and write	46	25
Prime education	43	23
Secondary	29	15
Above secondary	21	12
Marital status	Frequencies	Percent
Single	32	17
Married	109	59
Divorced(separated)	7	4
Windowed	37	20

4.3.2. Age Household Head at Study Area

Age household head was one of the demographic characteristics hypothesized to influence the decisions of farmers on the land management practices. The survey indicated that the age of respondents ranged from 26 to 79 years of age, with an average of 44 years. The t -test shows there is significant age at 5 % level of significance (P=0.034). Farmers in this average age group are assumed to have a good understanding of land management practices due to access to information, and as a result, usually more interested in land management practices.

According to FGD mentioned that, an old age group in which labor shortage can be a hindrance to practicing land management. However, these farmers usually implemented and accepted land management practices because of having access to money for buy inputs to land management practices.

4.3.3. The Family Size at Study Area

At study area household respondents family size majority belongs to the households with 1-4 members constitute 53(29%), 5-8 members constitute 73 (39%), 9-10 members constitute 42(23%),above 11is members constitute 17(%).The study results revealed that 75% of respondents agree on having large number of children or large number of family size. The size of family members can be seen from two different angles. The first when there is large family size in which the majority of family members are capable of working and it is very important for land management practices. On the other hand having small number of children requires additional labor to construct and maintain land management.

Table 4 the family size of respondents at study area

Family size	Frequencies	Percents
1-4	53	29
5-8	73	39
9-10	42	23
Above 11	17	9

4.3.4. Income Sources of Farmers at Study Area

Below the table3 indicates that the frequency and the percentage distribution sample household heads by income. Accordingly, about 68 (37 %) of the respondents had mean annual income of 5000-10000, about 77(42%) of respondents had mean annual income between 10000-15000birr. While, about 20(10.5%) of the respondents had mean annual income of 15000-20000birr. The remaining 20 (10.5%) of the respondents had mean annual income greater than 20000 birr. According to respondents, income is one of the factors which affect land management practices. During focuses group discussion of respondents thought that when lack of money to by fertilizers it limited to manage the lands. This indicates that can cost much money and needs large number of labor forces and give better role for large family members. This suggests that there was interested in land management practice.

Table 5 HH income source

Annually income Sources of respondents	Frequencies	Percents
5000-10000	68	37
10000-15000birr	77	42
15000-20000birr	20	10.5
20000 birr	20	10.5
Total	185	100

4.3.5. Farm Size of Household Respondents at Study Area

Farm size is important factors which affects the practice of land management practices. According to the respondents who are holding large size of farm land it is positively related to land management where as those who are holding small size of farm have negative attitudes towards land management. The size of farmland owned per household has been shrinking since so long due to the ever increasing human population. The majority of the sample households (91.4%) have less than one hectare.

Table 6 farm size of household

Farm size of household	Frequencies	Percents
0-1 ha	98	53
1-1.5 ha	52	28.1
1.5-2 ha	22	11.9
above 2 ha	13	7
Total	185	100

4.3.6. Marital Status at Study Area

The household survey results regarding to the marital status respondents show that, from total respondents 32 is single, 109 is married, 7 is divorced or separated and 37 is widowed. The chi- square test 27.731 and the p-value 0.000 there is significant association between marital status and land management practices is significant at 95% of confidence level. The marital status of respondents shows that about 59 percent of the respondents were married. This refers that the land management practice were married farmers more land management practices in the study area.

4.3.7. Educational Status at Study area

Results of the household survey show that the household survey results regarding to the educational status of respondents show that, 46 respondents has Illiterate, 46 has ability to read and write, 43 primer education ,29 has secondary education and 21 respondents has above secondary education (16 household respondents has diploma and 5 has degree). The household survey results regarding to the education level respondents show that, the chi- square test 10.875 and the p-value 0.040 there is significant association between respondent‟s education level and land management practices is significant at 95% of confidence level. The survey result shows variation statistically significant at less than 5% p-value level. Thus, literacy could have contribution in land management practice in the area. During FGDs and KIIs they also explain that level of education is one of the demographic features of households which play crucial role to increase farmer

knowledge about land management practice. More literate farmers are assumed to increase the ability to obtain process and use of information relevant to the use of new technology. In addition, high rate of literacy increases the capacity and ability to obtain and apply relevant information concerning the use of land management practices. The same to this idea (Jabbar, *et al.,* 2000) educational improvements appear to have contributed to several aspects of agricultural intensification and technology adoption, including use of fertilize and vaccines, some intensive land management practices such as composting, planting trees and live fences. Despite this, there is a puzzling association between education and declines in soil fertility and yields of some crops. This may be related to the fact that fallowing is declining more rapidly in areas where farmers are more educated. In fact, higher education level of farmers could have brought differences among farmers in their awareness about land management practices in general. As educational status of a household head increases, is assumed to increase the transfer of relevant information increase.

4.3.8. Experience at Study Area

As the respondents explain, experiences is the year of farmers who lose for farming With longer experience in farming, knowledge, skills, and attitudes are gained on the agricultural operation including land management practices. So, farmers with longer experience are less conservative and convinced. It is more likely that farmers with longer fanning experience was ready to accept changes and adopt new ideas and techniques for the increase of production on their farm including land management practices. However household survey shows that experiences weak relationship with land management practices, insignificant at 95% of confidence level.

Table 7 farmer experiences at study area

experience of house hold	Frequency	Percents
5-10	61	33
11-15	42	22.7
16-20	48	25.9
21-25	34	18.4
Total	185	100

4.3.9. Livestock

The household survey results regarding to the livestock respondents show that, the chi-square test 17.769 and the p-value 0.000 there is significant association between livestock and land management practice is significant at 95% of confidence level. As household explained that livestock play a central role in environmental protection, food security, and human health and land management and major role in reducing the negative effects of soil erosion in the stud area. They are critical for asset building, soil-nutrient cycling, and they constitute a sustained and irreplaceable source of macro- and micronutrients, especially for women and children. In designing interventions for mixed farming systems, researchers and their partners need to understand the complex interactions between people, livestock, crops and the environment.

Table 8 Survey HH respondent's responses for livestock production

Do you participates in animal husbandry	Frequencies	Percent
Yes	126	68.1
No	59	31.9
Total	185	100
Animal type	Frequencies	percent
Oxen	46	6.2
Cows	245	33.2
Horses	5	0.7
Donkeys	15	2
Goatees	25	3.4
Sheep	56	7.5
Chicken	346	47
Total	738	100

At study area mainly practices animal types are mentioned above the table. However, from those Animal types mainly practices animal types are chicken and cow. Because of chicken and cow more adapt the study environments rather than others livestock. The total number of livestock of the sampled households was 738, equivalent to three livestock per household. cows accounted for 33.2%, sheep for 7.5 %,goats for 3.4%, for oxen for 6.2%, horses for 0.7% , donkeys for 2% and Chicken for 47%.TLU (Tropical Livestock Unit) is equivalent to 250 kg live animal weight.

4.3.10. Extension Service at study area

The household survey results regarding to the Extension Service show that the chi- square 12.318 and the p-value 0.019 there is significant association between respondent‟s extension service and land management practices is significant at 95% of confidence level.

Access to extension service of the household has strong relationship with tendency of land management practices. Extension contacts play a great role in raising awareness about land management practices. By doing so the increased awareness would enhance farmers‟‟interest on land use. According to discussion of focus group, institutional factors had played major roles in the land management practices. Institutional Strengthening in Edo sub-watershed (Ecohydrology demonstration project site) through the districts of Wondo Genet area was an important input in the land management practices.

Table 9 HH survey Access to extension services at study area

From Where Do You Get Technical Advice and Information Concerning LMP/technology?		
	Frequency	Percent (%)
DA	115	62.2
from media (TV, radio)	25	14
Woreda SWC expert	12	5.8
Non	33	18
Total	185	100

4.3.11. Farmers level of perception

In the study area farmers‟‟ perception of soil erosion and recognizing it as a problem is an important factor that influences the land management practices. Differences level at farmer perception were field surveyed as higher level of perception is 107(57%), medium level perception is 56(30.3%), lower level perception is 22 (11.9%).The household surveyed show that insignificant at 95% confidence level.

Table 10 farmer level perception

Level of perception	Frequance	Percent
High	107	57.8
Medium	56	30.3
Low	22	11.9
Total	185	100

CHAPTER FIVE

5. CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

Biological and physical land management practices have in the study area. Such as soil bund, stone check dam, traditional ditches, gabion check dam, soil/sand bag check dam, Manure application, mixed cropping, inter cropping, crop rotation and tree planting.

Moreover, land management practices should not only be aimed at minimizing soil erosion but should also cover other household objectives, such as the improvement of Soil fertility, increase crop production and improve income at households. Finally, the livelihoods of the individual farmers show hardly any direct links with land management practices.

Based on the result of this study, demographic, socio-economic factors and institutional factors affect both biological and physical land management practices. An econometric estimation of selected variables that were hypothesized to affect the land management practices was done using logistic model .The study also revealed that sex (significant at p=0.005), age (significant at P=0.032), marital status (significant at P=0.000) education level (significant at P=0.040), livestock (significant at P= 0.000), extension (significant at P=0.002), have positive influence on land management practices while household size, farm size, experience, perception of the households in relation to soil erosion have negative effect on land management practices in the study area and they were not significant.

5.2. Recommendations

Make effective use of organic fertilizer by increasing the amount of manure and crop residues produced and used as organic nutrient sources. This is central to achieving the long-term need for increased biomass production for food and soil fertility, and hence sustainably higher productivity, needed to break the poverty cycle. Conservation works are done more by farmers who took training and experience sharing tour on improved land management practices. Therefore, the Ecohydrology demonstration project should provide training and experience sharing tour (extension support) and financial incentives at different levels.

Moreover, technical support by extension workers on the layout of such structures must be strengthened.

In this study the contribution of land management to income and land resource conservation is not depends on time series data and it is better if further study is conduct by using time series data and effect of land management practice on soil fertility are supported by experimental work.

Finally, the researcher also recommends conducting further study in the area to examine the relationship between demography, socio-economic and institution and the land management practices and its contribution to livelihoods at household level.

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APPENDXES

Appendixes 1

Part1: Interview Guides Protocols for the farmers‟ house hold heads.

General back ground information of respondent

1. Date of interview……

2. Name of Kebele----------

3. Respondent Name of ----------

4. Sex of household head; 1.Male 2. Female

5. Age----------

6. Household family size

Family members	Sex		Total
	Male	Female	
1-4			
5-8			
9-10			
Above 11			

7. Marital status 1. Single 2. Married 3. Divorced 4. Widow

8. What is educational level of household?

1. Illiterate 2. Primary school Education

3. Read and write 4 Secondary schools Education 5.Others

9. Household head experience in land management in years_____

1.5-10 2.10-15 3.15-20 4.20-25

10. What is your main economic activity?

1. Crop production 2. Livestock 3. Mixing farming 4. Other

11. What amount income you earn from your income source in year?

1.5000-10000 2.10000-15000 3.15000-20000 4.Above 20000

1. Please list your livestock in number and Types in the following Table.

Types of livestock	Number
Oxen	
Cow	
Sheep	
Goat	
Horse	
Donkey	
Mule	

12. Perception of household on soil erosion 1.Low 2.Medium 3.high

13. Do you get extension service? 1) Yes 2) No

13.1 If yes, who provides the extension service? 1) Development agents (DAs) 2) NGOs

3) All 4) others, specify ___

13.2 How often you have been visited by DAs last year? 1) Once per month,

2) Twice per month, 3) Three times per month

4) Others, specify-_____

13.3 How often you have obtained extension advice on land management practices?

1) Once per month 2) twice per month 3) Three times per month

4) Once per three month 5) Twice per three months

6) Others specify_____

Part 2: Questionnaires on land management practices

14. How many hectares do you have?

1. <0.5 ha 2. 0.5 ha-1.0 ha 3. 1 ha-1.5 ha 4. 1.5 ha-2.0 ha 5. >2 ha

15. What is the slope of your land?

1. Flat 2. Moderately steep 3. Steep slope

16. Have you participated in community conservation activities this year?

1) Yes, 2) No

17. Do you practice land management in your land? 1. Yes 2. No

18. What are your major sources of information for the land management practices?

1. Friends and relatives 2. Extension agents 3 Television and Radio 4. Non

19. If "yes" for question number (18) what types use the physical and biological land Management practices?

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20. Which of the following factors limit implementation of different land management practices in your land?

21. What are determinants that affect the land management and resource conservation practices on the farmer‟s adoption rate?

1. Demographic factors 2. Economic factor

3. Socio factors 4.Institutional factor 5. All

Part 3: Questionnaires on Contribution of Land management strategies to Livelihood

22. How you rate the fertility of your soil? 1. Good 2. Medium 3. Poor

23. Does the implementation of land management practices bring change on your livelihood?

A. yes B. No

24. What are the contributions of land management practices for you?

Appendix 2. Key Informant Interview

For development agents (DA)

1. What is modern land management practices implemented in your area?
2. By what criteria does the local community select each land management practice?

3. Do you use some kinds of resource conservation practices to maintain soil fertility of your cultivated land?
4. How you describe each land management practice regarding to reduction in soil erosion, crop production, Environment and income diversification?
6. What you thing the challenge for effective land management practice and also what are the best remedies?

Appendix 3: Focused Group Discussion

For farmers

1. Do male and female farmers equally participate in land management and resource conservation practice?
2. What are land management practices you have been using to increase your production?
3. What are the major challenges to land management practices?
4. What are the criteria that use to select land management practice?
5. What are the major livelihood strategies in your area?
6. Do you really believe that land management has impact on the livelihood of the community?

Appendix4: Description and summary of the variables used in the binary logistic model (n = 185)

Independent Variables	B	S.E.	Wald	Df	Chi-square	Sig.	Exp(B)
SEX	1.871	.662	8.000	1	25.723	.005*	6.496
AGEHH	-.061	.028	4.615	1	32.576	.032*	.941
EDULEV	-.351	.171	4.205	1	10.875	.040*	.704
MARSTAT	1.159	.325	12.688	1	27.731	.000*	3.188
FAMSIZE	.440	.248	3.146	1	6.854	.076**	1.552
EXPHH	-.039	.206	.036	1	5.890	.849**	.961
INCOME	-.302	.247	1.489	1	0.915	.222**	.739
FARMSIZE	-.278	.246	1.279	1	3.597	.258**	.757
LIVESTOCK	4.041	1.160	12.134	1	17.769	.000*	56.869
EXTEN	-3.977	1.278	9.686	1	12.318	.002*	.019
PERCEP	-.178	.425	.175	1	11.689	.675**	.837
Constant	-2.949	1.846	2.553	1		.110	.052

Source field survey, 2020, statistically significant* statistically not significant** .Number of observed 185 sample households