STUDIES ON FACTORS THAT DETERMINE FARMERS WILLINGNESS TO PARTICIPATE IN SOIL CONSERVATION PRACTICES AT GINDEBERET WOREDA, WEST SOA ZONE OF OROMIA REGION, ETHIOPIA. `

A THESIS

SUBMITTED TO INDIRA GANDHI NATIONAL OPEN UNIVERSITY, St. MARY'S UNIVERSITY COLLEGE, ADDIS ABABA, ETHIOPIA

IN PARTIAL FULFILLMENT OF THE RE QUIREMENTS FOR THE DEGREE OF MASTER OF ART IN RURAL DEVELOPMENT

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SEPTEMBER 2011

ADDIS ABABA

DECLARATION

I hereby declare that the Dissertation entitled STUDIES ON FACTORS THAT DETERMINE FARMERS WILLINGNESS TO PARTICIPATE IN SOIL CONSERVATION PRACTICES AT GINDEBERET WOREDA, WEST SHOA ZONE OF ORMOMIA REGION, ETHIOPIA, submitted by me for the partial fulfillment of the M.A. in rural Development to Indira Gandhi National Open University , (IGNOU) New Delhi is my own original work and has not been submitted earlier to IGNOU or 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 part is lifted and incorporated in this report from any earlier work done by me or others.

Place: St. MARY'S UNIVERSITY COLLEGE, ADDIS ABABA, ETHIOPIA.

Date: 25, Septem.2011 Signature _____

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CETIFICATE

This is to certify that Mr. ABAYNEH MEKONNEN Student of M.A.(RD) from Indira Gandhi National Open University , New Delhi was working under my Supervision and guidance for his project work for the Course MRDP – 001. His project work entitled STUDIES ON FACTORS THAT DETERMINE FARMERS WILLINGNESS TO PARTICIPATE IN SOIL CONSERVATION PRACTICES AT GINDEBERET WOREDA, WEST SHOA ZONE OF ORMOMIA REGION, ETHIOPIA, Which he is submitting, is his genuine and original work.

Place: St. MARY'S UNIVERSITY COLLEGE, ADDIS ABABA, ETHIOPIA.

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Biography

The author was born in north Shoa Zone of Oromia state Kuyu Woreda in Sombo Cheka PA in April 1966, He complete his primary education in Garba Guracha Elementary school. His secondary school education was entirely held at Fitche senior secondary school. After passing the Ethiopian school Leaving certificate Examination (ESLCE), he joined the Jimma Collage of Agriculture in September 1984, and graduate with diploma in the field of General Agriculture after two years of course work. He was employed at Illubabore Zone Agricultural Development office as Agricultural development agent and different assignments. In 2004 he joins Alpha University College and graduate with BA degree in the field of management after four years of course work. Since then he had been working as agriculture department head at the project level for Menschin fur Menshin foundation of nongovernmental organization in west Shoa zone of Oromia state.

Acknowledgements

I highly indebted to my advisor, Dr. Mengistu Hulluka; for which without his encouragement, insights, guidance and professional expertise the completion of this work would have been impossible.

My special appreciation also goes to Menschen fur Menschen foundation Gindeberet Integrated Rural Development project (MFM-GBIRDP) for supporting me for this research work as well as their invaluable technical advice during the whole research work. Furthermore, my particular thanks go to Ato Dejene Chimdi, Ato Tekaligne Fufa and all technical staff of MFM-GBIRDP for their participation in the survey work as enumerators. I also appreciate my colloquies Ato Berhanu Bedassa for his helpful comments during data analysis for this study and his continuous encouragement.

I wish to convey my hurtful thanks to W/t Wosene Chala for full typing the report without any reservation and also for Ato Seife Lemmas' helpful comments during editing the report.

I am also indebted to managing staff of Gindeberet district Agriculture and Rural development office, planning and program office, Administration office for providing the necessary information to this research.

I extend gratitude to my great lovely and dedicated sister W/r Aynalem Deribe, who she is the sources of my strength and the driving force for my achievements.

I also extend sincere gratitude to all individuals particularly farmers who have participated in fieldwork and as well government and non-governmental organization of west shoa Zone.

Finally, I wish to appreciate all other unmentioned Institutions who have supported the researcher while undertaking this research. However, all the findings and views express in this study are those of the author and do not necessarily reflect the views of either individuals or institution.

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ACRONYMS AND ABBREVIATIONS

AISCO	Agricultural input Supply Corporation
CBOE	Commercial Bank of Ethiopia
CSI	Central Statistic Authority
DA	Development Agent
FAO	Food and Agricultural Organization
GDARD	Gindeberet District Agriculture and Rural development
GDP	Gross Domestic product
Ha	Hectare
KM	Kilometer
M.a.s.l	Meters above Sea Level
Mm	Millimeter
MOA	Ministry of Agriculture
NGO	Non Governmental organization
NPCR	National population census Report
OADB	Oromia Agricultural Development Bureau
OIB	Oromia International Bank
PA	Peasant Association

Qt	Quintal
WSADD	West Shoa Agriculture Development Department
WTP	Willingness to pay
SWC	Soil and water Conservation

STUDIES ON FACTORS THAT DETERMINE FARMERS WILLINGESS TO PARTICIPATE IN SOIL CONSERVATION PRACTICES AT GINDEBERET WOREDA, WEST SHOA ZONE, OROMIA REGION

Abstract

In Ethiopian, much of the lowlands are characterized by heavy clay soils and low rainfall probably, over 80% of the population live in the highlands, and keeps about 70% of the cattle. It is common for farmers to till or graze slopes with a gradient greater than25% (Milas, 1984; Kebede and Jacob1988). Population increase had resulted in reduction of fallow land while fuel wood and dung collection had deprived the soil of and tree cover.

At the turn of the century, roughly 40% of ETHIOPIA seems to have been forested, in 1984; various estimates put the extent of forest at between 2% and 4% (Timberlake, 1985; Mackenzie, 1987). Measures which can be used to mitigate or avoid desertification, such as, appropriate forestry, fuel wood supply plantations, dry land cropping strategies and range managements have received more attention during the last decade.

The ETHIOPIAN highlands are among those agricultural lands in Africa that are threatened by accelerating land degradation, due to soil erosion.

In response to the extreme degradation of the soil resource base, new land conservation technologies have been introduced in some areas of the Ethiopian highlands, through food for work incentives. However, the technologies failed to win acceptance by the land users. So far, conservation projects failed to consider the land users' socio-economic, demographic and technical factors from the very inception. In order to design a useful plan of action it is

necessary to understand local peoples' response to soil conservation plans. Therefore, the major concern of this study is to identify determinants of farmers' willingness to participate in soil conservation practices that address farmers' socio-economic, demographic and institutional factors. It is also aimed at assessing farmers' perception of erosion hazards and their willingness to pay.

The study was conducted in Gindeberet District, West Shoa, Oromia region, west Ethiopia. A total of 100 farmers had been surveyed in the study area in August and September 2011 to generate the data used in the study.

The result of the study reveals that among 17 variables hypothesized to influence farmers' decision to participate in soil conservation practices in the study area, six variables of found powerful.

The education level of the house head was found to have a positive and significant impact on farmers' willingness to participate in soil conservation practices, implying that educated farmers where more opt in understanding the problem of soil erosion and could easily decided to take part willingly.

Farmer's perception of erosion hazard was found strongly and positively associated with farmers' willingness to participate in soil conservation practice. About 80 % of the respondents who were willing to participate in soil conservation practice perceived soil erosion as a problem.

The size of shared farm land was negatively related to the participation. It attributed to the fact that share cropping agreement may have short time horizon. Therefore, the higher the size of land a farmer shared the less likely it is that he make conservation investments.

Non-crop land affects the willingness of the farmers to participate. This is because as more land is put out of production, the farmers realize a reduction in their productive land and tend to be unwilling to invest in conservation measures.

Conservation undertaking in the past was positively related to the participation. Because of farmer who knows the available option for taking soil erosion is more responsive to conservation undertakings.

The attitude of the farmers towards soil conservation was found to affect positively the willingness to participate in soil conservation practices. This is possibly because of responsiveness to soil conservation technology which will differ positively with the strength of conservation related attitude.

CHAPTER ONE

1. INTRODUCTION

1.1.Background

The Ethiopian Economy is mainly based on Agriculture. This economic sector is the largest and slowest growing sector. About 90% of the nation's population depends directly or indirectly on this sector. It contributes also more than 45% of the GDP and over 90% total export earnings of the nation. It absorbs 85% of the labor forces and still remains the backbone of the economy of the nation (Belay, 1998; Tesfaye, 1995).

The country is one of the sub- Saharan Africa countries faced with pervasive poverty, high rate of population growth, insufficient food production and degradation of natural resource base. According to CSA (central statistic Authority), 1995, about 72% of farm house holds cultivate holding of less than 1 hectare and the average holding size is 0.8 hectare.

In the predominantly agrarian societies of Africa, one of the most ominous threats to food supply is environmental degradation, the degradation of croplands, grasslands and forests (Alemneh, 1990) land degradation and continuous fall in agricultural productivity in countries of sub- Saharan Africa have raised serious conceits in the international level (world Bank, 1992). In many agriculture based Developing countries environmental degradation takes mainly the form of soil nutrient depletion and loss of food production potential. Reversal of the erosion induced productivity decline and ensuring adequate food supplies to the fast growing population in these countries pose a formidable challenge (Bekele and Holden, 1998).

The concern about environmental degradation in Ethiopia is high because of the extreme degradation of environment (Tegegne, 1999). The forest land of the country, which once

covered 34% of the total land, has dwindled to a mere 2.7 % (ministry of Natural Resource, 1993). Clearing land for agriculture and cutting of trees for firewood account for the highest amounts of forest destruction.

The Ethiopia highlands, with inherently fertile soil and sufficient rainfall are amongst those agricultural areas in Africa and yet they are threatened by accelerating land degradation (Bekele and Holden, 1998). Half of the highland (about 27 million hectares) is significantly eroded and over one fourth (14 million hectares) is seriously eroded (tegegne, 1999). It is also estimated that over 2 million hectares of farmland have reached the point of no return, and are unable to sustain economic production in the future (Suteliffe, 1993). Maintaining soil fertility is an important step in creating a sustainable agriculture.

The major cause of land degradation in Ethiopia is erosion (Alemneh, 1990). Intensification of cropping on sloping lands without suitable amendments to replenish lost nutrients has led to widespread degradation of land. Available estimates on the economic impact of soil erosion indicate an annual on site average productivity loss of 2.2% from the 1985 yield level (FAO, 1987) land degradation is an economic problem when it reduces productivity on an individual farm. Because of this, the farmer either has to take conservation measures or has to bear the loss of productivity as a result of evasion (Demeke, 1998).

In Ethiopia efforts to install conservation measures on erodible lands were initiated following the 1975 land reform and establishment of peasants associations, which were instrumental in mobilizing labor and assignment of local responsibilities. This was further expanded with the involvement of the world food program, which had been providing food- for work incentives for conservation activities in the 1980s and early 1990s (Bekele and

Holden,1998). Even if considerable areas of erodible land have been treated, maintenance of the structures has become a cause for concern to the implementing agencies (Tato, 1990).

The sustainability of the future depends on our present actions to combat soil degradation and to introduce sustainable use of resources; there is a need to take action participant the local people in design and preparation of conservation measures. Farmers have a worth of knowledge about their problems, needs, environment, etc. that can be useful for planners. Moreover, farmers show greater readiness to accept, and participate in development programs that directly address their needs (Zemenfes, 1995).

This study was undertaken in Gindberet District, Oromia regional state, west Shoa zone, West Ethiopia. At present this area is facing extreme soil erosion. The principle factors responsible for the problem include very steep topography, inherent erodible nature of the soils and expansion of farmland by cleaning forest. The study is aimed at identifying the factors that determine farmers' willingness to take part in soil conservation practices, assessing farmers Perception of erosion problems and generating base line information for policy intervention.

1.2. Statement of the problem

Agriculture faces a new challenge in the coming century to feed more people on less land, without degrading the natural resource base. The very definition of sustainable agriculture points to a major problem with conventional agriculture 'in that it is inherently unsustainable in the long run. A sustainable agriculture is one that, over the long term, enhances environmental quality and the resource base on which agriculture depends provides for basic human food and fiber needs; is economically viable; and enhance the quality of life for farmers and society as a whole.

Uncontrolled run off flowing down a sloping land will detached and transport considerable quantities of soil particles which can result in gully formation. The resultant gullies may divide a field into several parts obstructing the movement from field to field. Roads, bridges, buildings, and fences are jeopardized by gully development. Soil carried from gullied areas contributes to costly downstream sedimentation damage.

Soil erosion in agricultural system is a very important problem to manage. The productive layer of dirt is called the humus or topsoil. If this soil is eroded away, then the ground is very unproductive in producing crops. High winds can blow away loose soil from flat or hilly terrain. Water erosion generally occurs only on slops and its severity increase with the severity the slop that causes land degradation. Of course there are a number of different methods of reducing soil erosion. Contour tillage reduces water erosion. On hilly area ploughing is done across the hill rather than straight up and down. One problem with this is that some fields shape makes this method impractical. Terrace can also be constructed so to reduce water erosion.

Land degradation is the result of complex interactions between physical, chemical, biological, socio-economic and political issues of local, national or global nature. Some of the causes of degradation are natural hazards, population growth, expansion of agriculture onto forest and marginal lands, poverty, land ownership problems, political instability and maladministration, inappropriate agriculture and large scale expansion of irrigated agriculture.

Area predisposed to disaster include steeply sloping areas ,easily damage soil, lowland close to sea, regions where rainfall is intense ,drought-risk areas ,parts of the earth where hurricanes or similar storm occur, area prone to sudden frost or cold winds, etc .population increase has been one of the frequently cited of land degradation.

The most productive forest lands in the country already been brought into agricultural production. Further expansion of agriculture and grazing now takes place on marginal land,

often on steeply slopes or on soils of poor physical structure or low inherent fertility. Wise land use practices have yet to be developed for such condition. Agriculture expansion on to these land often result in rapid land de gradation, with a subsequent decline in production or for timber also challenges the maintenance of biological diversity. There is an urgent need to develop land use practices that will not lead the type of land degradation now experienced in some part of the country, and that will encourage restraint in clearing forest land.

Structural soil conservation measures were introduced in the district during the military government through campaign work. However, the peasants started to dismantle the conservation structures when the coercive pressure was over. At present, this area is facing extreme degradation the principal factors being very steep topography, inherent erodible nature of the soil and expansion of farmland to hillsides without appropriate conservation measures.

One widely misunderstood subject in Ethiopia is the peasant's perception of their environment. It is misunderstood partly because outsiders, both experts and policy makers, who write about peasants and formulate polices, often have limited understanding about the peasants' environment (Alemneh, 1990). Conservation practices were mainly undertaken in a campaign after without the involvement of the land user. This shows that projects failed to consider local peoples economic, demographic, institutional and technical factors from the very inception of conservation projects. Thus, there is a need to take action on technology development and design of policies and strategies that promote resource conserving land use with active participation of local people.

Investment in land enhancing and conservation technologies become more attractive in these areas as increasing percentage of available cultivated land is degraded. It leads to chronic problems, as its impact had been shown by cyclical and recurrent drought in the north eastern

highlands particularly where population density is extremely high and the land resources is intensively exploited over a long period. Suggestions have been made and policies designed for a strategy of targeting diffusion of land enhancing technologies to be implemented particularly to areas with greater percentage of arable land degradation.

In Ethiopia, research about farmers' perception or soil degradation problem and factors influencing their willingness to participate in conservation practices through cash and /or labour contribution is non-existent except in few area specific studies, which are limited in scope and coverage. The latter provide location specific information and recommendations and, hence, may not help much in designing soil conservation strategies in other areas. In order to design a useful plan of action for environmental protection, it is necessary to understand local peoples' attitudes towards environmental plans.

Therefore, a study on farmers' perception of soil erosion and determination of their willingness to participate in soil conservation practices by contributing cash and/ or labor is useful for development of projects that address land users' economic, demographic, institutional and technical factors.

1.3.Objectives of the study

The specific objectives of the study are:

- To identify factors that determine farmers' willingness to participate in soil conservation practices,
- To assess farmers' perception of the problem of soil erosion in the district,
- To assess house holds' willingness to pay in cash and/ or contribute in labor for soil conservation practices.

1.4.Significance of the study

Sustainable natural resources management /conservation strategies become the main concerns of nations starting from the last couples of decades, considerably over the course of this century due to growth in the mouths to be fed and propositionally much less level of production and productivity lead to alarming rates of soil degradation and environmental imbalances due to poor management of natural resources (Baidu, 1999)

Investment in land enhancing and conservation works become significantly the major portion of development funds in some organizations and their efforts geared towards designing strategies to promote effective adoption of the one selected to be studied, which do have greater percentage of arable land degradation problem.

Despite the will known environmental problems, planning of the desired interventions, data collections and coordination of activities in the affected areas are proceeding slowly. Ethiopian agrarian policies particularly the extension package program should incorporate aspects of environment conservation and rehabilitation besides the aim of raising farm output.

Environmentally friendly activities require a lot of efforts and devotions in order to be accepted and effectively adopted by the farmers since mostly these activities don't have short-term visible advantages to the producer so efficiency gains coupled with keeping ecology in balance by use of integrated technologies should be demonstrated to the farmer above all.

To combat soil erosion problem many kilometers of bunds and structures have been constructed over croplands in Ethiopia in campaign and food for work incentive.

However, the conservation structures have not been as successful as they could be, because the users (the farmers) were not enthusiastic enough in accepting widely and maintaining the

technology (wood, 1990). The failure of conservation programs partly emerge from the fact that planners and implementing agencies ignore or fail to consider social cultural factors as key determinates of the success of failure of conservation programs. Hence, formulation of conservation projects with participation of farmers from the very beginning is use full for sustainability of the practice. From an economic perspective, perception of the degree of soil degradation problem and its impact on short term returns and land values should be highly correlated with the farmers' willingness to pay for soil conservation measures (Ervin, 1982).

Accordingly, identification of factors that influence farmers' willingness to participate in long- term conservation practices can help policy makers, Non Governmental organization (NGOs) , international organizations, etc. to take appropriate action in formulating project/ plans that curb the problem of land degradation with active particip0ation of farmers. This study is aimed to provide first hand information on farmers' perception of soil degradation problem, their willingness to participate in conservation practices, the factors affecting their participation and the relative importance of the factors on farmers' willingness to participate in soil conservation practices.

1.5.Scope and limitation of the study.

The study was undertaken in Gindeberet district, the west Shoa Zone of Oromia regional state. The study was restricted to limited number of farmers mainly because of limited availability of resource to undertake the study at a wider scale. Although the study is limited both in sample size and area coverage, the results of the study are expected to be of value in designing appropriate conservation polices moreover, the study can serve as a departing point to undertake similar researching other areas.

CHAPTER TWO

2. LITERATURE REVIEW

2.1.Factors Hindering Adoption of Technology

Promotion of different methods and improvement in their effectiveness will provide more choice to farmers so that they can select methods that they consider being the most appropriate to their situation. A range of field, form and farmer specific factors condition the adoption of technologies in agriculture and factors condition the adoption of technologies in agriculture and when we consider soil and water conservation practices factors such as low population density, insecurity of tenure, low initial productivity and limited access to market are expected to discourage adoption In other words presence of higher percentage of degraded farmland, extension education, lower risk aversion and the availability of short term land ,extension education lower risk aversion and the availability of short term profits are important for increasing the adoption and intensity of use of improved conservation measure .

Investment in land enhancing and conserving technologies become more attractive as an increasing percentage of available cultivated land is degraded .This suggest a strategy of targeting diffusion of land conservation technologies particularly to areas with greater rate of degradation.

Deterrent programs have introduced conservation measures on farmlands like construction of soil and stone and planting on mountains .In spite of these tremendous efforts, there, was little adoption of the introduced conservation measures by the peasants during the past decades (Alemneh, 1990). Failures and low adoption of the introduced practices are reported to be attributed mainly to the following cause:-

- Non-participatory nature of the conservation program (planning did not involve peasant, land taken without consent of villagers top down approach);
- peasants lack resources –scarce land ,labour ,capital ,times ,
- Institutional and organization problems- hastily designed, lack of feedback ,low trust of institutions mandated to introduce and promote practices ,
- Approach- lack of other aspects of farm development ,
- Economic-measures could not improve yield and production sufficiently.

The problem in technical feasibility and economic viability are reported to have contributed to a low acceptance of introduced conservation measures by peasant farmers.

Case study of adoption of soil conservation in the Philippines lists the factors determining effective adoption as: personal factors such as age and education level of farmers economic variables such as tenure, land /labour ratio, off farm activities in relation to income, institutional factors like road access, market through extension service, soil erosion potential of the field and slope of the farm in relation to rainfall intensity and pattern, soil physical characteristic. Also in relation to the techniques employed their relative efficiencies and farmers perceptions advantages of the techniques ,to improve fertility status ,yield advantages of land preparation, arresting land slid and gull formation finally hedgerow species planted serving as fodder (Lucile ma, Laper, A.andsushil,P.2001)

Returns to adoption/profitability valued by cost- benefit analysis demonstrated through patterns of changes in yield from fields with and without conservation practices using representative crops held raise adoption levels by farmers .The return structure may be demonstrated as adoption, improvement in soil status, improvement in yield and welfare. Therefore most important physical merits of different structures with species planting and sustained structures versus lost ones in categories of different systems since this factor mostly affect the cost

component. Hence a major challenge to the researchers is to develop methods and tools that permit a more reliable prediction of onsite effects of various land management practices.

In another literature (Morgan, 1981) the difficulties, which hinder the adoption of soil and water conservation measures, are generation as:

1. Social. Landownership and land rights, fragmentation or/and encroachment of poor land, social intera/resettlement against the desire of people, significant of cattle socially as wealth and reluctance to changes,
2. Economic. Element of risk, timing the benefit from the activity, question of who benefits and what are the benefits,
3. Political. Policy implementation, communal versus private ownership of land, land allocation and legislation versus incentives systems employed.

2.2.Environmental Issues in Ethiopia

The problem of environmental deterioration has now become one of the most serious problems confronting mankind. Sufficient attention has not paid to the global long term consequences of activities and as a result, our impact on earth is so subtitle that the vital important conditions of our existence are being affected and deteriorating. Mankind is faced with shortage of clean air to breathe, absence of clean water to drink and degrading of fertile soil to cultivate Increasing global problems such as hunger and desertification, depilation of natural resources and deficiency of energy, pollution and man- triggered changes of climate lead to a better understanding by man of his dependent position in the Earth's biosphere (Tuffa Tulu, 2002).

Ethiopia is a country where natural resource degradation has been going on for centuries. At the present time it is facing a serious ecological imbalance triggered mainly by the fast increment of its population size. This has led to a destructive cycle of land use pattern,

involving deforestation followed by continuous cropping and grazing with little or no investment on the soil. This pattern leaves few opportunities for the natural vegetation to regenerate, making the land more susceptible to erosion, affecting the hydrological cycle and altering the regimes of the rivers. Changing this situation calls for better management of natural resources including putting appropriate polices and regulation in place to facilitate better environmental management (Shibru and Kifle, 1998).

In Ethiopia, the ecological problem is deepening. It is result of misguided and unregulated modification of Ethiopian environment, in particular, the vegetation, soil and natural ecological processes Increases in human and animal population, whose livelihood is based on their fast depletion and serious degradation. Their exploitation has been and still is beyond their self regenerating capacity. The use of unsustainable agricultural practices is also considered as one of the causes of this crisis (Shibru and Kifle, 1998).

Land degradation is the major environmental problem in Ethiopia. It is expressed in many ways including soil removal by sheet and erosion, nutrient depletion by biomass burning including dune and crop residues resulting in a break of nutrient cycle (the Royal Nether lands Embassy, 1999). Soil erosion is a phenomenon, which occurs mainly in the highlands of Ethiopia. Here the surface is rugged, steep and deeply dissected, and slops exceeding 15% are commonplace. In addition, the rainfall is often torrential in many parts thus exacerbating erosion. Beginning around The end of the 19^{th} century, renewable resources in the central, eastern and southern parts of the country have been put under immense human pressure (FAO, 1986).

The major form of soil erosion is water- induced erosion. There is very little, if any, replacement of soil nutrients taken by crops in the traditional agricultural system, thus resulting

in loss of soil fertility. It is estimated that Ethiopia loss 400 tons/ha of to soil every year (Hurni, 1988). The severity of soil erosion could have been limited had it not been for the serious deforestation and removal of biomass cover that have been occurring for centuries and, which in turn have accelerated in the last 30 years. According to Hurni (1988), out of the 52 million hectar of land making up the high lands of Ethiopia, 14 million are severely degraded, 13 million hectares are moderately degraded and 2 million hectares have particularly lost the minimum soil cover needed for crop production. Soil erosion causes a considerable and, in most cases an irreversible soil fertility and productivity loss. The effect of erosion on soil productivity is especially sever in the southern, southeast and south western high lands, where nitosol are the predominant soil types, and most of the soil fertility is concentrated in the top soil (Belay, 1992). To control soil fertility decline, and to have sustainable agricultural development, soil erosion has to be arrested or at least reduced to a tolerable level, that is, to a level below soil formation rate. There are several techniques of controlling erosion and these are broadly grouped under (1) agronomic methods, which aim at controlling erosion by improving the vegetative cover of the soil, (2) soil management techniques, which try to control erosion by improving the aggregation of the soil particles, and (3) structural soil conservation methods, which control erosion by shortening the length and minimizing the gradient of the ground slope (Belay, 1992).

The conservation methods recently introduced in Ethiopia are of the structural type and, the most common ones are the fanya juu and, the normal bunds. Both of these structures consists of narrow ridges and channels that are constructed parallel or at slight angle to the contour in order to control erosion and facilitate terrace development. In the case of the normal bunds, the ridge

or the bund is constructed by digging a ditch and throwing the soil sown hill, while in the case of fanya juu the bund is constructed by throwing the soil up hill.

Effective and sustainable conservation programs cans be designed and implemented only if (1) the causes of land degradation are properly identified, (2)the right conservation technologies are selected,(3) the farmers are effectively introduced in the planning and implementation of the conservation technology. Though socio-cultural factors are central in all of these, they are by far more crucial in deciding the involvement and participation of farmers in the conservation programs (Sander, 1992).

2.3. Definitions and concepts

Adoption of SWC activities:- literally the dictionary meaning is to take over something and have or use it as one's own. In context of conservation adoption could be the people's awareness of the consequences of soil and water abuse and taking appropriate action by using available technology to avert the possible consequences of degradation and we can differentiate two kinds of adoption, the first could be spontaneous adoption, which refers to the voluntary adoption of technologies without external support or assistance other than technical guidance. And the second is acceptance with incentive.

Bunds and terraces: - these are structures, which are commonly used to conserve soil and water on hillsides and farms.

Conservation:- A broader and a more dynamic definition sees conservation as covering "improvement" as will, developing natural resources rationally and thus enabling maximum benefit to be obtained while production capacity is preserved indefinitely (FAO,1983).

Incentive:- Any inducement on the part of the state or other agency which will allow the peasant to absorb additional investments and gradually substitute income because of the works he/she has to carry out on his farm, to change the traditional method with techniques and methods which will ensure the sustained yield of renewable natural resources within his farm and in its area of influence which will also contribute to the latter's higher productivity (FAO, 1987).

Profitability of conservation structures:- the concept of profitability in SWC structures can be looked at from different perspectives, and net returns of conservation works is difficult to analyze since it has both individual and social components with it. Profitability and income stability can be especially important to small farmers who live in the edge of subsistence and operate in an extremely risky agricultural environment, but from the perspective of society we need to resort to social accounting and pricing.

Soil and water conservation (SWC):- activities at the local level which maintain or enhance the productive capacity of the soil in erosion prone areas through prevention or reduction of erosion, conservation of soil moisture, and maintenance or improvement of soil fertility (WOCAT, 2000).

Sustainable livelihood:- A livelihood depends on the capabilities, assets (including both material and social resources) and activities, which are all required for a means of living. A persons' or family's livelihood is sustainable when they can cope with and recover from stesses and shocks and maintain or enhance their capabilities and assets both now and in the future, without under mining environmental resources (Koos Neefies, 2000).

Watershed:- it is an area whose waters converge at its lowest point in a stream or river, which channels them towards a lake, sea or ocean. Its boundary line coincides with the peaks marking the divide between two drainage areas, although in certain special cases it will not necessarily coincide with the topographical basin (FAO, 1987).

Land is a place within, upon, or above which a number of resources may be exploited. Where there is exploitation of more than one resource, this may be mutually compatible, or there may be damaging interactions. Resources vary in character and some are more difficult to manage than others (Ramade, 1984). The term land degradation and soil degradation are often used interchangeably. However, land degradation has a broader concept, refers to the degradation of soil, water climate, and fauna and flora. Soil degradation refers more to water erosion, as well as chemical, physical, and biological (loss of organic matter) degradation (Hurni, 1996). Land degradation, is the temporary or permanent lowering of the productive capacity of land (FAO, 1994). The response of society to land degradation is defined as any set of measures that controls or prevents soil erosion, or maintains soil fertility (Stocking, 1996).

The effects of water and wind erosion are largely irreversible. Although plant nutrient and soil organic matter can be restored, replacing loss of soil is almost impossible. On the other hand, land degradation is reversible soils with reduced organic matter can be restored by addition of plant residues and improved range management of degraded pasture (FAO, 1994). For developing nations, soil erosion is among the most chronic environmental and economic burdens. Many of these nations are in the tropics. Where in just a few hours torrential downpours can wash away tons of top soil from each hectare.

Many others are in the drier zones, where swirling winds and flash floods can be equally devastating. In these regions swelling population, poor land management, Vulnerable soils, and

hostile climates add up to a lethal combination that fosters erosion , bring with it environmental degradation , falling crop yields, rising deforestation, erratic water supplies, and an ever expanding prospect of dry and dusty range land. Erosion is a double disaster: a vital resource disappears from where it is desperately needed only to be dumped where it is equally unwanted (Taffa Tulu, 2002).

Conservation has a wide range of meanings. In general it has two main goals. Namely protection of: (1) habitats, and (2) plant and animals. Protection of habitats includes reduction of soil erosion, protection of water shed areas, control of avalanches, prevention of pollution, protection of historically important features etc. (Taffa Tulu, 2002).

Land degradation may be defined as the loss of utility or potential utility or the reduction, loss or change of features or organisms which cannot be replaced. It is the result of complex interactions between physical, chemical, biological, socio-economic and political issues of local, national or global nature (Taffa Tulu,2002). As stated by stocking (1996), the objective of soil conservation is to achieve consistent and lasting production from loaned while keeping soil loss or below the soils rate of renewal. It is only comparatively recently that soil conservation has been reorganized as a necessary strategy for restoring degraded lands and protecting production. Partly in response to the difficulty of applying high cost solutions in resource poor- environments, and understanding of indigenous respones to land degradation has been developed along with recognition of the conservation value of many traditional systems in developing countries.

2.4.Soil Erosion in Agricultural systems

Soil erosion in agricultural system is a very important problem to manage. The productive layer of dirt is called the humus or top soil. If this layer is eroded away, then the ground is very unproductive in producing crops. Soil can be eroded away by wind and water. High winds can blow away loose soils from flat or hilly terrain. Water erosion generally occurs only on slope. There are a number of different methods of reducing soil erosion. Contour tillage reduces water erosion on hilly areas plowing is done across the hill rather than straight up and down. One problem with this is that some fields' shapes make this method impractical. The terraces can also be constructed so to reduce water erosion.

One method designed to reduce to wind erosion is the establishment of windbreaks. Windbreaks work well in reducing wind velocities over fields, but they have one serious drawback to farmers. That is it takes out crop land and shade out crops to the side of them as well (Taffa Tulu, 2002).

2.5.Sustainable Agriculture

A sustainable agriculture is one that, over the long term enhances environmental quality and the resource base on which agriculture depends, provides for basic human food and fiber needs, is economically viable, and enhances the quality of life for farmers and society as whole (American society of Agronomy, 1989). The term sustainable agriculture means an integrated system of plant and animal production practices having a site- specific application that over a long term will:

- Satisfy human food and fiber needs.

- Enhance environmental quality and the natural resource base upon which the agricultural economy depends.
- Make the most efficient use of non- renewable resources on-farm resources and integrate, where appropriate, natural biological cycles and controls.
- Sustainable economic viability of farm operations.
- Enhance the quality of life for farmers and society as a whole.

Thus definition of sustainable agriculture emphasizes productivity, environmental quality, efficient use of non- renewable resources, economic viability, and quality of life. Under this definition, a farm that emphasizes short run profit, but sacrifices environmental quality, would not be sustainable in the long run. From the other end, pursuing environmental quality without ensuring viability of short- run returns also would be unsustainable. Sustainable agriculture integrates three main gals' environmental health, economic profitability, and social and economic equity.

2.6.The soil as an Economic Asset

As with any economic asset, determination of an optimal rate of exploitation depends ultimately on a comparison of the benefits of conservation to potential returns from other investments and activities (Clark, 1976). Farmers may be justified in liquidating the capital value of soil fertility if the profits derived from non sustainable agriculture will yield a higher economic rate of return in some other enterprise than in soil conservation.

The decision to conserve soil can be described as a function of many variables, including the marginal production of fertile soil, agricultural input and output prices, risk and uncertainty, time preference and the opportunity cost of labor and capital, and information. Virtually all

decision models suggest that some depletion of soil fertility can be justified on economic grounds. The efficient or optimal rate of depletion is defined as the point where the costs and benefits of soil conservation are exactly balanced (in marginal, present value terms). While the costs of soil conservation are easily determined, the benefits are often ambiguous and depend on a number of factors. In general, the benefits of soil conservation may be expressed in terms of the value of increased future crop yields, relative to yield on degraded soil, plus the value of any off-site cost avoided (e.g. Sedimentation and siltation) (Bishop, 1992) the presence of market imperfections, policy distortions of institutional constraints is after used to Justify public subsidy of soil conservation efforts.

However, direct subsidies may not always be the best solution careful analysis of under lying social and economic conditions and institutions is required to Identify, Which factors contribute to inefficient land husbandry practices in a specific area, the extent of their influence, and the most appropriate policy response, if any.

Loss of soil productivity leads to reduced farm income and food insecurity particularly among the rural poor. Over 60% of the world's poorest people live in marginal areas and face a tradeoff between short term needs and the long term conservation of natural resources (Leonard, 1989). In managing land resources, the poor often have a short time horizon, and will resort to maximizing their immediate gains and overexploitation of natural resources to secure their basic necessities (World Bank, 1992). The poor also face financial and socio-economic constraints. These factors seriously impede introduction of improved land management practices and innovation, which increase the productivity, and income of the poor reinforcing the vicious cycle. Hence, narrowing this productivity gap between actual and potential yield is essential to avoid the poverty and actual resource degradation trap (Alemnehet al, 1997).

2.7.Need for practical Approach

Officials and local land users often have different perceptions about the land degradation problem. This continues to be a serious impediment to successful land degradation control project (Blaikie and Book field, 1987). A great deal of literature support the idea that indigenous practice often based on well informed ground and should be seriously considered in development of technologies and intervention measures to address land degradation (chambers and pacey, 1989). While the official view is drawn from references to the little data available (often derived from science) farmers views are based upon their observations, values, and experiences. These factors help them to interpret changes on indicators of soil and land degradation and make decisions about specific actions.

Land degradation symptoms must be seen with in the political institutional and socio- economic forces under which local land user operates. The “short- time horizon” of the poor is often due to policy and institutional failures such as absence of clearly defined property rights, limited access to market and credit, and lack of safety nets such brood analysis offers deeper insights into the land degradation problem, suggesting appropriate policy measures that should be applied before the degradation process be cams irreversible (World Bank, 1992). Misinterpretations of change in some indicators, and the assessment of its impact on land resources, add to the perception gap. For example, there is a common assumption among officials that land degradation is widespread. Local land user does not share the perception. Local technical knowledge is based on experience and tradition, and has low risk and minimum imputes. It is accumulate slowly and does not keep pace with changes that impact the farming system. Thus, improving local knowledge and integrating it with scientific knowledge, is a significant challenge (Ravnborg, 1992).

2.8.Theoretical approaches to land degradation.

The diagnoses of the solution to land degradation problem vary greatly across disciplines and among stakeholders. The literature reports at least three main approaches or policy paradigms towards dealing with the difficulties of land degradation in developing countries (Biot et al, 1995). These three approaches are classic, populist, and neo- liberal.

2.8.1. The classic approach

The classic approach assumes that technical solution to land degradation is available and that the problem is implementation related. The emphasis of this approach has been on technical fixes and participation (Clay and Schaffer, 1984). According to this approach, the extent of and solution to the problem of land degradation are well known, but the problem is to get people to implement them. It identifies mismanagement of land by users, which are ignorant, irrational and traditional and also their subsistence fundamentalism as the core problem in soil and water conservation practice. Many soil and water conservation projects in developing countries fail to take into account the factors determining resource users land management decisions and collapsed shortly after special incentives and subside where no longer available. Proponents of this approach cite escape hatches such as unfavorable weather condition of farmers for their failures (Clay and Schaffer, 1984). Many soil conservation and land reclamation projects have been influenced by the classic approach, which has often resulted in conflict between technology and local farming and socio- economic conditions.

2.8.2 The populist approach

The second paradigm often referred to a populist, links poverty and environmental degradation. It emphasizes the participation of local people by using their knowledge and practices as a guide

for policy and action (Chamber, 1983). According to this approach, failures in soil and water conservation measures are of technical nature inadequate or misapplied research, lack-of-fit between techniques and farming system and livelihood strategies, and lack of participation by land – users in designing and implementing resources conservation practices. The proposal that arise from this approach call for site- specific participation study and design a multi disciplinary approach by teams of specifically trained and conservation- oriented natural and social scientists in combination with local farmers and resource users and organization. However, the populist approach is not applied on a widely expanded basis and is not replicable on large scale.

2.2.3 The neo-liberal approach

The third approach often called neo-liberal draws from both the classic and populist approaches. From the classic approach, it takes the idea that technology to control land degradation exists, and from the populist approach, it borrows the notion of empowerment of the people. It then argues that the major degradative courses are institutional failures, and the lack of adequate incentives for the adoption of appropriate conservation technologies along land resource users (World Bank, 1992). This approach purports that suitable technologies exist presently or can readily come into existence.

The problem is to understand the present structure of incentive that prevents land users from adopting them, and to design incentives that induce adoption. This approach is typified by giving central role to population pressure on natural resources, re-establishes the certainty that technologies for soil and water conservation exist and it is the matter of getting farmers to adopt these technologies through extension and appropriate incentives.

2.9 People's participation in watershed Development and management

People's participation has become rhetoric these days in developing countries. Participation means different things to different people. In common parlance it is used to mean an act or fact of partaking in'. Participation means a dynamic group process in which all members of a group contribute, share, or are influenced by the interchange of ideas and actives toward problem solving or decision- making. There is no universally acceptable measure or index of people's participation. One could use as a crude measure of participation such as proportions of the target group of people who participated in various stages of a program, who adopted various recommended measures and practices, and who expended their time and money on participation in collective action (Singh, 1991). People's participation in watershed development and management programs is crucial for their successful and cost effective implementation. This is so because the watershed requires that every field/parcel of land location in a watershed/ be treated with appropriate soil and water conservation measures and used according to its physical capacity. For this to happen, it is necessary that every farmers having land in the watershed accepts and implements the recommended watershed development plan. There are some components of a watershed development plan such as bund construction, leveling, etc. which can be implemented by the farmers involved acting individually and there are many other items such as check dams, waterways, etc., that can be implemented only through collective action of the farmers. This means that for successful implementation of watershed development plan, people's participation is necessary for action on their individual farm as well as on common property land resource in the watershed. Like other agricultural and rural development programs, in most cases, watershed development programs suffer due to inadequate people's participation. It is, therefore, necessary for successful implementation of development programs

that the factors affecting people's participation are identified and necessary measures for securing the needed participation adopted.

2.10 Empirical Studies

The limitation of land and increased population competition for this resource can be postulated by different arguments. Partly it is historical, in the past there was enough land for everyone to have some, and an increase in population just meant brining more land into use. It is also partly because in dominantly agricultural economies there are no alternative to working on the land. But the Question is how to conserve it and feed the ever-increasing mouths to be fed. Extension services need to demonstrate gains and knowledge from technologies in relation to the conservation practices.

Farm household land use and conservation decisions are likely to be influenced by a number of factors. The effect of these factors on conservation investment decisions is also conditioned by the nature of rural market imperfections. In a theoretical economy, with perfectly function in markets and perfect information, the market mechanism should also ensure optimum investment level in conservation (Holden et al, 1998).

Pender and kerr (1996) demonstrated that when perfect market exists for all goods and services, household factor endowments would have no effect on production and investment decisions. However, those imperfections in labor markets force households to equate labor demand with family labor supply, and thus higher labor endowments may boost conservation investments. Imperfections in credit or productive assets will be able to invest more in conservation (Bekele and Holden, 1998). Thus, market imperfections are important in explaining farmer's decision to participate in soil conservation practices.

Sombroek (1993)stated that there would seem to be only limited possibility for the successful transfer of modern land use technologies from other tropical regions to sub-Saharan Africa, the author underlined that, the real challenge is to keep rural population settled on the land, allowing them to lead a decent life from consumption and sale of produce of the land under their care on sustainable bases, fair and stable prices, not trade barriers, no competition from subsidized food imports, assure supply of inputs and effective means to transmit innovations to and from farmers nationally and regionally.

Insecurity in land rights is generally regarded as one important deterrent to conservation investment (South Gate, 1988) when a system of property rights fail to provide sufficient security to enable individual users to reap future benefits from their investments, they fail to undertake otherwise profitable and environmentally sound investments.

Population pressure can act as a stimulus to the intensification of soil and water conservation technology but it is not the only factor to which farmer's respond in adjusting their practice in and environmentally sustainable way. Studies on land degradation should focus on understanding of how agricultural systems respond to various changes in social, economic and environmental context in which agriculture takes place rather than focus singly on population pressure as indicators of the use and non-use of soil and water conservation technologies. Thus, studies on soil and water conservation have to consider both technical and social way in which people conserve land (Muzzucato and Niemeijer; 2000).

Most empirical studies on land degradation analyze the impact of physical factors like topography, climate and soil, farming practices and population pressure on soil erosion (Bekel and Holden, 1998).

These studies suggest interesting causal relationship that shed light on the impact of population pressure on resource degradation, with an increase in population pressure on resource degradation with the increasing population pressure intensification of cropland is more common (Grupperud, 1996).

Relatively longer time is required for realization of soil conservation. This means that benefits are more likely to be uncertain, lack of appropriate information limits farmers ability to correctly anticipate the long-term productivity consequences of current land use practices. This, along with failures in land and crochet market, (common feature of many developing countries) increases the risk and makes conservation investment economically less attractive. An important implication of this is that policy support to increase farm production, as well as switching from low value subsistence crops to high value cash crops would improve the returns to investment in soil conservation. This has to be considered as an integral component of intervention designed to increase the profitability of the overall production system (Lacila et al, 1999).

According to Lynne (1988), factors such as income and nature of terrain were found to affect conservation behavior. Farmer's attitude influences the amount of effort exerted in conservation. The same author suggested other factors including attitude towards investment risk, extension education and percentage of cultivated land classified as degraded, attest conservation decision. The author state that investment on specific technologies will be enhanced by dissemination of knowledge and demonstration of the level of gains from the technologies and the potential risk reduction characteristic. Investment in land enhancing and conserving technologies become more attractive as an increasing percentage of available cultivated land is degraded.

Even though relatively few conservation projects have been evaluated in Ethiopia, available evidence indicates that extensive conservation work have been initiated since 1945, when the forestry and wildlife division of the Ministry of Agriculture attempted, through legal action, to protect forest areas (Campbell, 1991). Conservation works accelerated rapidly following the 1975 Ethiopian revolution, largely due to the creation of peasant association and nationalization of rural land under the nominal control of the peasants associations.

Study made by Tegegne (1999) on willingness to pay for environmental protection in Sekota District (Northern Ethiopia), suggested that efforts to make people participate and become involved in environmental protection should focus on their labor instead of their financial contribution. The author underlined that, if financial contribution is required, projects may target 'wealthy' farmers instead of poor. In order to convince people to contribute labor during peak season, education can be considered. During slack season, large sized households and younger people are more likely to spend time on environmental protection. Consequently, he recommended that polices should focus on younger people and households with large labor force.

CHAPTER THREE

3. DESCRIPION OF THE STUDY AREAS

3.1. West Shoa zone of Oromia National Regional state

3.1.1 Location and Physical Features

The study zone is located in the central part of Ethiopia. More specifically, it is located in the Western part of the Oromia National Regional State. The zone (west shoa zone) is one of the 18 zones of oromia Regional state. The capital of the zone, Ambo, is located at a distance of 144kms away from Addis Ababa. It is crossed by highway running from Addis Ababa to Nekemte. The zone is bordered by North Shoa and Gojam in the north, South West shoa Zone in the south, Addis Ababa Zuriya Oromia liyu Zone in the east and East Wollega Zone in the West.

With regard to agro-ecological one of the area, lowland, middle highland and highland cover 17%, 56%, and 27% respectively. The altitude ranges from 1150 to 3500 m.a.s.l. The mean annual temperature and rainfall of the zone are 18^{o}c and 1300mm, respectively.

3.1.2 Population situations

According to 2007 National population censes, the total population of the zone is 2058676 of which 50% are male and the remaining 50% are female. The rural and urban dwellers account for 88% and 12% respectively. The total area of zone covers 14,349 km^2. The crude population density of the zone is 143 persons per km^2.

3.1.3 Agriculture

The economic base of the zone is agriculture. The sector is rain-feed and is characterized by low productivity. The majority of the residents depend on agriculture for their lively hood. Individual small holder farms are the sole and dominate production units. moreover, the sector is characterized by low use of farm imputes, traditional farm practices, poor soil fertility and related problems. Mixed farming sustains a typical practice in the zone.

3.1.3.1. Crop production

Crop production in the zone is characterized by rain- fed nature. The agro climatic condition is favorable for growing diversified crops including annual and perennial crops. Wheat, Teff, Sorghum, Maize, Nigger seed and sesame are major cereals and oil crops grown by the farmers. Fruits and vegetables have been grown by some farmers for food and income. Irrigated agriculture using streams and springs is limited and practiced by a few farmers to grow vegetables, fruits and maize mainly at lowland areas using local varieties of seeds. According to West-shoa zone Agricultural Development Bureau annual report of year 2007 a total of 743,639 hectare of land cultivated and 115, 083,173 quintal of yield obtained.

3.1.3.2. Livestock production

Live stock is an integral part of the farming system of the zone. It is an important asset for farmers and providing them a way to accumulate wealth more easily than by acquiring land. The sole source of power for land cultivation is oxen and Equines for transportation. The major animals specious kept are cattle, small Ruminants and Equines. In the zone livestock production is constrained by shortage of feed, diseases and poor genetic potential of local breeds.

Table 1. Livestock Distribution in the zone, year 2007

Type of Livestock	**Number of heads**
Cattle	2,100,001
Shoat	895,350
Equine	318,238
Beehives(traditional)	6,647

Source: WSADD (2007), Annual report, unpublished Document, Ambo, Ethiopia

3.1.4. Infrastructure

West Shoa zone has about 250km of asphalt road, 407km of gravel surfaced all-weather road and 132km of dry weather road. With regard to telephone 4 of the zone districts and 2 urban administrations have digital telephone while 15 districts have automatic telephone. The zone has also 2 post offices at urban and 13 sub-post office at each district.

As to financial service in West Shoa Zone there are 9 commercial banks of Ethiopia, 1 Development Bank of Ethiopia, 3 Oromia International Banks and 4 Cooperative Banks of Oromia.

3.1.5. Health Service and Education Facilities

According to Wes Shoa zone plan and Economy department annual report of year 2007, the zone has 12 Hospitals, 30 Health centers and 152 Health posts. According to the report health service coverage of the zone is 66%. With regard to water supply, 851,304(41.9%) of the zone population are able to supplied with clean drinking water.

The west-shoa zone education bureau's annual report of year 2011 shows that, education coverage of the zone,1st cycle primary school (Grade1-4) is 73%, while the number of the student is 3,907,062 ; 2nd cycle primary school (Grade5-8) is 76%, while the number of the students is 2,084,453; high school (Grade 9-10) is 54.4%, while the number of the student is 519,244 ;and preparatory(11-12) is 7.5%,whil the number of the student is 98,815.

3.2 The study districts.

3.2.1. Location and physical features

The study was conducted in Gindeberet districts which is located in west Shoa zone of the oromia National Regional state. Gindeberet district is one of the 20 districts of the west Shoa zone. The capital of the district, kachisi, is situated at 180 kms away from Addis Ababa via Ginchi town and 136 km away from Ambo. The district bordered on East by Abuna Gindeberet district, on west by the Guder River which separates it from the west Welega Zone, and on North by the Abay River which separates it from Amhara Region. The district has 31 PAs and 1 urban. The topography varies from place to place and significant difference in altitude observed. It ranges from 1150 to 2600 m.a.sl. Its relief patent includes high and medium rugged mountain ranges undulating to rolling plateaus and plains, gorges and deep incised river valleys. The district is found in Abay (Blue Nile) basins surrounded by Mugger and Hurgaha rivers in

east and Abay River in north. It has two agro-ecological zones namely, lowland (57%) and middle highland (43%). The minimum and maximum temperature is 10^0, and 30^0c respectively. It receives rainfall twice in a year which is bimodal. The duration, amount and distribution of rainfall vary from place to place from year to year and depend on variation in elevation.

The rain received between March and April is not reliable and adequate to grow crops, only helps to prepare farmland for the regular crop season.

The total area of the district covers 1200 km^2. According to Gindeberet district Agriculture Development office Report (2010), the land use patterns of the district are 49,776 ha for cultivation, 40,509 ha for grazing, 14,638 ha for forest, woodland, shrubs and bushes and 14,957 ha is for other purposes. The dominant soil type is red to brown in color and medium textural clay soil found in mid high plateau all which accounts for 60%, while the remaining 20% is black in color and medium in texture is found in the lowland as well as 20% light sandy soil is found in the lowland.

3.2.2. Population Situations

According to the 2007 national population census Report, The population of Gindeberet district is 104,595. Of these, 50.4% are male and the remaining 49.6% are female. The rural and urban duelers account for 89% and 11%, respectively. The number of households is estimated to be 17,736, while 15% of households are female headed. The average family size is 5.9 persons per household. Regarding religions, protestant, orthodox and traditional believer accounts for 56%, 34% and 9.2%, respectively. The remaining 0.8% is other believers.

Table 2. Population size of the district (NPCR, 2007)

S/No		Male	Female	Total
1	Urban	5799	5706	11505
2	Rural	46917	46,173	93090
Total		**52716**	**51879**	**104,595**

Source:- Gindeberet district administration office

3.2.3. Agriculture

The dominant economic sector of the district is agriculture which is characterized by its rain fed nature and mixed farming. The farmers are engaged in crop and livestock production though they give more focus to crop production as compared to livestock sub sector. The existing realities reveal that low use of improved technologies, loss of soil fertility and irregularity of rainfall distribution are the factors affecting the productivity of agricultural sector.

3.2.3.1. Crop production

The agro climatic condition is favorable for frowning diversified crops including annual and perennial crops. Cereal crops (Teff, Maize, sorghum, Wheat, Barley), pulse crops (field bean, field peas) and oil crops (sesame, Niger seed, Linseed, Rape seed) are grown by majority of the farmers. Access to improved verities of crops (cereals, pulses and oil crops) is limited and farmers mainly grow the local verities in traditional ways. They rarely use inorganic fertilizer on Teff, maize and wheat in broadcasting.

Table 3. Area and production of major crops for the peasant holding in the year 2011, in the district

S/N	Crop type	Area cultivate (ha)	Production (Qt)
1	Teff	23,627	497,397
2	Maize	6,495	321,254
3	Sorghum	3,872	93,955
4	Wheat	1,737	40,186
5	Barley	602	15,521
6	Field been	1,609	27,353
7	Field pea	961	17,395
8	Sesame	4,739	42,651
9	Niger seed	4,120	38,522
10	Lin seed	1,940	21,573
11	Rape seed	74	888
Total		**49,776**	**1,116,695**

Source: - GDARD office

Fruits and vegetable are also grown by some farmers for food and income. Irrigated agriculture using streams and springs is limited and practiced by a few farmers to grow vegetables, fruits

and maize mainly in the low land areas using local varieties, however, the irrigation potential is not fully utilized. Clearing bushes and shrubs and put for crop cultivation is still under way in the district.

3.2.3.2. Livestock production

Livestock is an integral part of the farming system of the district the sole source of power for land cultivation is oxen while equines are for transportation. The major animals specious kept are cattle, shoat, equines, and poultry. The subsector is constrained by shortage of feed, diseases and poor genetic potential of local breed. The livestock per household is diminishing over time due to, among other things, high population and the resulting expansion of crop production in grazing land. The district has also potential for bee keeping according to the district Agriculture Development Report of 2010, significant number of the district farmers are Beekeepers and harvest honey every year.

Table 4. Livestock population in the District 2010 year

Livestock type	**Number**
Cattle	178,135
Shoat	66,534
Equines	16,213
Poultry	61,470
Beehive	15,966

Source: GDARD, annual report, unpublished document, Ginedeberet

According to the report the average livestock holding is about 14 heads per household. Free grazing is the only feeding system in the district. Due to feed insufficiency, poor health services and low genetic potential of local breeds, the contribution of the sub sector to small farmer's economy in the form of milk, meat, drought, egg and other by- product is minimal. To compensate this low production, the farmers are force to keep large cattle herds.

3.2.4. Agricultural Extension Services

Oromia Agricultural Development bureau (OADB) is the main institution responsible for extension of farm technology. Development agents are assigned at the grass root level (at peasant Association (PA)) ADMINSTRATIVE STRUCTURE. In the district there are 31 PAs and there are almost 3 development agents (DAs) in each PA. Their main tasks are demonstration, popularization and dissemination of improved crop varieties released from research centers.

Agricultural input supply corporation (AISCO), private companies and Ethiopian seed Enterprise are the main suppliers of agricultural inputs. Fertilizer, herbicides and improved seeds are the main inputs, which farmers are rarely using.

3.2.5. Transport and communication

There is about 180 km of all weather gravel surfaced road in Gindeberet district, which connects Ginchi town, the capital of Dandi district, situated at the highway running from Addis Ababa to Ambo. From the 31 PAs of the district, only 18 PAS are connected with kachisi (the capital of the district) with 70km dry weather road the remaining 13 PAs are inaccessible (there is no rood connecting them with the capital of the district) in both weathers. In general the road

network of the district is poorly developed. The residents are not well accessed to social services.

3.2.6 Health services and Education Facilities.

According to Gindebert District Health Office report (2011), there is 1 district hospital, 4 Health centers, and 31 Health posts, where primary health extension service is provided by Health Extension Agents. All the 31 PAs have one health post and 2 female health extension agents.

With respect to education facilities, elementary schools are fair in number. Almost all the 31 PAs have elementary schools. However, there are only 2 secondary schools and 1 technical school in the district, which meant to serve all students from different elementary schools in the district. Students in rural areas have difficulty in going school because of absence of secondary school nearby and there is dropout of students after elementary school for some student, particularly for females.

3.2.7 Other Social infrastructures

With respect to other infrastructures there are Oromia International Bank (OIB) and Commercial Bank of Ethiopia (CBOE), 24 hours hydroelectric power supply, town water supply one post office, and digital automatic telephone in the district capital Kachisi.

CHAPTER FOUR

4. METHODOLOGY

4.1. Selection of the study Area

The study district, "**Gindeberat"**, was selected purposively because of the following reason:

- The deforestation and de-vegetation process that are being carried –out overtime in different part of the district have resulted in reducing the vegetation, formation of active gullies and landslide.
- There is no wise utilization of land and significant soil conservation activities in the district. Hence there is increased washing away of the fertile top soil by erosion, relative to the other part of the oromia region.
- Like other part of the country there is no concentrated interventions in the district by both governmental and non-governmental agencies in soil and water conservation activities

4.2. Sampling Techniques

A two –stage random sampling procedure was adopted for the selection of the sample respondents. In the first stage four peasant association (PAs) were purposefully selected on the basis of their representativeness of the districts' two agro climatic zone (middle high land and lowland) and the severity of soil erosion.

The four PAs selected were Kiltu Senbeta Akale, Kiltu Gura Gijo, Gemeda Minea and Gemeda Amdo. In the second stage, farmers in the four sampled PAs were listed down. Given the limited resource and time a total of 100 farm households were selected randomly using probability proportional to sample size sampling technique. (Table 5)

Table 5. Number of households and sample size

S/No	PAs	Total number of households	Sampled households
1	Kiltu Senbeta Akale	154	23
2	Kiltu Gura Gijo	196	29
3	Gemeda Minea	174	26
4	Gemeda Amdo	147	22
	Total	**671**	**100**

Source: Gindeberet District Ministry of Agricultural development office 2011 own computation

4.3. Methods of data collection

Both primary and secondary data were used in this study. The primary data pertaining to the year 2011 were collected from sample respondents through a structured questionnaire, which was designed to generate data on some social, institutional and economic variables that were supposed to be important for the study. The enumerators who speak the local language (oromifa) were recruited from among Agricultural Development Agents of the study area and were trained on methods of data collection and interviewing techniques. Field trips were made before the actual survey is under taken to observe the overall features of the selected PAs and to select farmers to be interviewed using lists taken from respective PAs offices. The questionnaire was pre tested and its content was refined on the basis of the results obtained during the pre-test. With regard to the collection of primary data, it was done in two different ways: trained enumerators held interview with sample farms using the structured questionnaire, and the

researcher made personal observations and had made informal discussion with farmers, agricultural officials and local development agents on issues such as current practices in relation to soil conservation, agricultural production systems and the constraints with the sector. Continuous supervision was also made to reduce error during the data collection and to correct possible errors right on the spot. Secondary data were obtained from various sources such as reports of Ministry of Agriculture (MOA) at different levels, Maps, NGOs and other published and unpublished materials, which were found to be relevant for the study.

4.4. Methods of Data Analysis

It is hypothesized that the decision to participate in environmental schemes is influenced by a set of explanatory variables. However, the choice of these variables often lacked a firm theoretical basis. Much of the research on the role of environmental schemes have addressed farmer's behavior in relation to policy objectives and farming context. In general, decision was influenced by the consequence of particular policy on the farm income. The study has examined the life cycle and succession factors, such as, age, farming experience, availability of a successor to take over the benefit, farming intention in the future and conservation undertaking in the past. Similarly, physical farm factors (percentage of total area under crops, grassland area, total labor available, slope etc.) were considered to be important in the uptake of environmental schemes in agriculture (Wynn et al, 2001) based on the findings of past studies, on farmers willingness and decisions on investment and participation in commons.

Among large number of factors, which have been related to farmer's willingness to participate in soil conservation practices, the following variables are hypothesized to influence farmers' decision in the study area.

Farmers' perception of erosion hazard:- A variable for the perception of soil erosion problem is considered to be vital for soil conservation decision. In other words, farmers who have already perceived the problem of soil erosion are more likely to be willing to participate in soil conservation activities than those who have not perceived the problem. Thus, the perception variable was expected to be strongly and positively associated with farmers' willingness to participate in soil conservation practices.

Education level of the household head: - This variable, which takes a value 1 if the household head is literate and 0, otherwise. Education increases farmer's ability to get, process and use information. Education has been shown to be positively correlated with farmers' willingness to pay for environmental protection and with adoption and soil conservation effort (Tegegne, 1999; Eruin and Ervin, 1982; Noris and Batie, 1987; pender and kerr, 1996). Education is expected to reflect acquired knowledge of environmental amenities. Therefore, it is hypothesized to have a positive role in the decision to participate in soil conservation activities.

Age of the household head:- the effect of a farmer's age on investments decision can be taken as a composite of the effect of farming experience and planning horizon. While longer experience has a positive effect, young farmers on the other hand may have longer planning horizon and hence, may be more likely to invest in conservation. The net effect could not be determined a priori (Lucila et al, 1999). Featherstone and Good win (1993) reported that an older individual who is looking at a shorter time horizon may not be able to recoup all of the benefits from conservation investment. Similarly, Tegegne(1999) found out that age had a negative effect on conservation decision in that it decreases participation in environmental protection. Thus, in this study it is hypothesized that age has a negative influence on the willingness to participate soil conservation activity.

Family size:-This refers to the total number of family numbers. Imperfections in labor markets imply that households with large human capital may invest more in conservation (Bekele and Holden, 1998). The larger the family, the higher the probability that future generation will farm the land and reap the future benefits of conservation investment (Featherstone and Goodwin, 1993). Thus, in this study family size is hypothesized to have a positive influence on the willingness to participate in soil conservation activity.

Attitude of the farmer: - This variable takes a value 1 if there is a desire to try a new technology at own cost and 0 if the desire is to wait until other land users have adopted it. It is a proxy variable for the frame's attitude towards conservation technology. Economic incentives will increase efforts, but responsiveness will differ with strength of conservation related attitude (Lynee et al, 1988) Bekele and Holden (1998) indicated to be keen on undertaking and keeping conservation structure. Hence, in this study attitude is hypothesized to have a positive effect on the willingness to participate in soil conservation practices.

Past awareness about technology:- A variable, which takes a value 1 if the farmer has taken part in soil conservation activities in the past and 0 otherwise knowing available option for soil conservation makes land users to be more receptive to conservation structures (Bekele and Holden,1998). Therefore, conservation undertaking in the past which is a proxy variable for technology awareness was hypothesized to have a positive effect on the willingness to participate in conservation works.

Sex of the house hold head: - This variable, which takes a value 1 if the household head is male and to differentiate between male and females in their volition of environmental protection. Tegegne (1999) reported that females as opposed to males tend to participate more during slack season. The net effect may not be determined a priori.

Security of tenure :- A variable, which is a proxy for security of tenure that takes a value 1 if the peasant considered that he/she would be able to use the parcel at least during his or her life time and 0 otherwise. The incentive to land improvement decision is based in part on secured future access to land. In many studies, insecurity of tenure has been found to be deterrent factor to conservation investment (Norris and Battie, 1987; Reardon and Vosti, 1995). In this study, the farmer's feeling of using a given parcel at least during his/her life time was hypothesized to have a positive effect on his/her decision to participation in conservation activities.

Size of land under crop: - Rural credit market imperfections imply a positive role of asset holding of households for conservation investments. Farm size is often correlated with the wealth that may help ease the needed liquidity constraint (Bekele and Holden, 1998). Norri and Batie (1987) found that large farms are more likely to use conservation technology than small farmers. Therefore, it is hypothesized that size of the cropland is positively related with the willingness to participate in soil conservation activity.

Non-Cropland owned by the household in hectares: - since the private cost of erosion on grazing is limited, peasants are expected to invest more on cultivatable land than on permanent grazing land (Bekele and Holden, 1998). Hence, the size of non- cropland is expected to be negatively related with the farmers decision to participate in conservation activities.

Size of Livestock holding:- where credit markets are imperfect, the size of livestock holding may ease capital/cash constraints. It also reduces subjective rate of time preference (Holden et al, 1998) and provide security (lower risk) to land uses, which may enhance conservation investments. On the other hand, more specialization in livestock, away from cropping, may reduce the economic impact of soil erosion, and /or increase the availability of manure needed to counter the process of nutrient depletion and thus lower the need for soil conservation.

Hence, the effect of the size of livestock holding on conservation decision was difficult to hypothesize a priori.

Slope category of the farm based on local taxonomy:- This is a dummy variable for slope category of the parcel, which takes the value of 1 if the slope is steep or very steep and 0 otherwise. The slope category of the parcel has been found to positively affect the farmer's decision to invest in conservation technology (Ervin and Eruin, 1982; Norris and Batie, 1987; Gould et al 1989). The slope variable is thus expected to have a positive effect on farmer's willingness to participate in soil conservation practices.

Estimated amount of off- farm income in birr:- the net effect of off-farm income on investments in land quality is indeterminate on theoretical grounds (Gould et al,1989; Reardon and vosti, 1995). Increasing dependence on non-agricultural activities may lower the economic significance of soil erosion. On the other hand, off-farm income may ease the constraint on liquidity needed for conservation investments.

Dependency ratio: - An increase in consumer worker ratio (dependant ration) reduces the ability to meet subsistence needs, and also increases the personal rate of time preference (Bekele and Holden, 1998). This variable is expected to have a negative effect on farmers' willingness to participate in soil conservation activities.

Parcel area in hectares: - peasants expressed the difficulty they have in turning ox plow during cultivation of parcels where structures have already been installed (Vieth et al, 2001; Bekele and Holden, 1998). Plowing with a pair of oxen is more difficult on smaller parcels. Installing additional structures will squeeze farm operations between the structures. Thus, the size of the

parcel area exposed to erosion is expected to have a positive effect on willingness to participate in soil conservation activities.

Rented or shared holdings in hectare: - Conservation expenditures typically are made by landowners. As the percentage of land a farmer rents increases, it is less likely that he/she will make conservation expenditures (Featherstone and Goodwin, 1993). Hence, the expected effect of this variable on farmer's willingness of participation in conservation activities was negative.

Assistance in soil conservation practice: - It is a dummy variable, which refers to any form of assistance rendered to the farmers in the area of soil conservation practices. It takes a value 1 if the respondent received any assistance from any other source and 0 otherwise. It is obvious that conservation investment costs a lot and it is difficult to see the benefit in the short term planning horizon. In addition to this, physical conservation practices require more labor and materials, which the farmer cannot afford. It is expected that governmental and non- governmental organizations are involved in land conservation practices. Hence, assistance (material, technical and any other incentives) from any source encourages the farmers to decide on conservation practices and a positive effect was hypothesized.

CHAPTER FIVE

5. RESULTS AND DISCUSSION

5.1. Participation of sample respondents

Among the 100 sample respondents selected 78 reported that they were willing to participate in soil conservation activities, whereas the remaining 22 respondents were ported not to be willing to undertake any conservation activities.

5.1.1. Demographic characteristics of the sample households

The average family size of the sample farmers was about 7 persons per household. This average masks differences in family size, where the largest family size was 19 and the smallest was 2. The average number of economically active family members (15-65 years of age) was about 3.45 persons per household both for the willing and non willing farmers (Table-6).

The average dependency ratio was about 0.9, which shows that each economically active person in a household supports about one economically inactive person. The survey result shows the 98% of sample farmers were married while 2% widowed. With regard to religious affiliation, 44% of the respondents were orthodox Christian and 56% were protestant Christians.

Table 6 Average family size of Sample respondents by age group and farmers group

Age group	Average family Size (quantity)	
	Willing farmers	**Non- Willing farmers**
Children less than 10 years of age	1.62	2.41
Children 10-14 years of age	1.86	1.68
Adults 15-65 years of age	3.49	3.45
Elders above 65 years of age	0.26	0.14
Average family size	7.23	7.68

Source: - survey data

The age structure of the sample households shows that the average age of the willing and non-willing farmers was almost the same (47 years). This implies that both willing and non-willing farmers have had almost equal farming experiences.

In terms of education, 80.77% of the willing farmers were literate, and the remaining (19.23%) were illiterate (Table 7). On the other hand, the majority of the non-willing farmers (81.82%) were illiterate and only 18.18% where literate. (Table7).

Among the respondents 94% of them were male headed households while 6% were female households.

Of the 78 sample respondents who reported their willingness to participate in soil conservation practices 92.31% of them from male headed households while 7.69 were female headed households. The corresponding figures for the non willing farmers were about 90.01% and 9.09%, respectively.

Table 7- Education Status of sample respondents, by farmers group

Education status	**Willing farmers**		**Non willing farmers**		**Total**	
	Number	**Percent %**	**Number**	**Percent %**	**Number**	**Percent %**
Literate	63	80.77	4	18.18	67	67
Illiterate	15	19.23	18	81.82	33	33

Source:- Survey data

5.1.2. Socioeconomic Factors.

5.1.2.1. Land Holding

The average size of cultivated land owned by a sample respondent was about 2.3 ha, the minimum and the maximum being 0.5 ha and 9 ha, respectively. Willing farmers owned on the average 2 ha of cultivated land. The corresponding figure for the non-willing farmers was 3 ha.

Among the willing farmers 98% of them owned arable land whereas the rest (2%) owned land not considered arable. About 58% of willing farmers owned non-cropland mostly used for grazing purposes. Moreover, about 38% of the willing farmers had cultivated others land through share cropping arrangements. More than 95% of the non- willing farmers cultivated

their own land, while 18% share cropped other farmers' land. However 64% of the non-willing farmers possessed non- cropland, which is used for grazing purposes (Table 8).

Table 8. Land ownership 07 sample households, by farmers group

	Willing		**Non willing**		**Total**	
	No.	**%**	**No.**	**%**	**No.**	**%**
cultivated land	77	97.72	21	95.45	98	98
Non-cropland (grazing land)	45	57.69	14	63.64	59	59
Shared cropping	30	38.46	4	18.18	34	34

Source: - Survey data

Among the willing sample households, 56% of them had owned cultivated land of less than or equal to 2 hectares and 41% of households owned cultivated land between 2.01 and 4 hectares, while only 64% of the willing sample households had owned more than 4 hectares of cultivated farm land (Table 9).

In the case of non- willing farmers, 41% owned cultivated land of less than or equal to 2 hectares and 50% possessed cultivated land between 2.01 and 4 hectares. The rest (9.1%) possessed cultivated land of more than 4 hectares (Table 9).

Table 9 Own Cultivated farm size, by farmers group

Farm Size	Willing Farmers 18		Non willing Farmers 22		Total	
	No.	%	No.	%	No.	%
<1.00	8	10.26	1	4.55	9	9
1.01-2.00	36	46.16	8	36.36	44	44
2.01-3.00	21	26.92	7	31.81	28	28
3.01-4.00	11	14.10	4	18.18	15	15
4.01-5.00	2	2.56	1	4.55	3	3
5.01-6.00	-		-	-	-	-
>6.00	-		1	4.55	1	1
Total	**78**	**100**	**22**	**100**	**100**	**100**

Source: - Survey data

The respondents were asked on their expectations with respect to the type of interventions that the government should make in the future in view of achieving better land use and soil conservation system (Table 10). The majority of the respondents (51%) suggested that teaching farmers about soil conservation practices would be the principal activity. Thirty six percent of the respondents reported that the government should introduce an incentive system to farmers, for their involvement in soil conservation practices, until such time that they are aware of the

advantage of soil conservation practices and undertake them on their own accord. Seven percent of the respondents suggested that the government should put a policy in place that discourages the cultivation of hillsides and very steep land. It is important to note that due to land shortage in the study are, young farmers forced to cultivate hilly areas and steep slopes.

Six percent of the respondents suggest that they had no idea on soil conservation measures- since they were not exposed to soil conservation practices (Table10).

Table 10- Perception of sample respondents on the types of intervention required for better land use and conservation practices.

Farmers' suggestions	**No**	**%**
Teaching farmers on the advantage soil conservation	51	51
Support from the government in form of incentive	36	36
Policy that forbids cultivation of very steep land	7	7
No Idea	6	6
Total	**100**	**100**

Source: - Survey data

5.1.2.2. Land Tenure and sustainable land use

Land redistribution was practiced once during the military government of Ethiopia. After the fall of the military government (post 1991) land redistribution has not been practiced in the study area. As a result, young farmers could not get a plot of land of their own for cultivation.

Therefore, these young farmers either share crop with other farmers or cultivate marginal land by clearing forests. This mal practice created serious problem on the sustainable utilization of the land resources of the study area. Thus, sample farmers were asked to express their views on current land tenure system in their area (Table 11). Thirty one percent of the respondents stated that absence of land redistribution forced young farmers to cultivate land on steep slopes, since they have no other option. Moreover, they pointed out that unless the land use practice is backed by soil conservation activities, expansion to more steep land use will continue after the land they are now cultivating is exhausted because of overuse.

Twenty five percent of the respondents reported the existence of land size holdings among farmers in the study area and 19% reported the existence of fertility level differences on land owned by farmers. In this respect, the sample respondents pointed out that land size and land fertility differences had a negative bearing on sustainable land use, since farmers expand to steep slopes and marginal lands to increase the size of their holdings and in search of fertile land. Eighteen percent of the respondents pointed out the absence of clear land ownership title while seven percent of them have no opinion on the current land tenure system.

Table 11 Sample respondents view on the current land tenure system.

Opinion	**No**	**%**
Absence of land redistribution forced young farmers to cultivate steep slopes	31	31
Big differences in farm size among farmers	25	25
Absence of equity in terms land fertility	19	19
Absence of clear land ownership title	18	18
No opinion	7	7
Total	**100**	**100**

Source: - Survey data

5.1.2.3 Labor Availability

Any form of soil conservation activity demands labor input. In order to undertake the practice, farm households need to take some labor away from their farm activities. Most non-willing farmers (91%) reported labor shortage as a problem. The Corresponding figure for the willing farmers was 79% (Table 12). As can be seen from the table 82% of the total respondents had reported labor shortage as a problem, whereas labor shortage was not reported as a problem by 18% of the respondents.

Table 12. Sample respondent's opinion about the availability of labor by farmer group

Attribute	Willing farmers		Non- Willing Farmers		Total	
	No	%	No	%	No	%
Labor shortage reported as a problem	62	79.49	20	90.91	82	82
Labor shortage was not reported as a problem	16	20.51	2	9.9	18	18
Total	**78**	**100**	**22**	**100**	**100**	**100**

Source:-Survey data

5.1.2.4. Farmers' perception of soil erosion hazards.

The level of perception of soil erosion problem is positively associated with age, the level of education and diffusion of information through extension and other channels. Generally speaking, perception of soil erosion problem is an important factor for farmers to make decisions on conservation investments. In Gindeberet district in general and in the study site in particular, soil erosion is accelerated at an alarming rate mainly because of expansion of farmland to hillsides by clearing the natural vegetation. In spite of this fact the extension advice provided to farmers regarding soil conservation and the practical action being taken are minimal as compared to the severity of the problem. About 80% of the respondents who were willing to participate in soil conservation practices perceived soil erosion as a problem in their area where as only 9.09% of non- willing farmers perceived soil erosion as a problem in their area (Table

13). This shows that the degree of perception of soil erosion problem has a positive bearing on farmers' decision to participate in soil conservation practices.

Table 13 Perception of the problem of soil erosion by farmers group

Attribute	**Willing farmers**		**Non- Willing Farmers**		**Total**	
	No	**%**	**No**	**%**	**No**	**%**
Perceive the problem	62	79.49	20	90.91	82	82
Did not perceive the problem	16	20.51	2	9.09	18	18
Total	**78**	**100**	**22**	**100**	**100**	**100**

Source: survey data

The farms were classified on the bases of slope category. Of the respondents, 59 % of those who were willing to participate in soil conservation practices owned farmland on steep slope, and 41% on gentle slope (Table 14). The farmers who owned farmland on steep slope had been practically confronted with the problem of soil erosion and thus recognized its negative bearings.

Table 14. Distribution of sample farmers by slope category of their farmland and farmers

Slope category based on local taxonomy	Willing farmers		Non- Willing Farmers		Total	
	No	**%**	**No**	**%**	**No**	**%**
Gentle slope	32	41.03	9	40.91	41	41
Steep slope	46	58.97	13	59.09	59	59
Total	**78**	**100**	**22**	**100**	**100**	**100**

Source: Survey data

5.1.2.5. Farmers Attitude towards soil conservation.

The farming community have different attitude towards soil conservation activities. The survey result had shown that 95% of respondents were aware of soil conservation measures taken in the area, and in fact they had participated in soil conservation campaign during the military regime. In this study, the desire to participate in soil conservation practices at own cost was taken as a proxy for attitude to undertake conservation measures. Of the 63 sample respondents who had desire to use soil conservation measures at their own cost, most of them perceived soil erosion as a serious problem (Table 15). Whereas the 37 sample respondents who had no desire to participate in soil conservation measures at their own cost, 51% did not perceive the severity of soil erosion in the area and about 49% perceived it as a serious problem (Table 15).

Table 15 Farmers attitude towards soil conservation measures

Perception of erosion problem	Desire to use conservation practices on own cost		No desire to use conservation practices on own cost		Total	
	No	**%**	**No**	**%**	**No**	**%**
Perceived as a problem	60	95.24	18	48.65	78	78
Not perceived as a problem	3	4.76	19	51.35	22	22
Total	**63**	**100**	**37**	**100**	**100**	**100**

Sources:-survey data

5.1.2.6. Livestock ownership

In general livestock rearing is an important asset for rural households in Ethiopia. They are used as sources of food, draft power, income, and energy. Moreover, livestock are indices of wealth and prestige in rural areas. Almost all of the households had reared livestock continually (Table 16). The average number of oxen owned by non-willing farmers was 2.95 while willing farmers owned 2.46. On average, non willing farmers owned greater number of cows, heifers, bulls, calves, sheep, and horses than willing farmers (Table 16).

Table 16. Live stock Ownership

Type of livestock	Willing farmers	Non willing farmers
Oxen	2.46(n=74)	2.95(n=21
cows	3.01(n=72)	4.15(n=20)
Heifers	1.62(n=13)	2.25(n=4)
Bull	1.10(n=10)	1.33(n=3)
Calves	2.32(n=22)	3.08(N=12)
Sheep	4.42(n=48)	5.57(n=7)
Goat	3.63(n=19)	3.89(n=9)
Horses	1.73(n=40)	1.33(n=6)
Mules	1.00(n=3)	1.00(n=1)
Donkeys	1.64(n=53)	1.80(n=10)

Sources: survey data

5.1.2.7. Income sources.

Crop, livestock and off-farm activities such as handcrafts, bee keeping, wage employment in other farms and selling firewood were important income sources for the sample farmers. The entire sample farms reported that they produce crops, particularly cereals, but some uses

products domestic consumption. The reason might be lack of surplus production over family consumption requirements. However, crops were important sources of cash for 96 % of the farmers (Table 17). Among the sample respondents 71% had reported that they sold livestock and earned cash income from the sale of livestock is used to purchase clothing's, farm implements and inputs, to pay land tax and other social purposes.

Table 17 Respondents' source of cash income, by farmer group

Frequency of contact	**Willing farmers**		**Non-willing farmers**		**Total**	
	No	%	No	%	No	%
Crops	74	94.87	22	100	96	96
Livestock	57	73.08	14	63.64	71	71
Off-farm activities	6	7.69	6	27.27	12	12

Source: Survey data

The other sources of cash income for the farmer were reported to be off-farm activities. These off farm activities included employment in other farms, bee keeping and sale of firewood. About 12% of the sample household heads reported that they earned income in the form of cash or in kind from being involved in off- farm activities. A larger population of non-willing farmers (27.27%) used off-farm activities as a source of income as compared to the willing farmers (7.69%).

5.1.3. Institutional Factors

5.1.3.1. Agricultural Extension Service and conservation Activities.

Agricultural extension services provided by agricultural development offices are believed to be important sources of information about improved agricultural technologies among the respondents 36% of the had reported that they had contact with agricultural extension agents, either in groups or individually. Almost all of the reported farmers knew the existence soil conservation practices in the area and the major sources of information being extension agents.

Surprisingly, 58.97% of sample household heads who were willing to participate in soil conservation practices had no contact with extension agents. The corresponding figure for non-willing farmers was about 81.82%. Only 37.18% of the willing household head heads 1-10 contacts with extension agents per year on matters related to general agriculture practices and about 4% of them had more than 10 contacts per year. Similarly 18% of non-willing respondents had less than or equal to 10 contacts.

According to respondents who had contact with extension agents, their discussion was not related specifically to soil conservation except that the issue was raised as part of another discussion (Table 18).

Though the magnitude of soil degradation is intensified in the area, it is only recently that extension agents had given an emphasis to soil conservation issues.

Table 18 Number of Extension contact per year, by farmers group

Frequency of contact	**Willing farmers**		**Non-willing farmers**	
	No	%	No	%
0	46	58.97	18	81.82
1-10	29	37.18	4	18.18
11-20	3	3.85	-	-
21-30	-		-	-
Total	**78**	**100**	**22**	**100**

Source: survey data

5.2. The contingent valuation survey results

Survey was undertaken to evaluate the willingness of farmers to invest for soil conservation practices.

5.2.1 Households willingness to pay

Among the responding farmers, 78 of them were willing to contribute either in cash or labor or both for soil conservation practices. Of those willing to contribute, only 5.13% would pay in the form of cash while 42.31% were willing to contribute both money & labor. However the majority, 52.56% were willing to contribute only labor (Table 19)

Table 19 Willing to participate by type of contribution

Kind of contribution	**Number of farmers**	**percent**
Only money	4	5.13
Only labor	41	52.56
Both money and labor	33	42.31
Total willing farmers	**78**	**100**

Source: survey data

Respondents were asked for reasons to allot only a limited amount of money.

Eighty four percent of the respondents, who were willing to allot money, reported that they could not afford more than the amount what they stated and 11% of them think that contributed the amount insufficient to cover the cost of operation although they could afford more. The remaining (5.41%) stated that the government should fill the gap (Table 20).

Table 20 Reason for their un willingness to pay more money

Reason	**Number of farmers**	**Percent**
I could not afford more	31	83.78
That amount is enough	4	10.81
The government should fill the gap	2	5.41
Total	**37**	**100**

Source: Survey result

When asked for the reason to provide more labor than given 78.37% of respondents indicated they could not afford more due to labor shortage, while 19% reported that what they proposed was enough, whereas, the remaining 3% stated that the government should fill the gap (Table 21)

Table 21 Sample farmers reason for their un willingness to contribute more labor force.

Reason	**Number of farmers**	**Percent**
I could not afford more	58	78.37
That amount is enough	14	18.91
The government should fill the gap	2	2.72
Total	**74**	**100**

Source: Survey result

When the farmers were asked for reasons not to contribute in interims of cash for soil conservation practice, 47.62% of respondents stated that they could not afford to pay in cash, while 36.51% stated that it is the responsibility of the government to conserve natural resource, whereas the remaining 15.87% stated that they did not face the problem of soil erosion on their farmland as such they were willingly to contribute for conservation practice (Table 22).

Table 22 Sample farmers' reason for non-willing to pay money

Reason	**Number of farmers**	**percent**
I do not see the problem on my farmed land	10	15.87
I could not afford	30	47.62
The government should pay for it	23	36.51
Total	**63**	**100**

Source: Survey result

Farmers response for their non-willingness to contribute towards labor for soil conservation practices the majority (65.39%) pointed out that it is the government's role to pay for conservation measures. Whereas, 26.92% of respondents stated that they did not face the problem of erosion on their farmland and the remaining (7.69%) indicated that they had problem of labor shortage.

Table 23 Sample farmers, reasons for non-willing to contribute labor.

Reason	**Number of framers**	**percent**
I do not see the problem on my farm	7	26.92
Labor shortage	2	7.69
The government should pay for it	17	65.39
Total	**26**	**100**

Source: Survey result

5.3. Discussion on significant Variables

Of the 17 explanatory variables hypothesized to influence willingness of farmers' to participate in soil conservation practices 6 variables were more powerful in explaining the reason, as discussed below.

Education level of the household head

Level of education, had a positive and strong relationship with the dependent variable showing that literate household heads were more opt to recognize the advantages of soil conservation and were willing to take part in it. This could possibly be because education reflects acquired knowledge of environmental amenities. As the survey result shows, about 81% of the willing farmers to participate in soil conservation practices were literate. On the other hand, the majority of the non willing farmers (about 82%) were illiterate, and only 18% were literate. This confirms that Education has positively correlated with farmers' willingness to participate in soil conservation activities.

Farmers' perception of erosion hazard

The recognition of the soil erosion problem is considered to be vital for soil conservation decision. In other words, farmers who have already perceived the problem of soil erosion are more likely to be willing to participate in soil conservation activities than those who have not perceived the problem. Thus, the perception variable was expected to be strongly and positively associated with farmers' willingness to participate in soil conservation practice. The survey result shows that about 80% of the respondents who were willing to participate in soil conservation practices perceived soil erosion as a problem in their area. Only 9% of non-willing farmers perceived soil erosion as a problem in their area.

Farmers' attitude towards soil conservation practices.

Farmers' desire to try conservation activities at own cost was taken as a proxy variable for the attitude towards soil conservation practices. As expected, this variable had a positive impact on farmers' willingness to participate in soil conservation practices. Farmers who are willing to try new techniques at their awn cost are considered to be keen on keeping conservation structures. The survey result confirm that of 63 sample respondents who had the desire to use soil conservation measures at their own cost, 95% perceived soil erosion as a serious problem and only about 5% did not perceive it as a serious problem in the area. Similarly of 37 sample respondents who had no desire to use soil conservation measures at their own cost, 51% did not perceive the severity of soil erosion and about 49% perceived it as a serious problem. The result tends to suggest that farmers who have the desire to try new agricultural techniques are willing to participate in soil conservation practices.

Soil conservation undertaking in the past

This variable was positively and significantly related with the dependent variable. In other words, soil conservation undertaking in the past, which is a proxy for technology awareness, affected farmers' willingness to participate in soil conservation practices as expected. The survey result shows that 95% of respondents who perceived soil erosion as a problem and desire to use conservation practices on their own cost were reported that they participated in the campaign of soil conservation undertaking during the military government regime. The possible explanation is that, knowing the existing or available options for soil conservation techniques make land users to be more receptive to conservation measures. Farmers' awareness of technology attributes increases their willingness to use it.

Area of farmland shared.

The results of the study show that size of shared farmland was negatively related to the willingness of farmers to participate in soil conservation practices. As the percentage of the size of land a farmer rents/ shares increases, it is less likely that he or she agrees to make conservation expenditures. This is attributable to the felt need that share agreement may have short time horizon, which may not encourage farmers to undertake conservation practices as conservation investments pay back only in the long run. As the study result shows the average land size non- willing farmers rent in share cropping were 1.25 hectare while the average land size rent in share cropping by willing farmers were only 0.29 hectare. Therefore, as the size of land a farmer shared increases, the less likely one makes conservation investments.

Non- Cropland

The result of the study shows that this variable influenced farmers' willingness to participate in soil conservation practices negatively. About 64% of the non- willing farmers possessed non-cropland which is used for grazing purposes. The possible explanation is that taking more land away from cropping may help reduce the impact of soil erosion. However, as more and more land is put out of production, households realize a reduction in their productive land and tend to be unwilling to invest in conservation measures. In addition, soil erosion is less alarming on non- cropland than on cropland. Farmers are more likely to recognize soil erosion problem on intensively cropped land than on non-cropland.

CHAPTER SIX

6. SUMMARY, CONCLUSION AND RECOMMENDATION

6.1 SUMMARY AND CONCLUSION

The primary objective of this study was to identify and analyze the determinants of farmers' willingness to participate in soil conservation practices in Gindebert District of West Shoa Zone of Oromia Regional State. The study was designed to identify the variables, which determine farmers' willingness to participate in soil conservation practices. It was also intended to assess farmers' perception of the problem of soil erosion and their willingness to pay for soil conservation practices and to determine the relative importance of the factors affecting farmers' willingness to participate in soil conservation practice.

The data used for the study were collected from 100 farmers households drown from four PAs of Gindebert District which were selected by purposive sampling technique on the basis of representativeness of the agro-climatic Zone (middle highland and lowland) and severity of soil erosion. Primary data were collected using structured questionnaire. In addition, secondary data obtained from the survey.

Seventeen variables hypothesized to explain farmers' willingness to participate in soil conservation practices were: Farmers' perception of erosion hazard, education level of the household head, age of the household head, family size, attitude of the farmer, past awareness about technology, sex of the household head, security of tenure, size of land under crop, non-cropland owned by the household in hectares, size of livestock holding, slope category of the farm, estimated amount of off-farm income in birr, dependency ratio, parcel area in hectares, rent or shard holding hectares, and assistance in soil conservation practices.

The result of the study reveals that six variables were powerful in explaining farmers' willingness to participate in soil conservation practices. These variables included education level of the household head, perception of soil erosion problem, farm land shared, non-cropland owned by the farmer, awareness of soil conservation practices and attitude towards soil conservation.

The education level of the house head was found to have a positive and significant impact on farmers' willingness to participate in soil conservation practices, implying that educated farmers were more opt in understanding the problem of soil erosion and could easily decided to take part willingly in soil conservation practices. This is attributable to the fact that education reflects acquired knowledge of environmental amenities and educated farmers tend to spend more time and money on soil conservation. Likewise, perception of soil erosion problem was positively and significantly related to the farmer's willingness to participate in soil conservation practices.

This implies that farmers' recognition of soil erosion hazard is very important in their decision to participate in soil conservation activities.

Size of shared farmland was negatively related to the practices. This is attributable to the fact that share cropping agreement may have short time horizon, which may not encourage the farmers to undertake conservation practices, as conservation investments pay back only in the long run. Therefore, the higher the size of land a farmer shared the less likely it is that he or she makes conservation investments.

In the same vein, non- crop land affects the willingness of the farmers to participate in soil conservation practices negatively and significantly. This is probably because as more and more land is put out of production, the farmers realize a reduction in their productive land and tend to

be unwilling to invest in conservation measures. In addition, soil erosion is less alarming on non-cropland than on cropland. The other important variable is conservation undertaking in the past, which is a proxy for awareness. As expected, this variable was positively and significantly related to the dependent variable. This is because a farmer who knows the available option for taking soil erosion is more receptive to conservation undertakings. The attitude of the farmers towards soil conservation was found to affect positively and significantly for their willingness to participate in soil conservation practices. This is possibly because of responsiveness to soil conservation technology which will differ positively with the strength of conservation related attitude. This study attempted also to assess farmers' willingness to allot money and spend time on soil conservation practices. The findings had shown that farmers' willingness to pay money for soil conservation practices was very low as compared to their willingness to spend time. It was found that the majority of the farmers were not willing to spend money on conservation. The average amount of money that they were willing to contribute was also very small.

6.2. RECOMMENDATIONS

Based upon the findings of the study, the following points need to be considered as possible policy implications in order to enhance farmers' participation in the planning and implementation of soil conservation activities.

The study result shows that educated farmers are more opt to understand the problem of soil erosion and willingly decide to take part in soil conservation practices. This clearly indicates that if farmers' participation is required in soil conservation practices, projects may first target educated farmers so that soil conservation practices could reach other farmers through farmer – to- farmer way of dissemination of information. It is also believed that training of young farmers could enhance adoption of soil conservation technologies.

Those farmers who have perceived soil erosion as a serious problem were willing to participate in soil conservation practices. This implies that to implement effectively sustainable soil conservation project effectively the planners should first increase farmers' recognition of soil erosion hazard. From theoretical point of view, one of the policy paradigms for identifying and solving the problem of land degradation is the populist approach, which emphasizes participation of local people by using their knowledge as a guide for policy and action participation enhance farmers perception of the land degradation problem. The farmers who have better perception of soil erosion will develop positive attitude towards conservation schemes and become less dependent on external assistance for undertaking soil conservation activities.

The model result shows that farmers who participated in soil conservation undertaking in the past were well aware of the advantages of the practice. These farmers were willing to participate

in soil conservation practices. Thus, policy makers can target these farmers as major information sources about the strength and weaknesses of past soil conservation projects so that they could plan more appropriate projects in the future.

Even if cropland may suffer more extreme erosion than non- cropland, communal grazing land may be also seriously affected by soil erosion due to overgrazing. Therefore, there should be an extension service effort aimed at creating awareness regarding the subsequent erosion hazard on grazing land.

The study result had shown that farmers who shared other farmers' land were less likely to participate in soil conservation activities. Therefore, there should be an effort, from policy makers, aimed at enhancing the awareness of these farmers. This is extremely important in that the depletion and degradation of land resource have far- reaching implications on the whole ecosystem because of the fact that they impede agricultural productivity and sustainability, and exacerbate rural poverty.

Technical training and demonstrations help farmers internalize most technologies effectively. Policy makers should encourage and provide technical training to farmers who are practicing soil conservation at their own initiative and using their indigenous knowledge.

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APPENDICES

Appendix 1. Summary of Questionnaires

Instructions for enumerators

1. Tell the purpose of the study and introduce yourself before you starting interview

2. For all closed questions put tick mark (x) where appropriate

General information

Name of the enumerator---------- signature ---------- date----------

Name of the PA ---------- Name of the village ----------

1. Agro climatic characteristics

1.1 Agro ecology dega=1 ----------, Woyna dega = 2----------

1.2 Rain fall High = 1 ----------, normal = 2----------, Low = 3----------

1.3 Altitude ----------masl

1.4 Soil type----------, Average slope----------%

2. House hold characteristics

2.1 Age----------, 2. 2. Gender, male = 1, ----------, female = 2, ----------

-

2.3 Marital status, married = 1, ----------, divorced =2, ----------, single = 3, ----------

2.4 Education level

Illiterate = 1, ----------, Basic education =2, ----------,

Primary education = 3, ----------, Number of years ----------

Secondary education = 4, ----------Number of years----------

2.5 Religion Orthodox = 1, -------, Protestant = 2, ------, Muslim = 3, ------, Others = 4, --------

2.6 Farming experience of the household: ---------- years.

2.7 Did you have some social position in the community so far? Yes = 1, -------, No =2, ---------

2.8 If yes, what is your position in the community? ----------

3. Farm characteristics.

3.1 Total farm size: ---------- timad

3.2 Cultivated land: ---------- timad

3.3 Grazing area: ----------timad

3.4 Fallow land: ----------timad

3.5 Others, (Specify):----------timad

3.6 Did you practice share-cropping during2010/2011crppin season? Yes = 1, -----, No = 2, -----

3.7 If yes, which category do you belong to? Share in = 1, ----------, share out = 2, ----------

3.8 If it was share in, what was the area of land? ---------- timad.

3.9 If it was share out, what was the area of land? ---------- timad.

3.10 Did you rent land during 2010/2011? Yes= 1, ---------, No = 2, ----------

3.11 If yes, to which category do you belong? Renting in=1, ---------, renting out = 2 ----------

3.12 If you rented land in, what was the size of the land? ---------- timad.

3.13 If you rent land out, what was the size of the land? ---------- timad.

3.14 Did you practice contracting land during 2010/2011? Yes = 1, ----------, No = 2, -------.

3.15 If yes, to which category do you belong? Contract in =1, -------, Contract out = 2, --------

3.16 If it was contracting in, what was the size of the land? ---------- timad.

3.17 If it was contracting out, what was the size of the land? ----------timad

3.18 Did you practice intercropping during 2010/2011? Yes = 1, ----------, No = 2, ----------

3.19 If, Yes how did you arrange intercropping?

---------- with ----------

----------with ----------

---------- With ----------

3.20 did you practice crop rotation? Yes = 1, ---------- No = 2, ----------

3.21 If yes, what of the sequence of rotation?

2007/2008----------, 2008/2009----------, 2009/2010----------

3.22 Did you practice relay cropping? Yes = 1, ----------, No =2, ----------

3.23 If yes, which crops do you relay crop?

S/N	Main crop	Relay crop

Purpose: consumption, sale, others

3.24 .For what purpose do you use crop residues?

S/N	Crop type	Purpose it used

3.25 Crops grown and area allocated to each crop during 2010/2011

S/N	Crop	Area(Timad)	Yield(Qt)

3.26. Did you think that your land is adequate to produce enough crops to sustain your family?

Yes =1, ----------, No = 2, ----------

3.27. If, income source not, from where did you get to fulfill your family need in terms of food, reserved seed, and income source? Rent = 1, ----------, Share cropping =2, ----------, others (specify), ----------

3.28. Cultural practices of major crops

S/N	practice	Major crops				
1	Land preparation					
2	Frequency of land preparation					
3	Planting time					
4	Planting method					
5	Weeding method					
	.Hand weeding					
	. Use herbicide					
6	Weeding frequency					
7	Harvesting time					

3.31. What are months of lour requirement for each operation by crop?

S/N	Crops	operation				
		Land preparation	planting	Tillage	Hand weeding	Harvesting

What are your problems in crop production? (In order of their importance)

A) ----------

B) ----------

C) ----------

3.32. Do you have problem(s) in storing your production? Yes = 1, ----------, No = 2, ----------

3.33. If yes, what is (are) the problem(s)?

A) ----------

B) ----------

C) ----------

3.34. Number of livestock kept on-farm

S/N	Type of animal	Number	Purpose of keeping

Purpose of keeping: Milk production, draft power, consumption etc

3.35. What is/are the main feed source(s)?

Grazing = 1, -------, Hay =2, ------, Crop residue = 3, -------, others (specify) = 4, ----

3.36. If you say grazing, what grazing system practiced in the area?

Controlled grazing =1, --------, Cut and carry system =2, ---------, Free grazing =3, ------

3.37. For what purpose do you use animal dung?

For fuel =1, ----------, as a fertilizer = 2, ----------, No purpose =3, ----------

3.38. Do you think that your animals have adequate feed in different season? Yes = 1, -----, No = 2, ----------

3.39. If not what are the most difficult months of feeding animals? ----------

3.40. Who herds the animals during the day? ----------

Sex----------, Age ----------

4. LABOUR AVELABILITY

4.1. Total family size

< 10 years ------, 10-14 years------, Male 15-65 years-------, Female 15-65 years------,> 65 years-

4.2. Working full time on the farm. Male =1, -------, Female = 2----------

4.3. Working part time on the farm. Male = 1, -------, Female = 2----------

4.4. Number of family members working off-farm. Male = 1---------, Female =2----------

4.5. Is the farmer has labor shortage? Yes = 1----------, No = 2----------

4.6. If yes, which kind of farm activities?

Crop production =1------, livestock production = 2-----, soil conservation activities =3 ------ others (specify) = 4--------

4.7. If yes to 4.5 how do you solve labor shortage?

Hiring labor = 1-------, Use communal labor = 2----------, others (specify) =3----------

4.8. If labor is hired, what type of labor do you hire?

Permanent = 1----------, casual = 2----------, both = 3 ----------

4.9. If permanent, how much do you pay per annum? (Birr)----------

4.10. If casual how much do you pay per day? (Birr)----------

4.11. Can you get labor when you are in need? ----------

4.12. On what activities your female family members participate?

4.13. On which activities do children<14 years old involve?----------

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5. AWARENESS TOWARDS SOIL EROSION AND EROSION HAZARDS.

5.1. Do you perceived the problem of soil erosion in your area? Yes =1---------, No =2----------

5.2.If yes, what feature lead you to believe that such problem exists?----------

---

5.3. Is your farm land prone to erosion? Yes =1----------, No =2----------

5.4. If yes, How much of your farm land affected by erosion in (Timad)? ----------

5.5. How do you perceive the level of parcels exposure to soil erosion?

No risk =1----------, Medium =2----------, High exposure to erosion =3 ----------

5.6. Has your farm land been severely affected by soil erosion before? ----------

5.7. If yes, severely of erosion on your farming plots since started farming.

Very severe = 1 ----------, severe =2----------, minor =3----------

5.8. When did soil erosion problem start in your farm?

Before 20 years-------, Before 10 years ----------, Before 5 years----------, Others (specify) ---------

5.9. How does the household perceive the soil depth fertility since starting farming as compared to the past? Increasing =1----------, decreasing =2----------, no change= 3---------, do not know =4---------

5.10. If answer to 5.9 is increasing, what measures did the household take to rehabilitate the conditions? Apply manure = 1------- Apply chemical fertilizer =2--------, practice terracing = 3---------- Planet tree or grass =4----------, fallow system =5----------

5.11. How serious is the decline in soil fertility on the main plot since started farming with reference to normal year/adequate rainfall? Very serious =1----------, serious =2----------, Minor = 3---------, No problem= 4----------

5.12. Do you think soil erosion will affect your farmland in the future if situations remain unchecked?

Yes = 1----------, No = 2----------

5.13. Slop of the land (as perceived by the farmer) very steep = 1-------, steep =2-------, gentle = 3-----, Flat = 4--------

5.14. Have you taken any of the following measures because of erosion?

Abandoned your cultivated land = 1----------

Expanded to marginal land = 2----------

Have taken off farm employment = 3----------

Others (specify) = 4----------

5.15. How is the fertility of your farmland? (As perceived by the farmer) Fertile = 1----------, moderate fertile = 2----------, Infertile = 3----------, others (specify) = 4

5.16. If not fertile, what was the cause of infertility?

Intensive cultivation for many years = 1----------

Erosion = 2----------, Do not know = 3----------, others (specify) = 4----------

5.17. Do you observe change in the level of crop yield on your cultivated land? Yes =1------, No =2----------

6. WILLINGNESS TO PARTICIPATE IN SOIL CONSERVATION PRACTICES

6.1 Have you practiced any soil conservation measure on your farmland? Yes = 1----,No = 2----

6.2 If yes, types of measures practiced ----------

6.3 If not, reasons ----------

6.4 Would you be willing to contribute money to participate in soil conservation practices?

Yes =1----------, no = 2----------

6.5 If no why? I do not trust in conservation = 1----------

I could not afford = 2----------

The government should pay for it = 3---------

I do not see the problem itself = 4 ---------

6.6 If yes to 6.4, would you be willing to pay the birr amount fix by village leaders for the conservation practice? Yes =1----------, No =2----------

6.7 If no, the reason

I can afford only half of the fixed amount =1 ----------

I can afford only quarter of the fixed amount = 2 ----------

Others (specify) = 3----------

6.8 Would you be willing to contribute labor to participate in soil conservation practices?

Yes = 1----------, No =2 ----------

6.9 If not, why? I do not trust in conservation = 1----------

Labor shortage = 2----------

I do not see the problem itself = 3----------

Others (specify) =4----------

6.10 If yes, how many maydays per a week?

Three man days = 1-----, Two man days =2------, One man day = 3-------, Others (Specify) =4----------

6.11 What is the main reason for your maximum willingness to contribute labor in number 6.10?

I could not afford more =1---------- I think it worth than amount =2----------

The government should pay for it = 3----------

Other reason (specify) = 4----------

7. AWARENESS TO TECHNOLOGY

7.1 Do you know the existence of soil conservation practices? Yes =1----------, no=2 ----------

7.2 If yes, would you mention some of soil conservation measures? ----------

---

7.3 If yes to 7.1, have you used one of the following physical soil conservation practice(s)?

Terrace =1 ------, couture bunds =2--------, Grass strip =3 ------, others (specify) =4--------

7.4 If did not use any soil conservation practice, mention the reasons for not using.

Labor shortage = 1--------, lack of money =2 ----------, others (specify) =3----------

8. RESEARCH AND EXTENSION SERVICE

8.1 Distance to the nearest research centre ----------Km

8.2 distance to the nearest development centre----------Km

8.3. Frequency of visit by development workers per year. --- ------days.

8.4 Did you participate in on-farm research/demonstration/ field day about soil conservation?

Yes = 1----------, No = 2----------

8.5 Did you get extension advice/education/training on soil conservation practices so far?

Yes =1-------, No =2 ----------

8.6 If yes ,would you please mention the type of training?----------

---

8.7 Are there any governmental or non-governmental organizations working on soil conservation?

Yes = 1----------, No = 2----------

8.8 If yes, mention some of them (GOs and NGOs)

GOs	NGOs
----------	----------
----------	----------
----------	----------

8.9 Have you been advised by any of these organization to undertake soil conservation practice?

Yes = 1----------, No = 2----------

8.10 In which kinds of soil conservation programs have you been involved?

Food for work = 1----, money for work = 2-----, safety net = 3-----, free = 4----, others (specify) =5----

9. TECHNOLOGICAL OPTION

9.1 Do you use fertilizer on your farm to maintain soil fertility? Yes =1---------, No =2----------

9.2 If yes, amount per hectare in Kg ----------

9.3 How do you see the difference between using fertilizer and soil conservation measures as a means of maintaining soil fertility?

Fertilizer is more important and preferable = 1----------

Soil conservation is more important and preferable = 2----------

Both have to be used in combinations =3 ----------

Others (specify) =4----------

10. LAND TENURE AND OWNERSHIP RIGHT

10.1 For how long have you been with your farm? ----------Years

10.2 Do you feed secure that the land belongs to you at least in your life time?

Yes =1----------, No = 2 ----------

10.3 What are the reasons ----------

10.4 How would the newly married member(s) of the household get land?

Share the household land = 1----------

The PA provide him/her =2 ----------

Others (specify) =3 ----------

10.5 What is the problem with the existing land tenure system? ----------

---

10.6 How does the current land tenure system affect the use of soil conservation practices? ------

---

---

11. INCOME SOURCE

11.1 What are you main source of income (in order of important) Crop sale = 1----------,

Livestock sale= 2---------, off-farm income =3----------, others (specify) = 4----------

11.2 If off-farm activities are used as income sources, indicate them in order of importance.

Other farms (poultry and Beekeeping) = 1----------,

Trade = 2 ----------, Casual work = 3----------, others (specify) = 4----------

11.3 What was the estimated amount of off-farm income in birr (recent year)? ----------

12. CREDIT AND MARKETING

12.1 Distance to the local market centre ----------Km

12.2 Distance to the all weather road ----------km

12.3 Did you receive any credit service during the last year? Yes= 1--------, No = 2----------

13.4 If yes, for what purpose receive? ----------

13.5 If yes, did you repay your loan? Yes =1----------, No= 2----------

13.6 If No why? ----------

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13. GENERAL QUESTIONNAIRE

14.1 What intervention must be used for better implementation of soil conservation practices in the future in your area?----------

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14.2 Ay idea with regard to soil conservation practice ----------

---

14.3 Any idea with regard to the negative impact if soil conservation practice? ----------

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Appendix 2. Codes for slope range

Code	**Description**	**Slope range (%)**
A	Nearly level	0-2
B	Gentle	2-5
C	Rolling	5-10

D	Steep	11-15
E	Very steep	Above 15

Source: Tafa Tulu, 2002.soil and water conservation for sustainable agriculture.

Appendix 3. Codes of soil texture

Codes	Description	Soil texture
A	Very heavy	Heavy clay
B	Heavy	Clay, silt clay
C	Moderately heavy	Silt clay loam
D	Medium	Silt loam, very fine sandy loam
E	Moderately light	Sandy loam
F	Light	Loamy sand
G	Very light	Sand, coarse sand

Source: Tafa Tulu, 2002.soil and water conservation for sustainable agriculture.

Appendix 4. Code for soil depth ranges

Code	**Description**	**Soil depth range(cm)**
1	Very deep	More than 150
2	Deep	90-150

3	Moderately deep	50-90
4	Shallow	25-50
5	Very shallow	Less than 2

Source: Tafa Tulu, 2002.soil and water conservation for sustainable agriculture.

Appendix 5. Codes for soil erodibility

Code	**Description**
1	Shallow, easily erodible, badly gullied
2	Moderately erodible, some gullies
3	Fairly good soil, well-managed, moderately eroded
4	Moderately deep soil, moderate erosion
5	Deep soil and little erosion

.Source: Tafa Tulu, 2002.soil and water conservation for sustainable agriculture.

Appendix 6. Land use and capability classification suitable for Ethiopia

Class I. Nearly level slope, deep to very deep soil, good to very good permeability and fertility of soil ,little erosion problem, there may be drainage problem, suitable for permanent agriculture with irrigation.

Class II. Gentle to rolling slope, moderate to deep soil, good to very good permeability, moderate to good fertility, moderate to little erosion, suitable for continuous farming, for strip cropping or mulching

Class III. Steep slope, shallow soil, poor to very poor permeability, low to medium fertility, moderately erodible with some gullies, not suitable for row crops in which cover crops and improved practices are necessary

Class IV. Steep to very steep slope, shallow to very shallow soil, poor to very poor permeability, low fertility, moderately erodible with some gullies, semi-arid climate subject to wind erosion, cropping possible but once in 2to3years. Perennial crops are best, no row crops at all.

Class V. Nearly level slope, shallow soil, poor permeability low fertility, moderately erodible with some gullies, semi-arid condition, suitable for forestry or grazing, no cultivation due to stoniness.

Class VI. Steep to very steep slope, shallow soil, very poor permeability, very sandy or stony, suitable for forestry and grazing land and with careful management and controlled grazing.

Class VII. Very steep slope ,shallow soil ,very poor permeable ,very low fertility ,moderately erodible with some gullies , very sandy and stony , severe limitation even for grazing and forestry ,handle very carefully.

Class VIII. Consists of deserts, very high mountain peaks, extremely steep slopes ,used for wild life, recreation, or watershed value , no agriculture, no forestry , and no grazing ,protect them from fire or burning.

Source: Tafa Tulu, 2002.soil and water conservation for sustainable agriculture.

Appendix 7. Agro climatic zones classification of Ethiopia

S/N	Agro climatic zone	Annual Rainfall	Altitude(above sea level)
1	High wurch	>1400 mm	>3700 m
2	Moist wurch	900-1400 mm	3700-3200 m
3	Wet wurch	>1400 mm	3700-3200 m
4	Moist dega	900-1400 mm	3200-2300 m
5	Wet dega	1400 mm	3200-2300 m
6	Dry weynadega	<900 mm	2300-1500 m
7	Moiost weynadega	900-1400 mm	2300-1500 m
8	Wet weynadega	>1400 mm	2300-1500 m

9	Dry kolla	<900 mm	1500-500 m
10	Moist kolla	900-1400 mm	1500-500 m
11	Bereha(Desert)	<900 mm	<900 m

Source: Guidelines for Development Agent on soil and water conservation and community forest (CFSCDD).Ethiopia, 1986.

Appendix 8. Timad is local unit measure of land size that the farmers use it to express the size of their land.

1 Timad is equal to $1/4^{th}$ of a hectare

1 hectare = 4 Timad

Appendix 9. Conservation factors used to estimate tropical livestock unit (TLU)

Animals species	**Live weight(kg)**	**TLu**
Cow	250	1.00
Heifer	125	0.50
Oxen	250	1.00
Calves<1.2 years	50	0.20
Sheep and Goat	22	0.10
Horse and Mule	200	0.80
Donkey	90	0.40

Source: Varvikko (1991)