ST. MARY'S UNIVERSITY

SCHOOL OF GRADUATE STUDIES

INSTITUTE OF AGRICULTURE AND DEVELOPMENT STUDIES

Determinants of Farmer's Willingness to Participate in Soil Conservation Practices the Case of Sabata Hawas Woreda, Oromia Regional State, Ethiopia

BY

LECHISSA TOLERA MERDASSA

JUNE, 2017

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A Thesis Submitted to School of Graduate Studies of St. Mary's university in partial fulfillment of the requirements for the degree of master of science in agricultural economics

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APPROVAL OF BOARD OF EXAMINERS

As a member of the board of examiners of the Master Thesis open defense examination, we testify that we have read and evaluated the thesis prepared by Lechissa Tolera and examined the candidate. We recommended that this thesis be accepted as fulfilling the thesis requirements for the degree of Master of Science in Agricultural Economics.

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DECLARATION

I, Lechissa Tolera Merdassa, declare that this thesis is a result of my own original effort and work, and that to the best of my knowledge, the findings have never been previously presented to the University of St. Mary's or elsewhere for the award of any academic qualification. Where assistance was sought, it has been accordingly acknowledged in the text and a list of reference provided.

Lechissa Tolera Merdassa

Signature _____ **Date**_____

ENDORSEMENT

This thesis has been submitted to Saint Mary's University, School of Graduate Studies for examination with my approval as a university advisor.

Name _____

Signature _____

Date _____

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ACRONYMS AND ABBREVIATIONS

CAM	Conjoint Analysis Method
CEM	Choice Experiment Method
CIM	Cost-of-Illness Method
CSA	Central Statistics Agency
CV	Contingent Valuation
CVM	Contingent Valuation Method
FAO	Food and Agricultural Organization
FFW	Food for Work
GDP	Growth Domestic Product
GIZ	German Cooperation for International Development
GO	Governmental Organization
HPM	Hedonic Pricing Method
MPM	Market Prices Method
NCS	National Conservation Strategy
NFIM	Net Factor Income Method
NGO	Non-Governmental Organization
PA	Peasants Association
PFM	Production Function Method
RCM	Replacement Cost Method
SHFEDO	Sabata Hawas Finance and Economic Development Office
SHWAO	Sabata Hawas Woreda Agriculture Office
SLM	Sustainable Land Management
SMNP	Samen Mountain National Park
SPSS	Statistical Package for the Social Sciences
SWC	Soil and Water Conservation

TCM	Travel Cost Method
TEV	Total Economic Value
TLU	Tropical Livestock Unit
UNCCD	United Nations Convention to Combat Desertification
USD	United Stated Dollar
VIF	Variance Inflation Factor
WWMEO	Woreda Water, Mineral and Energy Office
WTC	Willingness to Contribute
WTP	Willingness to Pay/Participate

ABSTRACT

Soil erosion is one of the most serious environmental problems in the highlands of Ethiopia. The prevalence of traditional agricultural land use and the absence of appropriate natural resource management often result in the degradation of land in Sabata Hawas Woreda. Hence, this study assessed farm households WTP for soil conservation practices through a Contingent Valuation Method study. Based on data collected from 129 respondents, descriptive statistics indicated that 90% of the respondents have perceived the problem of soil erosion and are willing to pay for conservation practices. The econometric bivariate probit model was run to estimate both mean WTP and to identify the determinant factors for farmers` WTP for soil conservation. The mean WTP for the double bounded bivariate probit estimate with covariates ranged from 3.3 days/week to 1.95days/week for the initial bid and for the follow up bid amount respectively. A total of fifteen explanatory variables were included in the model of which nine were significant at less than 5% probability levels. Sex of households, Marital status, Social position of the household head, family size, perception of the soil erosion hazard, Labour shortage, Total income, Access to credit service and household owner of Tropical livestock unit were highly important in influencing WTP in soil conservation practices. Therefore, taking these factors into account in planning soil conservation measures may help policy makers to come up with projects that can win acceptance by land users. This study also attempted to assess farmers' willingness to pay money and spend time on soil conservation practices by applying the Contingent Valuation Method. The result showed farmers' willingness to pay money for soil conservation practices was very low as compared to their willingness to spend time due to the face shortage of cash. Hence, if soil conservation projects are to make farmers participate, they should target labor contribution than financial contribution.

Key words: Willingness to pay, Contingent Valuation Method, Double Bounded Dichotomous Choice, Bivariate Probit Model, Soil Conservation practices

CHAPTER ONE

INTRODUCTION

1.1 Background

The economic development of developing countries depends on the performance of the agricultural sector, and the contribution of this sector depends on how the natural resources are managed. Unfortunately, in the majority of developing nations, the quality and quantity of natural resources are decreasing resulting in more severe droughts and floods (Fikru, 2009).

In the predominantly agrarian societies of Africa, one of the most ominous threats to food supply is environmental degradation, the deterioration of croplands, grasslands and forests (Alemneh, 1990). Land degradation and continuous fall in agricultural productivity in countries of sub-Saharan Africa have raised serious concerns 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 same authors emphasized that the complex inter-linkages between poverty, population growth, and environmental degradation offer another dimension to the land degradation problem.

Ethiopia, being among these developing countries, has heavily relied on its environmental and agricultural resource base for the past years. In general, agriculture in the country is characterized by limited use of external inputs and continuous deterioration of the resources. According to Daniel (2002), Ethiopia large scale deforestation and soil erosion for the last couple of decades has faced serious ecological imbalances because of caused by improper farming practices, destructive forest exploitation, wild fire and uncontrolled grazing practices. Similarly, Ethiopian 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 highlands (about 27 million hectares) is significantly eroded and over one fourth (14 million hectares) is seriously eroded (Tegegne, 1999). This has resulted in a

declining agricultural production, water depletion, disturbed hydrological conditions, and poverty and food insecurity.

Bojo and Cassells (1995), assessed land degradation and indicated that the immediate gross financial losses due to land degradation in the Ethiopian highlands were about USD 102 million per annum which was about 3 % of the country's GDP. The study also showed that virtually all of the losses were due to nutrient losses resulting from the removal of dung and crop residues from cropland, while the remaining was mainly due to soil erosion. Other modeling work suggests that the loss of agricultural value between 2000 and 2010 to be a huge about $7 billion (Berry, 2003).

Natural and environmental resources conservation in Ethiopia, specifically soil, is therefore not only closely related to the improvement and conservation of ecological environment, but also to the sustainable development of its agricultural sector and its economy at large. According to Alemneh (2003), there was no Government policy on soil conservation or natural resources management in Ethiopia prior to 1974. The 1974-1975 famine was the turning point in Ethiopian history in terms of establishing a linkage between degradation of natural resources and famine. Since then, different soil conserving technologies with a varied approach has been underway.

As the government realized the problem of land degradation, it took policy actions. In this regard, a forest and wildlife conservation and development policy was declared in 1980. Following this policy, the government initiated various studies and capacity-building programs and massive soil and water conservation (SWC) interventions (Herweg and Ludi 1999). The capacity building programs involved training of professionals at the national level and farmers on the local. In this regard, SWC was included in the university curriculum, and the mandate to train farmers was given to the Ministry of Agriculture. SWC interventions in the highlands focused both on mechanical and biological measures (Tekle 1999). The mechanical measures included construction of bunds, terraces, diversion ditches, check dams, micro-basins and hillside terraces. The biological measures comprise enclosure of degraded land from human and animal interference (exclosure), tree seedling production, agro-forestry tree seedling planting on farmlands, reforestation, and tree planting at homesteads and in enclosures as tree enrichment (Nyssen et al. 2009).

Initially, the SWC activities were carried out using food aid in the form of food-for-work (FFW); however free community labor was mobilized as the people´s awareness increased (Tekle 1999). The basis for the implementation of the SWC interventions on a large scale was the 1975 land reform and the establishment of peasant associations (PAs). The reform gave farmland usufruct to the farmers that motivated them, and the PAs facilitated implementation of SWC and played an Instrumental role for labor mobilization (Shiferaw and Holden 1999).

The SWC interventions showed an inconsistent adoption trend over time. Initially, farmers viewed the structures as showing limitations, as they were not getting immediate returns (Amsalu and de Graaff 2007). Among the limitation farmers mentioned were that the mechanical structures on farmlands reduced the area of cultivable land, harbored rodents, and the construction was labor intensive (Amsalu and de Graaff 2007). Despite the problem of soil erosion and poor soil fertility, this perception of SWC is to be taken seriously because farmers have small and fragmented farmlands (ibid) reported that larger farms with less livestock, on steep slopes and with poor fertility adopted the practice better than those with contrasting conditions.

However, the achievements of those soil conservation attempts have been daunting. In order to combat soil degradation and to introduce sustainable use of resources, there is a need to take action. Thus, it is imperative that the local people participate in the designing and practices of conservation measures.

The study was undertaken in Highlands of Sabata Hawas Woreda , Oromiya National Regional State (Oromia Special Zone Surrounding Finfinne). At present, this area is facing extreme soil degradation. The principal factors responsible for the problem include very steep topography, inherent erodable nature of the soils and expansion of farmland by clearing forest. The study identified the determinants of farmers' willingness to take part in soil conservation practices, assessing farmers' perception of erosion problems and generating baseline information for policy intervention.

1.2 Statement of the Problem

Soil is the second most important to life next to water (FAO 1987). From the record of past achievements, history tells us that civilization and fertility of soils are closely interlinked. The

declination of the fertility of soils had occurred due to accelerated erosion caused by human interference. Today soil erosion is almost universally recognized as a serious threat to human wellbeing.

Soil erosion is one of the most serious environmental problems in the highlands of Ethiopia. The prevalence of traditional agricultural land use and the absence of appropriate resource management often result in the degradation of natural soil fertility. This has important implications for soil productivity, household food security, and poverty in those areas of the country (Teklewold and Kohlin, 2011). Serious soil erosion is estimated to have affected 25% of the area of the highlands and now seriously eroded that they will not be economically productive again in the foreseeable future. The average annual rate of soil loss in the country is estimated to be 42 tons/hectare/year which results to 1 to 2% of crop loss (Hurni, 1993), and it can be even higher on steep slopes and on places where the vegetation cover is low. This makes the issue of soil conservation not only necessary but also a vital concern if the country wants to achieve sustainable development of its agricultural sector and its economy at large.

Anemut (2006), argues that, natural resources such as soil are important natural resources as they have useful effects on ecological balances and also for they are the means for the livelihood of many local people worldwide; especially in the developing countries. However, due to lack of efficient property right, increased population growth, lower productivity of agriculture and fast expansion of farmlands in most developing countries many environmentally important areas are highly degraded. According to the same author, the non-participatory nature of environmental policies, which gives less priority to the local communities need and priorities in the management and use of natural resources, has worsened the problem of natural resource degradation in most developing countries.

In Ethiopia, research about farmers' perception of soil degradation problem and factors influencing their willingness to participate in conservation practices through cash and/or labor contribution is non-existent except in a 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. Polices that address the best interests of land users are needed in relation to soil conservation. According to Lynne *et al* (1988), economic incentives will increase efforts, but responsiveness will differ with the strength of conservation related attitudes.

Therefore, a study on farmers' perception of soil degradation problems and determinants of their willingness to participate in soil conservation practices by contributing cash and/or labor is useful for development of projects that address local peoples' (land users') economic, demographic, institutional, and technical factors. The specific study site, Sabata Woreda, is dominated by steep to hill land forming and higher annual rainfall amount that result higher soil erosion problem. At present, this area is facing extreme degradation the principal factors being very steep topography, inherent erodable nature of the soil and expansion of farmland to hillsides without appropriate conservation measures.

According to Wegayehu (2003), among the various forms of land degradation, soil erosion is the most important and an ominous threat to the food security and development prospects of Ethiopia and many other developing countries. It induces on-site costs to individual farmers, and off-site costs to society. That coupled with poverty, fast growing population and policy failure; poses a serious threat to national and household food security.

To avert the global as well as local environmental disaster being brought by soil erosion, it is imperative to take action quickly and on a vast scale. It is therefore, very necessary to induce in every one's mind the importance of conserving soil resources. Hence, in this study, an attempt was made to estimate local people's willingness to pay for conservation practices.

1.3. Research Questions

The underline questions of this study are;

1. What are the determinants of willingness of the household to pay cash and/or contribute labor for soil conservation?
2. What is the perception of farmers on soil erosion?

1.4 Objective of the Study

1.4.1. General Objective

The general objective of this study is to elicit farmer's willingness to participate in soil conservation and rehabilitation practices in the study area.

1.4.2. Specific Objective

The specific objectives of the study are:

- To identify the determinants that affects farmer's willingness to participate on soil conservation practices.
- To estimate farmer households mean willingness to pay for soil conservation practice in the study area

1.5 Working Hypotheses

With market imperfections, the probability or the level of farm household's WTP for soil conservation depends on various factors, such as poverty and household characteristics, than only farm characteristics. If markets (for example, credit markets) were perfect, then farm households‟ WTP would depend only on farm characteristics as they could address cash liquidity problems through these credit markets (Tessema and Holden, 2006). Therefore, based on this theory the hypotheses are as follows:

1. Perception of severity of soil degradation at the study area will not affect the household's WTP for soil conservation.
2. Socio economic variables such as age, sex, education level, social position of the household head and land tenure do not affect household's willingness to pay for soil conservation practices.
3. Wealth and resources endowments such as family size, total livestock holdings and income of households do not affect willingness to pay of households' for soil conservation practices.

1.6. Significance of the study

The achievements of the soil conservation practices that have been undertaken in Ethiopia have fallen far below expectations. The country still loses a tremendous amount of fertile topsoil, and

the threat of land degradation is broadening alarmingly (Tekelu and Gezeahegn, 2003). This is mainly because; farmer's perception of their environment has been misunderstood partly in the country. It is misunderstood partly because outsiders, both scholars and policy makers, who write about farmers and formulate polices, often have limited understanding about the farmer's attitude towards environment. Furthermore, the farmers view of the environment is often ignored without due consideration of the condition he/she faces between survival and environmental exploitation (Alemneh, 1990). So far, conservation practices were mainly undertaken in a campaign often without the involvement of the land user (Shiferaw and Holden, 1998).

Does such an experience mean that there is no hope for soil conservation in Ethiopia? Absolutely not, the problem would have been rather, the projects that have been undertaken in Ethiopia for soil conservation failed to consider local peoples willingness to participate for such projects from the very initiation of conservation measures. This motivates that, there is a need to study on willingness to pay and design of polices and strategies that promote resource conserving land use with active participation of local people.

Thus, this study analyzes the value that farmer's attach to soil conservation practices, determinants of their willingness to pay for soil conservation via labour contribution and the welfare gain from such activities. Generally, understanding the factors leading to willingness to pay in soil conservation practices would help policy makers to design and implement more effective soil conservation plans.

1.7. Delimitation/Scope of the Study

Geographically, this study is confined to one woreda of Oromia Special zone surrounding Finfinnee Sabata Hawas Woreda due to limited availability of resources; money and time. Sample sizes of 129 households were taken from 5 purposely selected kebeles out of the 36 kebeles in woreda using random sampling technique.

1.8. Organization of the Thesis

This thesis research report includes different parts. The first part is about brief introduction of the study. The rest of the thesis is organized as follows. In Chapter Two literature review was

presented. The reviewed studies are in the area of soil and land degradation problems, natural resources valuation methods and theory of welfare economics. Chapter Three presents study area and methodology. The Chapter starts with background of study area, sample and sampling technique and methods of data collection. Later the bivariate probit models are discussed. Results and discussions are presented in Chapter Four. Chapter five concludes the study and presents policy recommendations.

CHAPTER TWO

REVIEW OF LITERATURE

This chapter is mainly concerned with the review on soil and land degradation problem in Ethiopia, natural resources valuation techniques and theory of welfare economics. The chapter further reviews the criticisms of the contingent valuation method. Finally, some studies that have been done in Ethiopia and elsewhere using the contingent valuation method are reviewed.

2.1 The Concept and Problem of Land Degradation

According to the United Nations Convention to Combat Desertification (UNCCD), land degradation is defined as a natural process or a human activity that causes the land to be unable to provide intended services for an extended time (FAO, 2004).

Land degradation can be defined as a process that lowers the current and future capacity of the land to support human life (Demeke, 1998). Land degradation and soil degradation are often used interchangeably. However, land degradation has a broader concept and refers to the degradation of soil, water, climate, and fauna and flora (Alemneh et al. 1997 cited in Behailu, 2009).

Land/soil degradation can either be as a result of natural hazards or due to unsuitable land use and inappropriate land management practices. Natural hazards include land topography and climatic factors such as steep slopes, frequent floods and tornadoes, blowing of high velocity wind, rains of high intensity, strong leaching in humid regions and drought conditions in dry regions. Deforestation of fragile land, over cutting of vegetation, shifting cultivation, overgrazing, unbalanced fertilizer use and non-adoption of soil conservation management practices, over-pumping of ground water (in excess of capacity for recharge) are some of the factors which comes under human intervention resulting in soil erosion (Dominic, 2000).

Ethiopia is one of the Sub Saharan African countries where soil degradation has reached a severe stage. Land degradation mainly due to soil erosion and nutrient depletion, has become one of the most important environmental problems in the country. Coupled with poverty, fast growing population and policy failures, land degradation poses a serious threat to national and household food security (Shiferaw and Holden, 1999). According to Gebreegziabher et al. (2006), in

Ethiopia where deforestation is a major problem, many peasants have switched from fuel wood to dung for cooking and heating purposes, thereby damaging the agricultural productivity of cropland.

2.2 Causes of Land Degradation

Land degradation is the result of complex interactions between physical, environmental, biological, socio-economical, and political issues of local, country wide or global nature. But, the major causes of land degradation are caused by the mismanagement of land by the respective local uses.

The causes of land degradation can be grouped in to proximate and underlying factors. The proximate causes of land degradation include cultivation of steep slopes and erodible soils, low vegetation cover of the soil, burning of dung and crop residues, declining fallow periods, and limited application of organic or inorganic fertilizers. The underlying causes of land degradation include such factors as population pressure; poverty; high costs or limited access of farmers to fertilizers, fuel and animal feed; insecure land tenure; limited farmer knowledge of improved integrated soil and water management measures; and limited or lack of access to credit. The proximate causes of land degradation are the symptoms of inappropriate land management practices as conditioned by the underlying factors. Hence, efforts for soil conservation need to address the underlying causes primarily, as focusing on the proximate causes would mean addressing the symptoms of the problem rather than the real causes (Gebremedhin, 2004).

According to Hurni (1988), both environmental and socio-political factors have contributed to the poor performance of Ethiopian agriculture. Environmental factors include the dissected terrain, the cultivation of steeper slopes, erratic and erosive rainfall, and so on. Socio-political factors include the top down approach adopted by bodies intervening to improve soil and water conservation. Farmers have been minimally involved in soil conservation activities and indigenous knowledge has been undermined within planning, design, and implementation processes. As a result, soil and water conservation programs have to date proved to be highly unpopular among farmers.

In response, the government of Ethiopia attempted to combine incentives with participatory approaches to soil conservation. However, real participation of beneficiaries has not been realized in the country. Perhaps as a result, the adoption of soil conservation practices remains low. Moreover, the use of indirect economic incentives such as credit supply, extension services, reduction of land taxes, input and output price support and market development has been limited. These experiences indicates that there is a need to use both direct and indirect incentives combined with real participation of beneficiaries if effective and sustained soil conservation effort is to take place (Gebremedhin, 2004). This is due because there are no perfect markets for soil erosion prevention practices as the good is public. Therefore, the objective of this study is to determine the value that households attach to reduce soil and land degradation in the study area, as manifested in their willingness to pay.

2.3 Conservation and Rehabilitation

A community confronts two basic situations with respect to soil or natural resources. Either soil or natural resources are not degraded, because they are not being overexploited, or else the landscape and soil are degraded (i.e. partially or totally destroyed) and this destruction is progressive. Each situation requires a different type of action (FAO, 1987).

Soil conservation is a means of preserving natural resources for potential agricultural production, and is essential for the survival of certain groups of people given demographic and social trends. A broader and more dynamic definition sees conservation as covering improvements as well, developing natural resources rationally and thus enabling maximum benefit to be obtained while production capacity is preserved indefinitely (FAO, 1987).

Rehabilitation on the other hand, is defined as restoring the productive potential of degraded natural resources to their original level or one approaching it: in other words, corrective action. The rehabilitation concept goes hand in hand with restoration and normally dominates projects involving upland communities. Only in rare instances has society had the foresight and the vision to conserve its natural resources dynamically, that is, by using them wisely and well. Whilst the rehabilitation of natural resources tends to rely on artificial rather than natural methods, in conservation the reverse is true (FAO, 1987).

2.4. Economic Values of Natural Resources

For market prices to represent the correct value society attaches to the good, markets need to be competitive and work freely. In such cases, prices are taken as an expression of the willingness to pay for the good, which is the total value the buyer, has for the good. But in reality markets are far from being perfect, and even they do not exist for some class of goods. Therefore, to measure the value people attach to goods, which do not have a perfect market, or any market at all; we need to understand the concept of value (Aklilu, 2002).

This is at least for the following reasons. Firstly, there is a situation where markets are missing to value the natural resources. In the absence of perfect markets, values of goods and services are not properly revealed. Secondly, even if markets exist, they do not do their job well due to market distortions, for example imperfect land property rights in the study area could lead to land degradation, in this case. Thirdly, uncertainty is involved about the demand and supply of natural resources and/or it is difficult to estimate, especially in the future due to the non rival and excludability nature of such resources. This is in the sense that, most economic markets capture, at best, the current preferences of the buyers and sellers. Fourthly, governments may like to use the valuation as against the restricted, administered or operating market prices for designing natural resources conservation programmes. Fifthly, in order to arrive at natural resource accounting, for methods such as Net Present Value methods, or for cost-benefit analyses, valuation is a necessity. Finally, for most natural resources, it is essential to understand and appreciate its alternatives uses apart from its direct value of the resources such as existence and indirect values (Kadekodi, 2001).

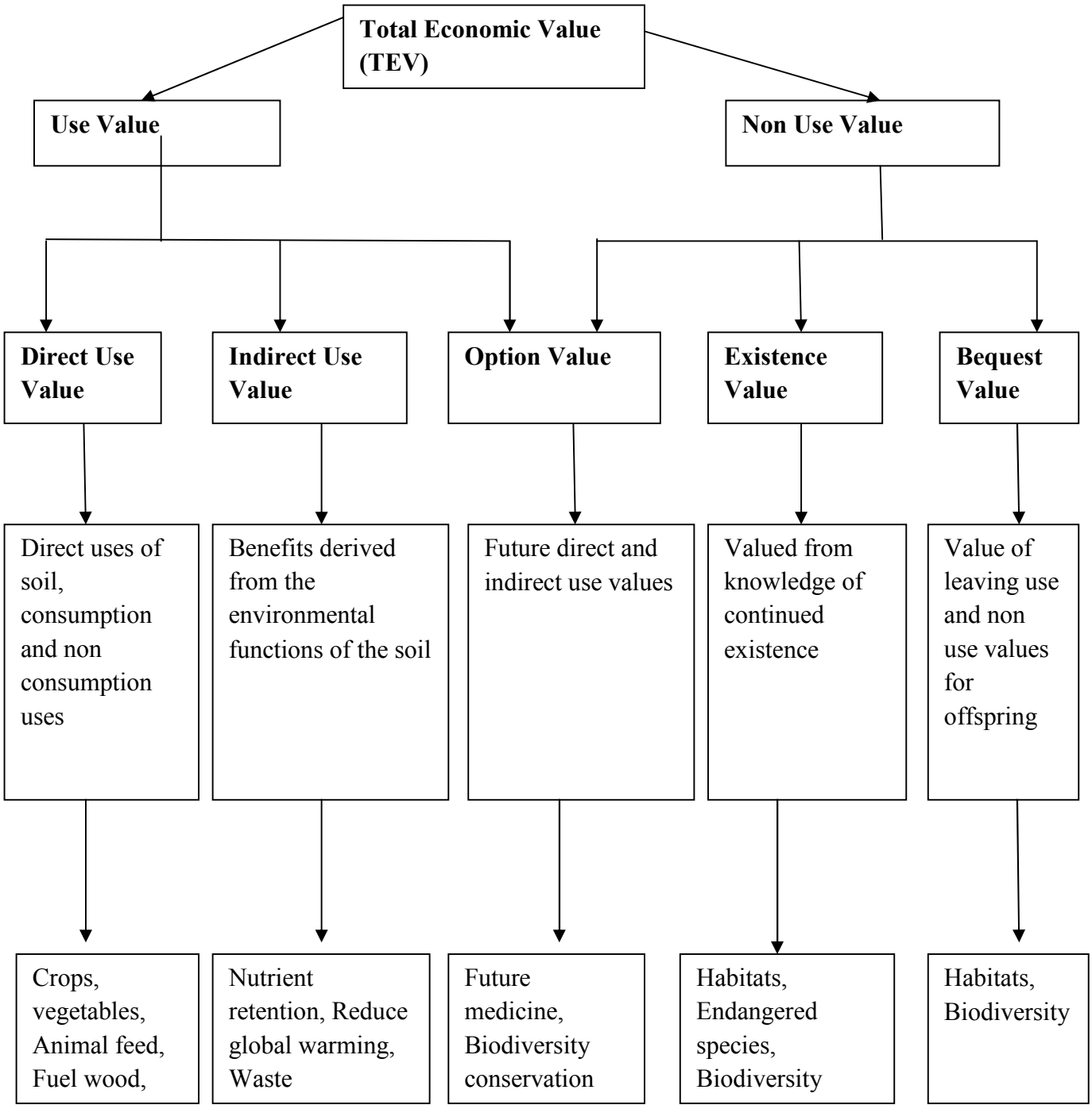
The expression of total economic value bears as an attempt to overcome the traditional evaluation of environmental goods, exclusively based on the use value attributed to goods considering direct benefits enjoyed by final consumers. It seems that the expression “total economic value” appeared for the first time in an essay by Peterson and Sorg in 1987, “Toward the measurement of total economic value”. Then the term was more and more used by other environmental economists.

The use value derives from a concrete use of environmental goods. Every use, in any moment and by anyone is realized to create use values, which are more or less measurable since they

derive from their current use. Increase in crop production can be considered as the use value of soil conservation.

But the total economic value is not only use value; it is given by the sum of use and nonuse values referring to intrinsic benefits, i.e. those deriving from the mere existence of environmental goods, in our case soil. The first economist, who identified the total economic value double feature, was Kutrilla (1995). After Kutrilla the scholars interested in these topics have not been limited to theoretical analysis of the total economic value and of its components, but their attention is centered on an empirical analysis which allows them to identify the main features especially of non-use value and the different methods usable for their measurement.

As shown in Figure 2.1 the Total Economic Value (TEV) that people attach to an environmental good is the summation of use value and non-use value. Use value refers to the benefit people get by making actual use of the good now or in the future. Use value is divided into direct use value, indirect use value and option values. Protection from soil erosion is a direct benefit that comes from better soil management practices. By definition, use values derive from the actual use of the environment while non-use values are non-instrumental values which are in the real nature of the thing but unassociated with actual use, or the option to use the thing. Instead such values are taken to be entities that reflect people's preferences, but include concern for, sympathy with, and respect for the rights or welfare of non-human beings. Soil resources can be also valued for their potential to be available in the future. These potential future benefits constitute an option value. It may be thought of as an insurance premium one may be willing to pay to ensure the supply of the soil resources later in time.



Source: Adopted from Marcouiller et al. (1999)

Figure 2.1. Components of TEV of Soil Resource

Non-use value is divided into existence and bequest value. Existence value is the value people attach to soil conservation service not because they want to use the soil now or in the future, but because they just want to make sure the soil exists. Bequest value is a non-use value that one expects his/her descendents to get from the soil conservation services.

2.5 Natural Resources Valuation Methods

Environmental valuation techniques help to estimate the value people attach to environmental amenity or services, i.e., how much better or worse off individuals are or would be as a result of a change in environmental quality. Since there are no existing markets for environmental goods, people‟s valuation for these kinds of goods could be elicited using two techniques. When a valuation technique considers related or surrogate markets in which the environmental good is implicitly traded, it is referred as a revealed preference method or indirect valuation method. Examples of this valuation method include the travel cost method (TCM), the hedonic pricing method (HPM), the production function method (PFM), the net factor income method (NFIM), the replacement cost method (RCM), the market prices method (MPM), and the cost-of-illness method (CIM). The second category of environmental resource valuation methods is known as the stated preference method or direct valuation method. These comprise survey-based methods that can be used either for those environmental goods that are not traded in any market or for assessing individuals‟ stated behavior in a hypothetical setting. The method includes a number of different approaches such as choice experiment method (CEM), contingent valuation method (CVM) and conjoint analysis method (CAM) (Aklilu, 2002; Tietmberg, 2003; Birol et al., 2006 cited in Habtamu, 2009).

But for this study, only contingent valuation method was used to elicit the WTP of households for soil conservation practices. One reason for using CVM is its superiority over other valuation methods, which is its ability to capture, both use and non-use values. Using other valuation methods such as hedonic pricing and travel cost method would underestimate the benefits people get from soil conservation since they measure use values only (ibid).

The other reason for using CVM is its ease of data collection and requirement compared to other valuation methods. Further, the other methods such as TCM and HPM are based on Marshallian

demand which does not hold utility constant, which is difficult to measure the change in welfare if utility does not hold constant. Therefore, CVM is the best valuation method available for measuring the total value people give for soil conservation in Sabata Hawas, Ethiopia.

2.5.1. 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; Smith, 1977). 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 product 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 yields on degraded soils (the on-site impact), plus the value of any off-site costs avoided (eg. sedimentation and siltation) (Bishop, 1992).

According to the same author, the presence of market imperfections, policy distortions or institutional constraints is often used to justify public subsidy of soil conservation efforts. However, direct subsidies may not always be the best solution. Careful analysis of underlying 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.

2.6. Contingent Valuation Methods (CVM)

2.6.1 Theoretical Literature

CVM is an environmental valuation method, which uses a hypothetical market to appraise consumer preferences by directly asking their willingness to pay or willingness to accept for change in the level of environmental good or services. The contingent valuation method involves directly asking people, in a survey, how much they would be willing to pay for specific environmental services.

The contingent valuation method involves directly asking people, in a survey, how much they would be willing to pay for specific environmental services. In some cases, people are asked for the amount of compensation they would be willing to accept to give up specific environmental services. It is called "contingent" valuation, because people are asked to state their willingness to pay, contingent on a specific hypothetical scenario and description of the environmental service.

If a researcher manages to correctly apply the procedures, CVM can able to capture the total value of the good- both use and non-use values and its flexibility facilitates valuation of a wide range of non-market goods. As a result, CVM is becoming the most preferred valuation method at present (Mitchell and Carson, 1989; Whittington, 1998). Although economists were slow to adopt the general approach of CVM, the method is now ubiquitous (Haab and McConnell, 2002).

In most CVM applications, the major steps are the following

- Deciding what change you are going to value
- Deciding how you are going to implement the questionnaire
- Designing and administering the CVM survey
- Analysis of the responses
- Estimating and aggregating benefits (WTP)
- Evaluating the CVM exercise (Validation Tests)

Contingent valuation survey consists three basic parts (Mitchell and Carson, 1989). First, a hypothetical description of the condition under which the good or service is to be offered as presented to the respondent. Second, questions which elicit the respondents‟ willingness to pay for the goods being valued are presented.

Finally, questions on socio-economic, demographic characteristics and their use of the good or service under consideration are given to the respondents. A CVM study could be undertaken using different elicitation methods or method of asking questions. This part of the questionnaire confronts the respondent with a given monetary amount, and one way or the other induces a response. This has evolved from the simple open-ended question of early studies such as "What is the maximum amount you would pay for…..?" through bidding games and payment cards to dichotomous choice questions. Below, we have discussed the approaches of asking questions that lead directly to willingness to pay or provide information to provide preferences (Haab and McConnell, 2002).

Open Ended Format: A CVM question in which the respondent is asked to provide the interviewer with a point estimate of his or her willingness to pay (ibid).

Bidding Games: This method starts by asking respondents whether they accept a given price for the good and higher or lower prices will be offered depending on the answer given to the initial prices. The bidding stops when iterations have converged to a point estimate of willingness to pay (ibid).

Payment Cards: A CVM question format in which individuals are asked to choose a willingness to pay point estimate (or a range of estimates) from a list of values predetermined by the surveyors, and shown to the respondent on a card (ibid).

Dichotomous or Discrete Choice CVM: A CVM question format in which respondents are asked simple yes or no questions of the stylized form: Would you be willing to pay $t? (ibid)

As it is discussed earlier, a CVM study could be undertaken using one of the above methods. But the first three methods have been shown to suffer from compatibility problems in which survey respondents can influence potential outcome by revealing values other than their true willingness to pay. The dichotomous choice approach has become quite widely adopted, despite criticisms and doubts, in parts because it appears to be incentive compatible in theory. When respondents do not give a direct estimate of their willingness to pay, they have diminished ability to influence the aggregate outcome. However, this advantage of compatibility has a limitation. Estimates of willingness to pay are not revealed by respondents (Haab and McConnell, 2002). To improve the precision of the WTP estimates, in recent years researchers have introduced a follow up question to the dichotomous question (Alberini and Cooper, 2000). Hence, in this study, a double bounded

dichotomous question and an open ended follow up was used. This approach is similar to real life situation in Ethiopia at a market where the seller first states some bid price for a good and then negotiation starts between the seller and the buyer. Some studies (for instance, Alemu, 2000; Paulos, 2002; Anemut; 2006, Habtamu, 2009) implement an elicitation procedure, which includes an initial dichotomous choice payment question followed by another question.

2.6.2 Bias Issues in Contingent Valuation Methods

Although CVM is the best method for valuing non marketed goods, it has some limitations. One of the main limitations of a CVM study is that due to the hypothetical nature of the good which is going to be valued. This relates to the fact that, many people have little experience in making explicit value of the environmental good especially the non use values. Therefore, some people have difficulties to accept results obtained through CVM as true willingness to pay which will be revealed if the good valued were to be supplied in reality. But many studies have shown that CVM can give a reliable result if applied correctly and carefully (Whittington, 1998; Alberini and Cooper, 2000).

The other main limitation of a CVM study is that, it looks only at the demand side of the public good. It is argued that as an expressed-preference valuation method, CVM is inherently susceptible to various types of bias. Biases can be broadly classified into: general (strategic) and instrument (starting point bias). The designer of CVM study should, therefore, take these possible biases into consideration (Paulos, 2002). Some of the biases in CVM study are discussed below.

Starting point bias: This is a bias that occurs when the respondent‟s willingness to pay is influenced by the initial value suggested to the respondent to take it or leave it. This problem is encountered when the elicitation format involves starting values.

Hypothetical bias- The unique future of CVM is its hypothetical nature of the good and hence could be suffered from hypothetical bias. If respondents are not familiar with the scenario presented, their response cannot be taken as their real willingness to pay. This bias can be minimized by a careful description of the good under consideration for the respondents.

Compliance bias–occurs when the interviewer is leading the respondent towards the answer he/she is expecting. Compliance bias can also come because of the sponsor of the good being

valued. This bias can be reduced by carefully designing the survey, good training of the interviewers and good supervision of the main survey (Mitchell and Carson, 1989).

Strategic bias –arises when the respondents expect something out of the result of the study and report not their real WTP/WTA but something which they think will affect the research outcome in favour of them. Respondents may tend to understate their true willingness to pay if they think they have to pay their reported willingness to pay, but their response will not affect the supply of the good. But if they think they will not pay their reported willingness to pay and if they want the good to be supplied they overstate their WTP for the good (Mitchell and Carson, 1989). To reduce this bias, giving detailed description of the good being valued and telling the respondent that the objective of the study is only for designing policy also helps.

2.7. 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' or 'sharing 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 activities toward problem solving or decision-making. There is no universally acceptable measure or index of people's participation that could be used to evaluate development programs in terms 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).

According to the same source, people's participation in watershed development and management programs is crucial for their successful and cost-effective implementation. This is so because the watershed approach requires that every field /parcel of land located in a watershed/ be treated with appropriate soil and water conservation measures and used according to its physical capability. For this to happen, it is necessary that every farmer having land in the watershed accepts and implements the recommended watershed development plan. There are some components of a watershed development plan such as bunding, 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 farms as well as on common property land resources in the watershed. Like many 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.

2.8. Empirical Literature Review

Studies made by Bekele and Holden (1998), in North Shewa Zone identified that farmers perceptions to soil erosion problems are determined by factors related to erosive potential of the area, access to information, perceptions of technology attributes, and the intensity and type of land use. Physical erosion potential (slope) is the most important determinant of the perception of soil erosion. The higher the slope, the higher the probability that the recognition of soil erosion will be above any fixed level. Access to information through extension and other channels was found to be positively correlated with recognition of soil erosion problems. Peasants' perception of technology characteristics also seemed to be highly associated with recognition of soil erosion as a problem. Those who perceived the traditional technique as highly ineffective for retaining soil seem to have higher recognition of the threat of soil erosion.

A 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 added that polices should focus on younger people and households with large labor-force.

Basarir et al. (2009), analyzed producer's willingness to pay for improved irrigation water in Turhal and Sulvova regions of Turkey. A survey technique was implemented via face to face interview with 130 randomly selected producers to elicit the willingness to pay, as well as, to collect data for the factors responsible for willingness to pay. The researchers used Tobit and Heckman sample selection model for data analysis since their data were censored at zero. The researchers finally found that, producers who are male, from Turhal region, have more vegetable land, and polluted water were willing to pay more for increasing the quality of irrigation water.

Chukwuonee and Okorji (2008), had studied determines of willingness of households in forest communities in the rainforest region of Nigeria to pay for systematic management of community forests using the contingent-valuation method. A multistage random-sampling technique was used in selecting 180 respondent households used for the study. The value-elicitation format used was discrete choice with open-ended follow-up questions. A Tobit model with sample selection was used in estimating the bid function. The findings show that some variables such as wealth category, occupation of the household head, number of years of schooling of the household head and number of females in a household positively and significantly influence willingness to pay. Gender (male-headed households), start price of the valuation, number of males in a household and distance from home to forests negatively and significantly influence willingness to pay. Finally, the researchers recommend that incorporating these findings in initiatives to organize the local community in systematic management of community forests for non timber forest products conservation will enhance participation and hence poverty alleviation.

Alemu (2000), uses a CVM in his study on community forestry in Ethiopia. The researcher examines the determinants of peasants' willingness to pay (WTP) for community woodlots that are financed, managed and used by the communities themselves. He used a Tobit model with sample selection to test for selectivity bias that may arise from excluding (discarding) invalid responses (protest zero, missing bids and outliers) in his empirical analysis of theoretical validity of responses to the valuation question. The value elicitation method used in his paper is discrete question with open-ended follow up. A total of 480 rural household samples were used, and the survey was administered through face to face interviews. He included income, household size, age-sex composition, sex, education of household head, distance of homestead to the proposed place of plantation and other variables as explanatory variables which can affect willingness to

pay. The results of his study showed that income, household size, number of trees owned, distance of homestead to plantation and sex of household head are important variables that explain WTP for community woodlots in rural Ethiopia. The study also found that discarding invalid responses leads to sample selection bias, and suggest that community afforestation projects should consider household and site specific factors.

Anemut (2006), was the one who conducted a CVM study to analyse the determinants of farmers willingness to pay, intensity of payment and expected net loss of the Simen Mountains National Park (SNPA) in Ethiopia. A three stage random sampling technique was used to select 100 respondents. He founds that farmers were willing to contribute only labour for the park conservation and he forced to take only labour for the elicitation of WTP. He used Heckman two stage econometric estimation procedure. Results from the probit model showed that age of the household head and degradation of farm plots were negatively and significantly related to the probability of farmers‟ willingness to pay. On the other hand, developmental projects intervention as a result of the park, total livestock unit, total cultivable land, perception of environmental degradation and land tenure security were found to positively and significantly relate to the willingness to pay for the conservation of the SMNP. The results of second stage estimation for labor contribution intensity showed that, training related to soil and water conservation, farm plot degradation, satisfaction with conflict resolution mechanism of the park management and distance from the Woreda town was negatively and significantly related to labor contribution intensity.

However, economic benefits obtained as a result of improved technologies and total income received from touristic activities was positively and significantly related to labor contribution intensity. Furthermore, his second stage estimation results of the expected net loss regression showed that, sex of the household head and existence of farm plots with in the park boundary are positively and significantly related to expected net loss. However, age of the household head, number of oxen, distance from the Woreda centre, dependency ratio and willingness of the households to pay were found to negatively and significantly relate to expected net loss.

Zewudu & Yemsirach (2004), on their study of people's willingness to pay for the Netchsar National Park, Ethiopia also used a CVM. The Guji and Kore communities have settled in eastern part of the park and in areas adjacent to the park. These pastoralist communities use the

park for cattle grazing purposes. For this and other reasons, the park is endangered. The researchers used a dichotomous choice contingent valuation method (CVM) format to elicit the willingness to pay. The results showed that the means for WTP are Birr 28.34 and Birr 57.07 per year per household for Guji and Kore communities, respectively and its determinants were primary economic activity of the household, dependency ratio and distance from the park. The study suggested that the park management should involve the local community in its conservation endeavour and share the benefits with them.

Tessema and Holden (2006), assessed farmer's willingness to pay for soil conservation practices in southern Ethiopia. Based on data collected from 140 farm households operating 556 plots, descriptive statistics indicate that majority of the households in the study area perceive the severity of land degradation in their village and especially on their private farms, in terms of soil erosion and nutrient depletion. Contingent valuation results indicate that about 96 percent of the respondents were willing to contribute labour to conserve soil in their farms. When the payment is in cash, about 84% were willing to pay. Household random effect model was used to empirically investigate the determinants of the farm households‟ willingness to pay or contribute for soil conservation. The empirical result shows that WTP is affected by perception of erosion, poverty in terms of resource endowment and cash, and plot characteristics. The study noted that the farm households are able to contribute more in terms of labour than money due to sever cash poverty. Using labour days as a payment vehicle for WTP studies in similar areas would provide a more sensible outcomes than using monetary payments.

In this chapter the problem of soil erosion has been reviewed. From the literature it was found that soil erosion is a great treat to Ethiopia which accounts a substantial loss of the GDP. This chapter also presents the economic values of natural resources and their methods of valuation. The method of contingent valuation which this study uses for valuing soil conservation practices in Sabata Hawas Woreda was also critically reviewed. The literature shows that despite its limitations, contingent valuation can be applied in less developing countries like Ethiopia to value non marketed goods. Contingent valuation studies that have been done by other researchers were also presented.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Description of the study Area

The Sabata Hawas woreda administrative seat is existed in the Sabata town. It is found 25Km from South –West of Addis Ababa along Jimma main road. The total area of the district is 87,572 hectare. The district found at an altitude of 8^0 37‟ N and longitude of 38^0 45‟ E. The average elevation of the district is 2592 meter above sea level. The mean annual rainfall of the district is about 1033mm. its mean annual temperature is about 21.5^0C. The district has good vegetation covers. It is dominated with cupurses lusitania, ollia Africana, junipers procera, ecliptic tree, cordia africana, acacia absyinica and casuarina equistofolia. However, wild life protections have been less exercised in the district. The soil type that existed in the district is black (61%), red (34%) & mixed soil (5%). The land use of the district by hectare is cultivated land 54,943.3, pasture land 3,642.2, forest land 2,533.7, water bodies (Ponds, rivers, etc) 1475, building area (residential, settlement, etc) 5907 and investment 124 has been found in the woreda (SHFEDO, 2011).

The woreda consists of 36 rural kebeles and 4 urban centers (Tefki, Awash-Melkakunture, Bonaya and Oda Guda).The district's total population census for 2007 is 133,746 of which 68,908(51.5%) are males while 64,838 (48.5%) are females (CSA, 2007). With regards to the ratio of rural urban population of the district, the rural population accounts for 127,173 while the urban population is 6,573. The average number of persons per household is 5 and the total number of households living in the district is estimated to be 26,056 (WMEO, 2013).

Both Livestock rearing and crop production are the main economic activities of the majority of communities. Teff, Wheat, and Maize are the major crops grown in the district. The major livestock reared in the district include cattle, sheep, goats and poultry. Numerous farmers have no adequate farm land. More than 55% of the farmer households have owned less than 1.5 hectare of land-holding per household size (SHAO, 2014). As a result, farmers produce less number of livestock and amount of crop production. Out of total population (133,746), 88 percent of the populations have been engaged in mixed economic activities (both crop production and livestock rearing).The district has mineral resources such as white stone, black stone, sand stone and red sand (scoria). All and dry weather are 67Km and 91Km roads was

existed correspondingly in the district. With the exception of the four urban centers and five of the rural kebeles all the rest have no access to electricity. In the district there are 40 health posts, 6 health centers, 2 rural drug venders, 16 first cycles (1-4) 30 secondary cycles (5-8) (SHFEDO, 2016).

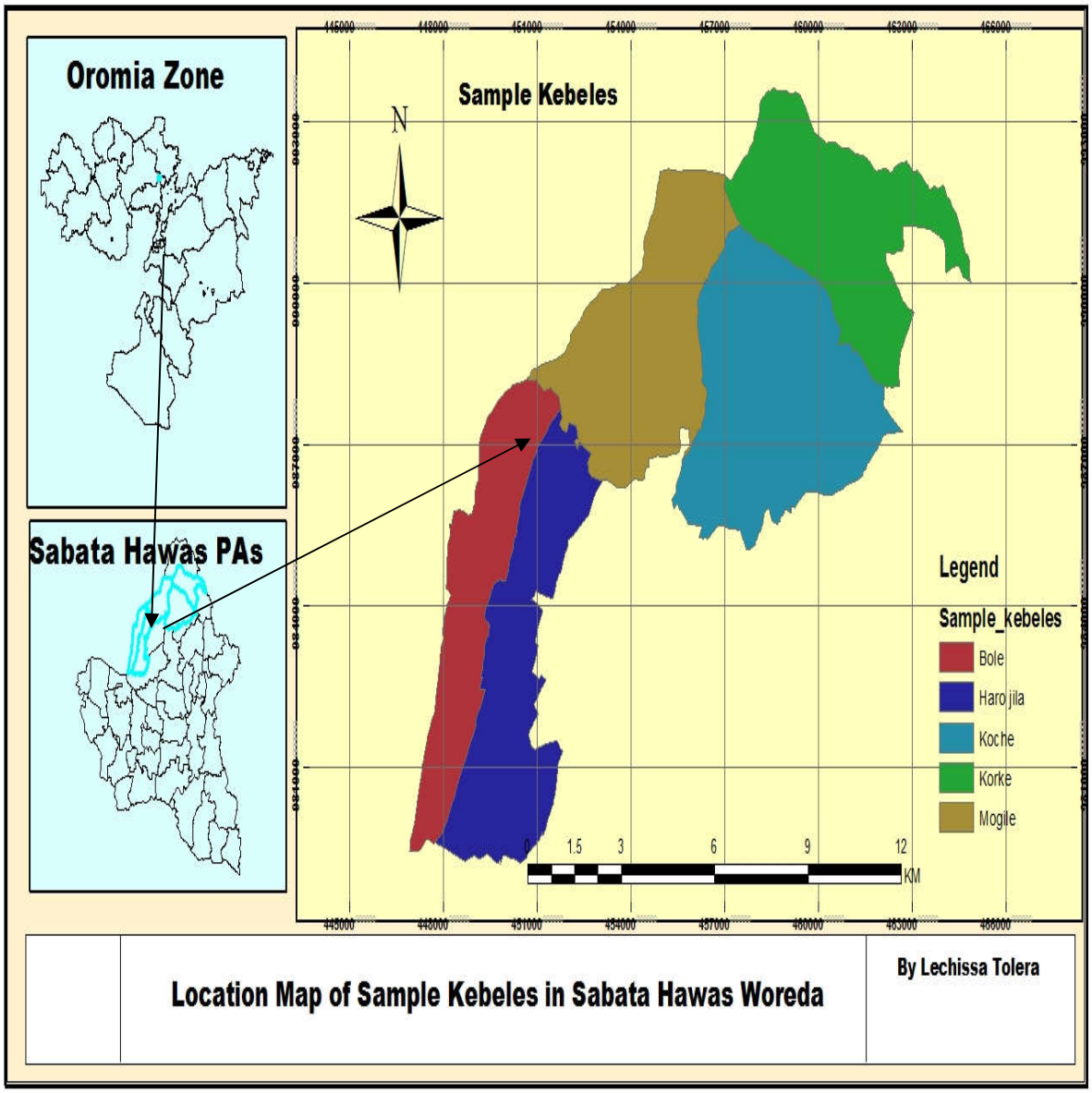


Figure 3.1: Location map of sample kebeles

3.2. Sample and Sampling Technique

The study area, Sabata Hawas Woreda of the Oromia Special zone surrounding Finfinnee was selected for this study because; it is one of the erosion prone areas in the woreda, as well as, in the country. In the second stage, the study purposely selected 5 rural Kebeles out of the 36 rural kebeles in the Woreda. Further in third stage, farm households were selected using the probability proportional to the size (number of farm households) of the peasant associations from the five peasant associations using simple random sampling technique. The sampling list was obtained from the Woreda and respective peasant association administrations. 129 households from the five kebeles were selected using systematic random sampling. Sample size is calculated by using William (1977) sample size determination formula. Therefore, 129 sample households were included in the survey in which 29 from *Mogole, 15 from Koche, 25 from Korike, 35 from Haro Jila* and 25 households from *Bole kebeles* proportionately.

The formula is given as,

$$n= Z^2pq/d^2$$

Where, Z= 1.96=the standard of normal variable in the accepted level of d^2confidence

P= the proportion of the target population estimated to have the desired characteristics that is 90 % (for this survey)

q = 1-p

d = level of statistical significance (0.05)

q = 1-0.90 = 0.10

$$n = \frac{(1.96)^2 X\ 0.9\ X\ 0.1}{(0.05)^2} = 138$$

Hence the desired sample size (fn) will be

fn = n/ (1+ (n/N)) where, fn = desired sample size

$$n = Z^2pq/d^2$$

N = sample frame of the study (total No. of HHs i.e. 1888)

Fn =138/ [(1+ (138/1888)] = **129**

Therefore, 129 sample households were included in the survey

Table 3.1.: Summary of households participated on the survey

No	Name of Kebeles	Total household in the Kebeles	Sample household in the Kebeles
1	Mogole	**421**	**29**
2	Koche	**222**	**15**
3	Korike	**372**	**25**
4	Haro Jila	**513**	**35**
5	Bole	**360**	**25**
Total		**1888**	**129**

Source: SHWAO (2016)

3.3 Field strategy

Early planned field survey avoids unnecessary time and financial wastage. Moreover, well scheduled field survey plan would also help the researcher to collect important information which is free from unnecessary complication and biases. Thus, this study was planned a head of time to carry out the following activities prior to actual data collection. The plan includes training of enumerators to equip them with relevant techniques until they internalize the questionnaire in such a way that helps to avoid biased data collection generated from questionnaire misinterpretation. To further iron out the ambiguity, a pre-testing of questionnaire was conducted on randomly selected households from aforementioned kebeles i.e. 13 respondents which was not included in the actual survey. Moreover, pre-testing also helps to decide on starting bid amount with different level of payment vehicle. Following the pre-test feedback, the questionnaire was translated into Oromiffa version to avoid ambiguity, misinterpretation and communication breakdown that is likely to happen between enumerator and the respondent.

3.4. Data Source and Method of Data Collection

Primary data was collected from sample respondents through a structured questionnaire via face to face interview. The primary data was collected on the demographic, social, institutional, economic, awareness, and willingness to pay for soil conservation practices. The enumerators were used to undertake the data collection. Prior to data collection training was given to the enumerators on method of data collection and interviewing techniques. Discussions with stakeholders were also done on the sources of primary data. Continuous supervision had been made by the researcher of this study to correct possible errors on the spot. Secondary data was obtained from various sources such as reports of different sectors (eg. Ministry of Agriculture Bureau of Agriculture, Sabata Hawas Woreda Agriculture Office (SHWAO), Journal articles.

A CVM (contingent valuation method) was employed to elicit households WTP for soil conservation practices. In CVM surveys, there are about four major elicitation methods, namely Open ended format, Bidding game, Payment cards and Dichotomous or Discrete choice.

The dichotomous choice approach has become quite widely adopted, despite criticisms and doubts, in parts because it appears to be incentive compatible in theory. When respondents do not give a direct estimate of their willingness to pay, they have diminished ability to influence the aggregate outcome. However, this advantage of compatibility has a limitation. Estimates of willingness to pay are not revealed by respondents (Haab and McConnell, 2002). To improve the precision of the WTP estimates, in recent year's researchers have introduced a follow up question to the dichotomous question (Alberini and Cooper, 2000).

The single bounded dichotomous choice format is easier for respondents to make willingness to pay decisions than open-ended questions (Bennett and Carter, 1993). However, the double-bounded dichotomous choice format is useful to correct the strategic bias and improve statistical efficiency over single-bounded in at least three ways. First, it is similar to the current market situation in Ethiopia, where sellers state an initial price and a chance is given to the buyers to negotiate. Second, the yes-yes, no-no response in the double bound dichotomous choice format sharpens the true and makes clear bounds on unobservable true WTP hence; there is efficiency gain (Haab and McConnell, 2002).

Finally, the double-bounded dichotomous choice format is more efficient than single bounded dichotomous choice as more information is elicited about each respondent's WTP and a parametric mean could be elicited (Hanemann et al., 1991; Haab and McConnell, 2002). Hence, this study employs the double-bounded dichotomous choice format to elicit respondents WTP for soil conservation practices in the study area.

3.5. Method of Data Analysis

3.5.1 Descriptive and Econometric Analysis

Descriptive statistics are important to have clear picture of the characteristics of sample units. By applying descriptive statistics one can compare and contrast different categories of sample units (farm households) with respect to the desired characteristics. In this study, descriptive statistics such as *mean, standard deviation, percentages* and *frequency of occurrence* were used along the econometric model, to analyze the collected data. The bivariate probit regression model used and SPSS (Statistical Package for the Social Sciences) and STATA 13 were employed for analysis of the data.

3.5.1.1. Model specification

Contingent valuation method (CVM) was applied to elicit the people's willingness-to-pay for the environmental change (soil conservation). This method is particularly applicable in a situation where market information about people's preference is absent.

In this study, CVM was applied to elicit the willingness to pay (WTP) in cash and/or labor for soil conservation practice. The reason for including the latter (labor) is justified by the fact that that farmers in developing countries may be willing to contribute more labor than money for environmental protection as labor is cheaply available than money (Tegegne, 1999). It is also important to examine differences among farmers in terms of their willingness to pay money and their willingness to spend time. Dichotomous choice format, with one follow up dichotomous choice question and with an open ended follow up question, was used to elicit the WTP. This approach is similar to real life situation in Ethiopia at a market or in an auction (Warolin, 1998). Some studies (Albertini and Cooper, 2000) implement an elicitation procedure, which includes an initial dichotomous choice payment question followed by another dichotomous choice question and final open-ended question.

Questions on the amount of money farmers are willing to pay per week for soil conservation activities and on the number of days they are willing to spend in soil conservation per week were included in the questionnaire. A week as a reference period is believed to be a good length of time for farmers especially in terms of evaluating their labor contribution. A reference period more than a week made it difficult for farmers to budget their time (Tegegne, 1999). A week's time were used for cash payment in order to keep the consistency with labor requirement. Descriptive statistics (frequency distribution, mean, standard deviation, etc.) were used to assess farmers' willingness to pay in cash and in labor and to compare different categories of sample units in terms of their WTP.

Thus, this study adopts the model developed by Cameron and Quiggin (1994) and aims at identifying the true WTP of farmer households and assessing determining factors using single and bivariate probit model. Accordingly single bound probit model takes the following form.

$$Yi = Xi\beta + \varepsilon j)$$

$$\mathrm{I} = 1 \qquad if \;\; yi \geq ti$$

$$\mathrm{I} = 0 \qquad if \; yi < ti$$

Where

Y_i = i^{th} respondent's true unobserved point valuation for the environmental resource in question.

ß = a coefficient for X

t_i = the offered threshold, assigned arbitrarily to the i^{th} respondent

I = discrete response of a respondent for the WTP question (1=yes, 0= no)

ε_i = unobservable random component distributed N (0, σ)

X_i = observable attributes of the respondent

3.5.1.2. Bivariate Probit Model

Bivariate normal probability density functions are the most familiar bivariate distributions employed commonly by statisticians; they allow for a **non-zero correlation**, whereas the **standard logistic distribution (logit model) does not** (Werner, M., 1999 and Cameron and Quiggin, 1994). Hence, the bivariate probit model was employed in this study to estimate the mean WTP and determinant factors the affect WTP from the double bounded dichotomous choice. The bivariate probit model commonly used for double dichotomous question (i.e. in this study for the first bid price yes/no and for the second bid price yes/no). Logit/probit model could not used for this kind of questions but, we can you for single bounded (only yes/no question for a given price) after some tests.

The model takes the following form (Haab and McConnell, 2002)

The j^{th} contribution to the Likelihood function is given as;

$$L_j(\mu / t) = \Pr(\mu_1 + \varepsilon_{1j} \geq t_1, \mu_2 + \varepsilon_{2j} < t_2)^{YN} * \Pr(\mu_1 + \varepsilon_{1j} > t_1, \mu_2 + \varepsilon_{2j} \geq t_2)^{YY} * \Pr(\mu_1 + \varepsilon_{1j} < t_1, \mu_2 + \varepsilon_{2j} < t_2)^{NN} * \Pr(\mu_1 + \varepsilon_{1j} < t_1, \mu_2 + \varepsilon_{2j} \geq t_2)^{NY}$$

This formulation is referred to as the **bivariate discrete choice model**

Where

μ = mean value for willingness to pay

YY = 1 for a yes-yes answer, 0 otherwise, NY =1 for a no-yes answer, 0 otherwise, etc.

And the j^{th} contribution to the bivariate probit Likelihood function becomes.

$$L_j(\mu / t) = \Phi_{\varepsilon 1 \varepsilon 2}(d_{1j}((t_1-\mu_1)/\sigma_1), d_{2j}((t_2-\mu_2)/\sigma_2), d_{1j}d_{2j}\rho).$$

Where: $\Phi_{\varepsilon 1 \varepsilon 2}$= Standardized bivariate normal distribution function with zero means

y_{1j}=1 if the response to the first question is yes, and 0 otherwise

y_{2j}=1 if the response to the second question is yes, 0 otherwise

$d_{1j}=2y_{1j}-1$, and $d_{2j}= 2y_{2j}-1$

ρ = correlation coefficient

σ = standard deviation of the errors

The general model can be readily estimated using standard packaged bivariate probit algorithms using STATA (version 13) software.

3.5.1.3. Estimation Techniques

Contingent valuation method is used to elicit the mean WTP of the respondents to changes in the environment under study, the soil of interest. A dichotomous choice contingent valuation method with follow-up questions was used. The dependent variable in the model is a dummy variable, which assumes either 0 or 1. The use of dichotomous choice questions with follow-up bids implies that the response for the second question is endogenous to that of the first (Model II). This means that, the model cannot be estimated using the ordinary probit/logit model. Thus, bivariate probit model, which simultaneously estimate the two equations, was employed in order to minimize the misrepresentation that might be happen due to the endogenous characteristics of the second response.

The Variance Inflation Factor (VIF) was used to test for the existence of multi-collinearity between continuous explanatory variables. VIF shows how the variance of an estimator is inflated by the presence of multi collinearity (Gujarati, 1995). If R^2 is the adjusted square of the multiple correlation coefficients that results when the explanatory variable (X_i) is regressed against all the other explanatory variables, VIF is computed as follows:

$$VIF\ (X_i) = (1-R^2_i)^{-1}$$

As the adjusted R_i^2 approaches 1, the VIF approaches infinity. That is as the extent of collinearity increases, the variance of the estimator increases, and in the limit it can become infinity. If there is no collinearity between regressers, the value VIF will be 1. As a Rule of Thumb, values of VIF greater than 10 are often taken as a signal for the existence of multi-collinearity problem in the model (Gujarati, 1995).

Contingency coefficients were also calculated to see the degree of association between the dummy variables. These were calculated for each pair of dummy variables using contingency coefficient procedure available in SPSS. Contingency coefficient is a chi-square based measure of association. A value of 0.75 or more indicates a stronger relationship (Healy, 1984). The contingency coefficient was computed as follows.

$$C = \sqrt{\frac{\chi^2}{N + \chi^2}}$$

Where C= coefficient of contingency, χ^2= Chi-square test and N= total sample size

3.6. Definition of Variables and Description of Explanatory Variables

The Dependent Variable of the Model: The dependent variable is a dichotomous choice variable and measuring the willingness of households to pay for soil conservation practices of labour contribution. The value of the dependent variable takes 1 for the "yes" to the initial bid, 0 otherwise (Model I). The use of dichotomous choice questions with follow-up bids implies that the response for the second question is endogenous to that of the first (Model II)

The Independent Variables of the Model: With market imperfection, the probability or the level of farm household's WTP for soil conservation depends on various factors such as poverty and household characteristics, than only farm characteristics (Tessema and Holden, 2006). Based on the findings of past studies on households willingness to pay for non market goods, decisions on investment and participation, the following variables were hypothesized to determine household‟ willingness to participate in soil conservation practices.

1. Age of the household head (**AGE**): This is a continuous variable indicating the age of the household head in years. The age of farm household head may have *either negative or positive* effect on the willingness to soil conservation. Older age may have shorten planning time horizon and reduce the WTP; or it may relate to farm experience and increase willingness to improve the soil for better productivity (Tessema and Holden, 2006). The longer farming experience, here equated with the older farmers is expected to have a positive effect on conservation decision. On the other hand, young farmers may have a longer planning horizon and, hence, may be more likely to invest in conservation. Yitayal (2004), Tessema and Holden (2006), found a negative

and significant relationship, on the contrary, Demeke (2003), found a positive relationship between age and soil conservation investment decisions. So, the effect of age of the household head to willingness to pay for soil conservation can be positive or negative.

2. Gender of the Household Head (SEX): This is recorded as dummy variable (1=male, 0 =female) and is included in the model to find out the influence of Gender for soil conservation willingness to pay. Male farmers have a probability of getting more access to information than female household heads. Doss and Morries (2001), as it is cited in Behailu (2009), confirmed that women farmers tend to adopt improved technologies at a lower rate than men because of limited access to information and resource. This can be further justified that soil conservation structures need intensive labour so male headed households are expected to be more willing than *female headed households*. It is, therefore, hypothesized that sex of the household head will have a positive influence on the WTP.

3. Marital status (MRST): The marital status of respondents is dummy variable with 1 for married and 0 otherwise. It was assumed that married respondents have more attachment with the resources than their counter parts. The more individuals have strong attachment with resources the more they understand its benefits and the more they interested to pay for its management.

4. Education level of the Household head (EDUCATION): This is the number of years that the household head had spent in a formal school. Household heads who have high level of education can better understand the problem of soil erosion, hence would be willing to contribute to the specified bid. Household heads with better education are expected to understand consequences of degradation and be willing to invest more in soil conservation (Tessema and Holden, 2006). Paulos (2002), reported a positive relationship. It had a positive and strong relationship with the dependent variable showing that literate household heads were more to recognize the advantages of soil conservation and was willing to take part in it. Similarly, Yitayal (2004), in his study in Jimma Zone found a positive relationship. So, the expected sign of Education level of the household head is positive

5. Social Position (SPOSITION): Is a dummy variable which takes 1 if the household has some social position in its community; 0, otherwise. Social position of the household head is expected to affect willingness to pay positively.

6. Household Family Size (FSIZE): It is a ***continuous variable*** which refers to the number of family members of the household. This explanatory variable is included because it affects the labour supply at household level. Some soil conservation technologies are labour intensive and this may have a positive implication on whether the household can decide to participate in the soil conservation practices.

7. Farm land forgone by erosion (FEROSION): This is a dummy variable which takes 1 if the farmer had abandoned a farm land because of soil erosion, 0 otherwise. It is expected to have a positive influence on willingness to pay.

8. Farmers' perception of erosion hazard (FPERCEPTION): This is a dummy which takes 1 if the household perceives the problem of soil erosion, 0 otherwise. 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 (Paulos, 2002). Thus, the perception variable will be expected to be strongly and positively associated with farmers‟ willingness to pay for soil conservation.

9. Initial offered Bid (FINITIALBID1): This is bid price offered to the respondents. In this study the bid price was used as one of the explanatory variables in the analysis. The bid price is expected to influences negatively to the willingness to pay of the respondents.

10. Labour Shortage (LSHORTAGE): This is a dummy variable which takes 1 if the household has a labour shortage for farm activities and had hired some labour for farm activities and 0, otherwise. We expect to have a negative relationship with willingness to pay.

11. Frequency of extension contact (FREQEXTENSION): This is continuous variable which is the number of days that the farmer had contact with extension agent in a year. Extension is a way of building the human capital of farmers by exposing them to information that reduces uncertainty (Feder et al. 1985). In this study this variable is expected to affect willingness for soil conservation of farmers positively. This is because extension intervention is expected to strengthen technology usage of the farmers which further improves the income status and thus resulting in increase in the willingness of the households to use soil conservation practices.

12. Perception to Security of Land Tenure (LTENURE): A dummy variable, which is a proxy for security of land tenure that takes a value 1 if the peasant considered that he/ she would be

able to use the plot area at least during his/her life time, 0 otherwise. The incentive to land improvement decision is based on part of secured future access to land. Hence, a positive effect was expected.

13. Total Income (TINCOME): This is a continuous variable which is the total income from crop production, animal selling, off farm income as well as remittance that the household gets in a year, valued in Ethiopian birr. It is expected to have a positive relationship with WTP.

14. Amount of Credit (CREDIT): This is a continuous variable which is the amount of money that the household gets in the past two year from formal and informal credit sources. Credit might relax cash constraint and might enhance willingness to pay. Hence, it was hypothesized that there would be a positive relationship.

15. Total livestock holding in Tropical Livestock Unit (TLU): This refers to the total number of livestock (measured in Tropical Livestock Units, TLU) the farmer owns. In Ethiopia, livestock are important source of cash income, food, household energy, manure and source of power for cultivation. It is, therefore, hypothesized that the higher the livestock holding the higher the household will be willing to pay for soil conservation practices.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1. Descriptive Statistics

4.1.1. Summary of Households' Characteristics

Summary of Households' Characteristics for this study, data were collected from 129 randomly selected respondents for the purpose of analysis. From the total sample of 129, 85 households which are 65.9% of the respondents were male headed households and 44 which are 34.1% were female headed households.

Out of the total sample households taken 101 (78%) were willing to take and contribute labour in the pre specified initial offered bid and 28 (22%) of the households were not willing to pay the initially offered pre specified bid. Out of all the 28 non willing households, male headed households contribute 12 (42.9%) while female headed households were 16 (57.1%). On the other hand, from 101 willing households 73 from the total 101 willing households, 72.3% were male headed households and 28 (27.7%) were female headed households. Similarly out of 129 sample households 30 households were willing to pay money for soil conservation practices, out of these 24 were male household and the rest 6 household were female. Out of all the 99 non willing households for money contribution for soil conservation practices 61 (85.9%) were male and the rest 38 (14.1%) were female households. Table 4.1 indicates that there is strong relationship between sex of the household head and willingness status to accept the offered initial bid for money to pay for soil conservation practices, which is significant at less than 1% probability level. This underlines that, sex difference is an important component in WTP decision.

Table 4.1: Sex Composition of Sample Household in WTC Labour and WTP Money to participate in soil conservation practices.

SEX	Willing farmers		Non-willing farmers		Total		X^2
	Number	Percent	Number	Percent	Number	Percent	
Male	73	72.3	12	42.9	85	65.9	8.44
Female	28	27.7	16	57.1	44	34.1	
Total	101	100	28	100	129	100	

SEX	Willing farmers		Non-willing farmers		Total		X^2
	Number	Percent	Number	Percent	Number	Percent	
Male	24	80	61	85.9	85	65.9	3.46
Female	6	20	38	14.1	44	34.1	
Total	30	100	99	100	129	100	

***** Significant at less than 1% Non-Willing is a "No" answer for the first bid while Willing is a "Yes" answer for the first bid**

Table 4.2 shows the relationship of willingness to pay and marital status of households in the study area. Of the total farmers surveyed, 81 (62.8%) were married, 4 (3.1%) single, 19 (14.7%) divorced and the rest 25 (19.4%) widowed. In addition, out of the 81 married respondents, 23 (17.8%) were willing and 57 (44.2%) were not willing to pay money for soil conservation measures. Similarly from 81 married households only 12 were not willing to contribute labour for soil conservation.

Accordingly, from the total of 48 households with rest marital status (single, divorced and widowed) 32 (67.67%) were willing and the rest 16 (33.33%) were not willing to contribute their labour for conservation activities. Furthermore only 6 (12.5%) were willing and 42 (87.5%) were not willing to pay cash for soil conservation from these 48 households

In addition, there is also statistically significant relationship between willingness status and marital status of the household head showing that, marital status systematically and significantly relates with WTP status. This is mostly because married households have the capacity to accept the offered initial bid due to they have more family size than single households for labour contribution for soil conservation.

Table 4.2: Marital Status of Sample Household in WTC Labour and WTP Money to participate in soil conservation practices

Marital Status	Willing farmers		Non-willing farmers		Total		X^2
	Number	Percent	Number	Percent	Number	Percent	
Married	69	68.3	12	42.9	81	62.8	
Single	3	3	1	3.5	4	3.1	9.61
Divorced	15	14.9	4	14.3	19	14.7	
Widowed	14	13.9	11	39.3	25	19.4	
Total	101	100	28	100	129	100	

Marital Status	Willing farmers		Non-willing farmers		Total		X^2
	Number	Percent	Number	Percent	Number	Percent	
Married	24	80	57	57.6	81	62.8	
Single	1	3.3	3	3	4	3.1	
Divorced	2	6.7	17	17.2	20	14.7	5.35
Widowed	3	10	22	22.2	25	19.4	
Total	30	100	99	100	129	100	

Source: Own Survey, 2016

The survey results show that 53 (52.5%) of the willing farmers for contributing labour for conservation works were literate (primary and secondary education), and the remaining 48 (47.5 %) were illiterate (no formal education). (See the table 4.3 below). On the other hand, the majority of the non-willing farmers 18 (64.3 %) were illiterate, and only 10 (35.7 %) were literate. The survey results show also that from sample household respondents 17 (56.7%) willing to pay cash were not attend formal education and 13 (43.3%) attend primary and secondary education. Accordingly, 49 (49.5%) non willing farmers were illiterate and 50 (50.5%) non willing farmers were literate.

Paulos (2002), reported a positive and strong relationship with the dependent variable showing that literate household heads were more to recognize the advantages of soil conservation and was willing to take part in it. Similarly this survey result also shows that there was a positive relationship with willingness to contribute labour and pay money for soil conservation.

Table 4.3: Education Level of Sample Household in WTC Labour and WTP cash to participate in soil conservation practices

\	Willing farmers		Non-willing farmers		Total		X^2
	Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**	
No formal education	48	47.5	18	64.3	66	51.2	
Primary education	50	49.5	10	35.7	60	46.5	
Secondary education	3	3	0	0	3	2.3	2.93
Total	101	100	28	100	129	100	

EDUCATION	Willing farmers		Non-willing farmers		Total		X^2
	Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**	
No formal education	17	13.2	49	38	66	51.2	
Primary education	12	9.3	48	37.2	60	46.5	0.76
Secondary education	1	0.8	2	1.6	3	2.3	
Total	30	23.3	99	76.7	129	100	

Source: Own Survey, 2016

Social Position

From the sample households 58 (45%) have some social position in the community and the rest 71 (55%) no social position. The survey result show that from the willing farmers to pay their labour 52 (51.5%) were have social position and 49 (48.5%) were no social position in the community. The non willing farmers to pay labour conservation 22 (78.6%) were from respondents with no social position in the community. On other hand from willing farmer to pay cash 19 (63.3%) were having social position and the rest 11 (37.7%) no social position in the community. Out of 99 non willing farmers to pay cash 39 (39.4%) have social position and 60 (60.6%) were no social position in the community.

Table 4.4: Social Position of Sample Household in WTC Labour and WTP Money to participate in soil conservation practices

Social Position	Willing farmers		Non-willing farmers		Total		X^2
	Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**	
Yes	52	51.5	6	21.4	58	45	
No	49	48.5	22	78.6	71	55	8.00
Total	101	100	28	100	129	100	

Social Position	Willing farmers		Non-willing farmers		Total		X^2
	Number	Percent	Number	Percent	Number	Percent	
Yes	19	63.3	39	39.4	58	45	5.33
No	11	37.7	60	60.6	71	55	
Total	30	100	99	100	129	100	

Source: Own Survey, 2016

Family Size

The family size of the sample farmers were within the range of 1 to 10 persons and the weighted average is 5. About 72 (55.8%) sampled households have a family size within the range of 4 to 6 family members. The survey result shows that from willing households for labour contribution 32 (31.7%) had 1 to 3 family size, 54 (53.5%) had 4 to 6 family size and 15 (14.9%) had 7 to 10 family size. Similarly from non willing farmers to pay labour for conservation 9 (32.1%) had family size 1 to 3 and 18 (64.3%) were households with family size from 4 to 6 only and the rest one household had family size of 7 to 10 family.

Table 4.5: Family Size of Sample Household in WTC Labour and WTP Money to participate in soil conservation practices

Family Size	Willing farmers		Non-willing farmers		Total		X^2
	Number	Percent	Number	Percent	Number	Percent	
1-3	32	31.7	9	32.1	41	31.8	
4-6	54	53.5	18	64.3	72	55.8	2.71
7-10	15	14.9	1	3.6	16	12.4	
Total	101	100	28	100	129	100	
Family Size	**Willing farmers**		**Non-willing farmers**		**Total**		X^2
	Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**	
1-3	3	10	38	38.4	41	31.8	
4-6	22	73.3	50	50.5	72	55.8	8.56
7-10	5	16.7	11	11.1	16	12.4	
Total	30	100	99	100	129	100	

Source: Own Survey, 2016

Age of the household head

Furthermore, the mean total sample age of the household heads of the respondents was 47 years. The willing households had a sample mean age of 44 years, while the non willing farmers had a sample mean of 54 years. The mean difference between the two groups was statistically

significant at less than 5% probability level; showing that there is a strong relationship between age and willingness to pay. (See the table 4.6 below)

Table 4.6: Age of sample households

Variable	Willing (N= 101)		NonWilling (N = 28)		t-test	Mean (N = 129)
	Mean	Standard deviation	Mean	Standard deviation		
Household Age	44	9.2	54	11.7	4.5**	47

Source: Own Survey, 2016

4.1.2. Resource Ownership

The survey results showed that the households possession of cultivable land ranged from the smallest 0.25ha (which is equivalent to one a „‟timad‟‟‟) to the highest 4 ha (which is equivalent to 16 „‟timad‟‟‟). The average size of cultivated land owned by the sample respondents was about 1.76 ha. Willing farmers owned on the average 1.91 ha of cultivated land. The corresponding figure for the non-willing farmers was 1.25ha. The mean difference of own cultivated land for the two groups was significant at 5 % significance level (Table 4.7). This means, willingness tends to increase as farm size increases. This is probably because soil conservation practices take proportionally more space on small land holdings and the benefit from such practices on these small land holdings will not be enough to compensate for the decline in production due to the loss in area devoted to the conservation structures. On the other hand, households who have small land holdings may need to subsidize their income from off farm activities given productions are low from small land holdings and might not get time to spend on conservation practices.

Table: 4.7. The maximum and minimum values of Farm Size, Total Income and TLU Ownership of Sampled Households

	N	Minimum	Maximum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
FSIZE	129	0.25	4.00	1.76	.0751	.85
TINCOME	129	12660	55960	36315.20	706.33	8022.46
TLU	129	2.0	11.0	7.512	.18	2.07

Source: Own Survey, 2016

The total mean income of the sample households was estimated to be 36,315.19 Ethiopian birr per annum. The main sources of income are crop production, livestock selling, laboring and off farm activities. The mean total income of the willing and non-willing was estimated to be 37,101.58 Birr and 33,478.57Birr respectively. Table 4.8 shows that there is statistically significant difference between the two groups in terms of total income at less than 5% probability level. It was also tested whether or not there was a statistical difference between the willing and non willing households based on the total livestock possession (TLU). The results show that there is statistically significant difference at less than 5% probability level based on TLU among the two groups which had a mean of 6.50 for the non-willing and 7.79 for the willing. The total sample mean of TLU of the respondents was 7.51 units. This implies that resource possession indicators such as Income, TLU and Farm size gives farmers the capacity and courage to take soil conservation measures.

Table 4.8: Farm Size, Income and TLU Ownership of Sampled Households

Variable	Willing (N= 101)		NonWilling (N = 28)		t-test	Mean (N = 129)
	Mean	Standard deviation	Mean	Standard deviation		
FSIZE	1.91	0.86	1.25	0.55	3.87**	1.76
TINCOME	37101.58	8180.78	33478.57	6825.27	2.14**	36315.19
TLU	7.79	1.89	6.5	2.13	3.1**	7.51

FASIZE= Total farm Size TINCOME= Total income TLU= Total Livestock Units *** and ** statistically significant at 1% and 5% respectively
Source: Own Survey, 2016

4.1.3. Physical Characteristics of Households Farm Land

The sample respondents were asked whether or not they have forgone farm land because of soil erosion. About 126 (97.7%) of the respondents reported that they have abandoned because of soil erosion at medium and high erosion level, while the rest 3 (2.3%) reported that they did not.

From willing households to contribute labour 99 (98%) reported they have abandoned some portion of their farm land by soil erosion, while only 2 (2%) households not affected by soil erosion problem. But for non willing farmers 27 (96.4%) their farm land affected by soil erosion

at medium to high level. On other hand from willing farmer to pay cash 30 (100%) reported they have abandoned their farm land at medium and high level.

As it is presented in the Table 4.9, there is no significant relationship between abandoned of farm land due to farm erosion and willingness status at 5% probability level. This shows both groups have abandoned some proportion of their cultivable land due to soil erosion.

Table 4.9: Farm land forgone by erosion (FEROSION): for Sample Household in WTC Labour and WTP Money to participate in soil conservation practices

Farm land erosion likely to happen	**Willing farmers**		**Non-willing farmers**		**Total**		X^2
	Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**	
No risk	2	2	1	3.6	3	2.3	
Medium	48	47.5	12	42.9	60	46.5	0.38
High	51	50.5	15	53.6	66	51.2	
Total	101	100	28	100	129	100	

Farm land erosion likely to happen	**Willing farmers**		**Non-willing farmers**		**Total**		X^2
	Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**	
No risk	0	0	3	3	3	2.3	1.86
Medium	12	40	48	48.5	60	46.5	
High	18	60	48	48.5	66	51.2	
Total	30	100	99	100	129	100	

Source: Own Survey, 2016

Slope of the lands

Based on farmers understanding of slope and possibility of plots for oxen plough and hoe cultivation, farm plots were classified into four. These were; relatively flat farm plots, gently sloped farm plots, plots that have very steep slope but possible for oxen plough and plots that is very steep slope not possible for oxen plough.

Out of the total sample surveyed, 8.5% households had very steep slope lands (Table 4.10) and 46.5 % of the households had lands which are steep sloped, 42.6 % of the farmers have gently sloped lands. Only 2.3 % of the farmers had relatively flat plots. This shows how soil erosion is a serious problem in the study area. But, the results in Table 4.10 show that there is no statistically significant relationship

Table 4.10: Distribution of sample farmers by slope category of their farmland and farmers group for Sample Household in WTC Labour and WTP Money to participate in soil conservation practice

Slope category	Willing farmers		Non-willing farmers		Total		
	Number	Percent	Number	Percent	Number	Percent	X^2
Very steep	9	8.9	2	7.1	11	8.5	
Steep	49	48.5	11	39.3	60	46.5	1.18
Gentle	41	40.6	14	50	55	42.6	
Flat	2	2	1	3.6	3	2.3	
Total	101	100	28	100	129	100	

Slope category	Willing farmers		Non-willing farmers		Total		
	Number	Percent	Number	Percent	Number	Percent	X^2
Very steep	6	20	5	5	11	8.5	
Steep	11	36.7	49	49.5	60	46.5	
Gentle	13	43.7	42	42.5	55	42.6	7.76
Flat	0	0	3	3	3	2.3	
Total	30	100	99	100	129	100	

Source: Own Survey, 2016

According to the farmers respond before 10 to 20 years the problem of soil erosion was not significant in the areas. However, after 10 years the soil erosion problem gradually increasing at an alarming rate due to vegetation cover removal for farmland expansion and an improper land use system in the area. (See the table 4.11 below)

Table 4.11: Times when soil erosion start on farmland for Sample Household WTC Labour and WTP Money to participate in soil conservation practices

Years of SErosion started	Willing farmers		Non-willing farmers		Total		
	Number	Percent	Number	Percent	Number	Percent	X^2
<5years	13	12.9	6	21.4	19	14.7	
5-10 years	87	86.9	22	78.6	109	84.5	1.52
10-20years	1	1	0	0	1	0.8	
Total	101	100	28	100	129	100	

Years of SErosion started	Willing farmers		Non-willing farmers		Total		
	Number	Percent	Number	Percent	Number	Percent	X^2
<5years	0	0	19	19.2	19	14.7	
5-10 years	30	100	79	79.8	109	84.5	7.17
10-20years	0	0	1	1	1	0.8	
Total	30	100	99	100	129	100	

Source: Own Survey, 2016

4.1.4 Farmers' Perception of Soil Erosion Hazard and Soil Conservation

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 (Bekele and Holden, 1998). Generally speaking, perception of soil erosion problem is an important factor for farmers to make decisions on conservation investments. In the Oromia highlands in general, and in the study site in particular, soil erosion is accelerated by 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 actions being taken are minimal as compared to the severity of the problem. More than 94% of the respondents who were willing to participate through labour contribution in soil conservation practices perceived soil erosion as a problem in their area. Whereas, around 75 % of non-willing farmers to participate for soil conservation perceived soil erosion as a problem in their area (Table 12).

According to previous study by Paulo, (2002) 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.

The study also shows that similar result in those farmers who have perceived soil erosion as serious problems were willing to participate in soil conservation practices. This implies that unless planners first increase farmers' recognition of soil erosion hazard, it would be very difficult to implement effectively sustainable soil conservation projects. This shows that the degree of perception of soil erosion problem has a positive bearing on farmers' decision to participate in soil conservation practices

Tab le 4.12: Perception of the problem of soil erosion, by farmers group for Sample Household WTC Labour and WTP Money to participate in soil conservation practices

Perception of the problem	Willing farmers		Non-willing farmers		Total		X^2
	Number	Percent	Number	Percent	Number	Percent	
Yes	95	94.1	21	75	116	89.9	
No	6	5.9	7	25	13	10.1	8.79
Total	101	100	28	100	129	100	

Source: Own Survey 2016

Perception of the problem	Willing farmers		Non-willing farmers		Total		X^2
	Number	Percent	Number	Percent	Number	Percent	
Yes	29	96.7	87	87.9	116	89.9	
No	1	3.3	12	12.1	13	10.1	1.96
Total	30	100	99	100	129	100	

4.1.5 Land Tenure Security

Land tenure system which is the result of a complex interrelated linkage of social, cultural, economical, political and institutional system needs a special attention. In Ethiopia, government owns land and farmers have uses right and they can also rent their land (Behailu, 2009). The sampled households were also classified based on tenure security of their farm lands. 71 (70.3%) percent of the respondents who were willing to take the offered initial bid for soil conservation practices were secured that their farm land will be with them at least until their life time. Of the 28 respondents who were not willing to participate through labour contribution in soil conservation practices, only 15 households (53.6%) were secured that their farm land will be with them at least until their life time (Table 13).

Table 4.13 shows that there is a statistically significant relationship between land tenure security and willingness to pay at less than 1% probability level showing that land tenure security is an important variable for household's decision to participate in soil conservation practices. This implies that security of land at least until life time gives farmers opportunity to invest in soil conservation practices. About 70% of willing farmers to contribute labour for conservation having land certificate on their own land. (Table 4.14)

Table 4.13: Sample respondents' Land Security feel for Sample Household WTC Labour and WTP Money to participate in soil conservation practices

Land Security feel	Willing farmers		Non-willing farmers		Total		X^2
	Number	Percent	Number	Percent	Number	Percent	
Yes	71	70.3	15	53.6	86	**66.7**	
No	30	29.7	13	46.4	43	**33.3**	2.76
Total	101	100	28	100	129	**100**	

Land Security feel	Willing farmers		Non-willing farmers		Total		X^2
	Number	Percent	Number	Percent	Number	Percent	
Yes	16	53.3	70	70.7	86	**66.7**	
No	14	46.7	29	29.3	43	**33.3**	3.13
Total	30	100	99	100	129	**100**	

Source: Own Survey 2016

Table 4.14: Having of Land certificate for Sample Household WTC Labour and WTP Money to participate in soil conservation practices

Land Certificate	Willing farmers		Non-willing farmers		Total		X^2
	Number	Percent	Number	Percent	Number	Percent	
Yes	70	69.3	19	67.9	89	69	
No	31	30.7	9	32.1	40	31	0.02
Total	101	100	28	100	129	100	

Land Certificate	Willing farmers		Non-willing farmers		Total		X^2
	Number	Percent	Number	Percent	Number	Percent	
Yes	15	50	74	74.7	89	69	
No	15	50	25	25.3	40	31	6.59
Total	30	100	99	100	129	100	

Source: Own Survey 2016

4.1.6 Labor Availability

A natural resource management activity is a labour intensive in it's nature. Accordingly, any form of soil conservation activity demands labour input. In order to undertake the practice, farm households need to take some labour away from their regular agricultural activities. Table 4.15 shows that a large number of willing farmers to contribute labour for conservation 90 (89.1%) and all non willing farmer to contribute labour 28 (100%) reported labor shortage as a problem. As can be seen from the table 4.15 below, 118 (91.5%) of the total respondents had reported labor shortage as a problem, whereas labor shortage was not reported as a problem by 11 (8.5%) of the respondents. And there was a statistically significant relationship between willingness status and problem of labor shortage. Showing that, labor is an important factor in determining willingness to pay for soil conservation practices.

Table 4.15: Sample respondents' opinion about the availability of labor for Sample Household WTC Labour and WTP Money to participate in soil conservation practices

Labour Shortage	Willing farmers		Non-willing farmers		Total		X^2
	Number	Percent	Number	Percent	Number	Percent	
Yes	90	89.1	28	100	118	91.5	3.33
No	11	10.9	0	0	11	8.5	
Total	101	100	28	100	129	100	
Labour Shortage	**Willing farmers**		**Non-willing farmers**		**Total**		X^2
	Number	Percent	Number	Percent	Number	Percent	
Yes	28	93.3	90	90.8	118	91.5	0.173
No	2	6.7	9	9.2	11	8.5	
Total	30	100	99	100	129	100	

Source: Own Survey 2016

4.1.7. Agricultural Extension services and Soil Conservation Activities

Agricultural extension services provided by agricultural development offices are believed to be important sources of information about improved agricultural technologies. About 100 (77.5%) of the sample respondents reported that they had contact with agricultural extension agents, either in groups or individually. From households willing to contribute their labour for conservation activities about 83 (82.2%) households had a contact with extension agents. Out of the 28 non willing farmers to participate on soil conservation practices by labour 17 (60.7%) were reported that no contact with extension agents. Table 16 shows that 99 (76.7%) of sample household heads who were non willing to pay cash for soil conservation practices. Out of this 28 (28.3%) households were not get the extension services on soil conservation services practices. Except one household all 29 households whom get advice by extension agents they were willing farmers to pay money for soil and water conservation works. According to the sample respondents who had contact with extension agents, before 2012 they had no specific contact with extension agents on matters related to soil conservation except that the issue was raised as part of another discussion. Though the magnitude of soil degradation is intensified in the area, it is only recently that extension agents have started to give emphasis to soil conservation issues.

Table 4.16: Extension service received for Sample Household WTC Labour and WTP Money to participate in soil conservation practices

Extension Service	**Willing farmers**		**Non-willing farmers**		**Total**		X^2
	Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**	
Yes	83	82.2	17	60.7	100	77.5	
No	18	17.8	11	39.3	29	22.5	5.80
Total	101	100	28	100	129	100	

Extension Service	**Willing farmers**		**Non-willing farmers**		**Total**		X^2
	Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**	
Yes	29	96.7	71	71.7	100	77.5	
No	1	3.3	28	28.3	29	22.5	8.22
Total	30	100	99	100	129	100	

SC Training	**Willing farmers**		**Non-willing farmers**		**Total**		X^2
	Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**	
Yes	27	90	54	54.5	81	62.8	
No	3	10	45	45.5	48	37.2	12.39
Total	30	100	99	100	129	100	

Source: Own Survey 2016

The main objective of this section is to evaluate the sample households' willingness to pay (WTP) in cash or in labor for soil conservation practices. This section presents results of the survey on the respondents' willingness to pay for soil conservation practices.

4.2. Testing the Contingent Valuation Method

A common concern of researchers, who use the contingent valuation method as well as those who are end-users of the results of the method, is the validity of the research outcome. This issue of validity refers to the degree to which valuation outcomes from the CVM indicate the true value of the asset being investigated. In this regard, the literature identifies few categories of methodological issues, which could in fact reduce the validity of CVM results.

One of these is the loss of validity arising from biased results generated by the CVM. Two major potential sources of biases are identified here. The first one is the consideration whether WTP responses derived from a contingent valuation study could somehow be influenced by respondents' strategic behavior. The second one arises when the WTP responses are influenced by the starting bid values.

4.2.1. Test for Strategic Bias

Although a well-designed questionnaire coupled with an appropriate questionnaire administration can present the desired hypothetical market to the potential buyers, households may not reveal their true valuation of the service in the expectation of getting the service for lower price than they actually think it is worth. Alternatively, households could overestimate their valuation if they think the provision of the proposed service would not materialize unless they offer higher WTP.

To assess for the possible existence of such biases in the WTP responses, the hypothetical market scenario used during the study was presented in two formats. The basic difference between the two is that the first was intended to capture any strategic behavior. The second one, on the other hand, includes a statement, which was specifically designed to discourage respondents from incorporating any strategic element in their valuation of the service. The latter explicitly states that, respondents' answers to the WTP question will not affect the soil conservation plan in the area.

Then questionnaire coded as code 1 (= scenario 1) and code 2 (= scenario 2) and explanation was given by data collectors on each scenario before data collection from the farm household begin. (See what explained for farmers under each Scenario in Appendix I. Open ended questions A) These two scenarios were distributed randomly among the questionnaires and hence 64 questionnaires carried the scenario, which was designed to capture strategic behavior and 65 questionnaires carried a scenario, which was designed to discourage strategic behavior. Then after a test was conducted to determine whether there is a significant difference between the average WTP values (Table 4.17)

Observations under scenario one represents the sub-sample of respondents who were presented with a statement encouraging strategic behavior. The mean WTP of this group was birr 1.78 per week in the case of cash contribution and 1.08 days per week in the case of labor contribution. On the other hand, under scenario two, respondents were confronted with a situation, which was open for potential strategic manipulation and resulting in an average contribution of birr 1.75 per week and 1.05 days per week. Table 4.17 shows that the statements have resulted in some difference in the mean WTP in birr per week and days per week. The two means, however, were not significantly different for both cash and labor as revealed by the t-test showing that respondents did not behave strategically.

Table 4.17: Mean WTP values for two scenarios of sample households

	WTP Money (Birr/week)		**WTP Labor (days/week)**	
	Scenario 1	Scenario 2	Scenario 1	Scenario 2
Observation in each group	64	65	64	65
Mean WTP	1.78	1.75	1.08	1.05
Standard deviation	0.417	0.434	0.270	0.211
t-test	0.37		0.75	

Source: Own Survey 2016

4.3 Analysis of Determinants of Household's WTP

Estimation results of the bivariate probit model are reported based on the theoretical model that has already been developed in chapter three. The model was used to examine whether WTP for

soil conservation of surveyed households are related to the explanatory variables or not. A total of fifteen explanatory variables were considered in the econometric model.

Before running the econometric model, the independent (continuous) variables were tested for the presence of multicollinearity (Appendix II). The result showed that there were no multicollinearity problems between the variables. The value for Contingency Coefficient(CC) (Appendix III) for the dummy variables were less than 0.75 and the value of Variance Inflation Factor (VIF) for the continuous variables were less than 10; which are obviously the indicators for the absence of multicollinearity. As can be seen from appendix III the contingency coefficients calculated for the qualitative variables show a weak degree of association among the variables. Therefore, all the dummy variables were included in the model.

The result indicated on Appendix IV that, all explanatory variables are not significant while the overall model is significant at 1% level. As it was expected, although education level, marital status, farmer perception about the problem of soil erosion and frequency extension service on soil conservation insignificant but positively will affect their WTP for the labour in questions.

Moreover, in contrast to the expectation; social position in the community and sex of the household are found insignificant and also negatively affected their WTP to conserve the soil. (Table 4.18). Thus, as per the recommendation by Cameron and Quiggin (1994) it seems better to run the bivariate model to get individuals innate behavior, because the result of the double-bounded dichotomous choice is more efficient statistically than single-bounded probit model.

In bivariate probit model (II), out of the fifteen explanatory variables hypothesized to explain the willingness of farmers' to participate in soil conservation practices in the study area, nine were found to be significant at less than or equal to 5% probability level. Two variables were significant at 5% probability level and the rest seven variables were significant at 1% probability level. The significant variables included, sex of household, marital status of the household, social position in the community, family size, labor shortage, total income and owns of tropical livestock unit (TLU) of the household, the coefficients of which were significant at less than 1% probability level. The coefficients of the perception farmers on soil erosion and the amount of credit service given to the farmers on soil conservation were at 5 % probability level.

According to the model result shown in the table 4.18 below, sex of the household head (SEX) was found to significantly affect WTP decision positively. On the other hand, marital status of the household (MRST), farmer perception of soil erosion problem (FPERCEPTION) , farmer social position in the community (SPOSITION), Family size of the household (FSIZE), labour shortage (LSHORTAGE), total income (TINCOME) and Total livestock units (TLU) were found to be significant to affect willingness to pay positively. The model result also show that six of the fifteen explanatory variables were less powerful in explaining farmers' willingness to participate in soil conservation practices as their coefficients were not significance at conventional probability levels. These variables include age, education level of household, farm land gone by erosion, the first initial bid for labour contribution, frequency of extension service and land tenure.

Table 4.18. Results of bivariate probit parameter estimates from the double bound with Covariates

Variables	Probit coefficient		P>/Z/		SD Error	
	Model-I	Model-II	M-I	Model-II	Model-I	Model-II
AGE	-.0489877	.0123141	0.991	0.225	.0109866	.0101589
SEX	-.7262557	1.386043	0.245	0.000***	.2564857	.3193093
MRST	-.268458	.455441`9	0.316	0.000***	.0977485	.1159307
EDU	.2562314	-.1391058	0.243	0.464	.2196553	.1900315
SPOSITION	.7658739	.8084878	0.635	0.001***	.2713389	.2367233
FSIZE	.1831208	.6964557	0.358	0.000***	.1990989	.1866731
FEROSION	1.196693	-.1714277	0.311	0.732	.4705821	.499639
FPERCEPTION	1.007976	1.050016	0.917	0.046**	.3737234	.5258481
FINITIALBID1Labr	-.4306968	NA	0.981	NA	.1389969	NA
SECONDBIDLabor	NA	.5198297	NA	0.998	NA	.2280667
LSHORTAGE	-5.214784	-1.398956	0.997	0.010***	1288.569	.5422324
FREQEXTENTION	.0239396	.0006481	0.112	0.943	.0095491	.0090936
LTENURE	.4191107	-.1913805	0.102	0.427	.2561304	.2410907
TINCOME	.0000337	.0000606	0.125	0.000***	.000015	.000166
CREDIT	.445713	.42402	0.219	0.022**	.1895047	.1846163
TLU	.1769176	.1755344	0.653	0.005***	.0605773	.063109
Constant	1.434307	-1.011195	0.190	0.277	1.094044	.9304781

Number of observation	129
Wald $Chi^2(30)$	47.73
Rho(p-value)	0.8369
Prob>Chi^2	0.000***
Log pseudo likelihood	-94.48
$Chi^2(1)$	12.5765

***, ** and * are significant at 1 percent, 5 percent and 10 percent probability level respectively.
Source: Own survey, 2016

The quantity Chi^2 illustrated in the table above represented a full test of significance. The null hypothesis was that, the parameters of all explanatory variables including the constant term assumed to be zero..

Mean Willingness to pay (Mean WTP) for Soil Conservation and estimation of explanatory variables from single and double bounded dichotomous choice question

The mean willingness to pay (μ) was calculated using the formula (Haab and Mconnell, 2002)

$$\mu = -\alpha / ß \quad \text{---------- (1)}$$

Where: α = a coefficient for the constant term

ß = a coefficient for the amount of the bid that the family was asked to pay

Double-bounded contingent valuation model is used to estimate the mean willingness-to-pay and its determinants. There are two options of independent models which can be used to estimate mean WTP. The models are bivariate model with no covariates i.e. WTP checked against the offered amount and bivariate model with covariates i.e. WTP against age, gender, education, family size, social position in the community, marital status, farmer perception on soil erosion, effect of soil erosion on their farm land, labour shortage, land tenure, frequency of extention service, total income, tropical livestock unit, offered amount and credit service. Thus, before deciding on which model to apply, it seems important to compare their results which would help to capture the true behavior of people that expressed through their preferences. Thus, the result from the second model was preferred for it uses covariates to run the model (Tables 4. 19). Cameron and Quiggin (1994) indicated that, the model which runs with determinant factors to estimate mean WTP are more preferred for its high marginal value accuracy estimation for environmental changes. Thus, the result revealed that, the mean willingness-to-pay for conserving soil for the two simultaneously run equations is 3.3 days/week and 1.95 days/week for the initial bid and follow up bid amount respectively. As indicated by the Pro>chi2=0.000, the model is significant at 1% significance level (Table 4.18).

In contrary Applying equation (1) above, the coefficients of constant term divided to the coefficient of offered amount to estimate the mean willingness to pay for soil conservation.

Accordingly, the double bounded bivariate probit estimate (with covariates) of the mean willingness to pay ranged from 3.3 days/week to 1.95 days/week for the initial bid (Fbid) and for the follow up second bid amount (Sbid) respectively. Generally, this figure was much higher

than the mean willingness to pay amount from the open-ended question (Maximum WTP) which was 1.68 days/week (see table 4.21). Also the mean WTP of single bounded probit estimate was highly exaggerated than that of the double bounded estimate. Mean WTP will be overestimated if a cumulative density function estimated from dichotomous choice data has an unrealistically fat right-hand tail. Ready and Hu (1995) have suggested a statistical approach to the 'fat tail problem' for dichotomous choice format. If a cumulative density function estimated from dichotomous choice data has an unrealistically fat right-hand tail, mean WTP will be overestimated.

4.3.1. Determining factors affecting respondents WTP

Furthermore, respondents' exposed to various socio-economic and demographic situations which will influence their mean willingness-to-pay. Results of bivariate probit analyses (Table 4.18) revealed that among the variables that were expected to affect the respondents willingness to pay for soil conservation illustrated as here under;

To this effect, fifteen (15) independent variables which were expected to have impact on individual's WTP for conservation of soil included in the model. Thus, seven explanatory variables were found to be statistically significant at less than 1% probability level, while two variable significant at less than 5%.

Sex of the household head (SEX): Sex of the household head was found to have a positive effect to willingness to pay for soil conservation. The result of bivariate probit model revealed that male headed household heads were found to be willing to pay more for soil conservation practices than female headed households. The sign of sex turned out to be consistent with the prior expectation and it was positively and significantly related with the dependent variable at less than **1%** level of significance for mode lI. Alemu (2000), and Animut (2006), reported the same result. This is mainly because; female headed households have less resources possession endowment as well as some cultural constraints than male headed households. But for model Ithe result indicate that negative and insignificantly related for willingness to participate soil conservation practices.

Marital status (MRST): The marital status of respondents is dummy variable with 1 for married and 0 otherwise. It was assumed that married respondents have more attachment with the resources than their counter parts. The more individuals have strong attachment with resources the more they understand its benefits and the more they interested to pay for its management.
Marital status of the respondents are also positive and significant at 1% probability level for model II result. Moreover, the variable marriage also indicated that when one respondent shift from single (unmarried) status to married status it resulted in increased probability of answering yes to the WTP question.

Social Position (SPOSITION):. The result of the bivariate probit model II showed that having social position in the study area was positively and significantly related to the probability of yes for the offered initial bid for conservation practices at less than 1 % probability level. This implies that farmers who have some social position in the study area are more willing to participate for the conservation practices. The reason might be due to the fact that having some social position increases responsibility hence willingness to participate for soil conservation practices.

Family size of the household (FSIZE): The coefficient of this variable supports the proposed hypothesis and it was found to be significant at 1 percent probability level. Households with higher family size are expected to pay more than those who have less family size because the proposed project was by labour contribution.

This is precisely because soil conservation practices are labor intensive to build and maintain, hence households with large labor may tend to pay more for conservation. The implication of the positive sign is that an increase in household family size increases the probability of a respondent to support the proposed voluntary labour contributions to soil conservation.

Farmers' perception of erosion hazard (FPERCEPTION): The sign of perception of soil erosion in a plot is turned out to be consistent with the a priori expectation and it was positively

and strongly related with the yes answer to the first initial bid offered. That is, households that have perceived the problem of soil erosion in the study are willing to pay more than the farmers who didn‟t perceive the problem of soil erosion in their plot land. The coefficient of this variable was significant at 5% probability level. Paulos, (2002) also found similar result.

Labour Shortage (LSHORTAGE): As priori expectation the coefficient of this variable was found to be negatively related and significant at 1% probability level. That mean, farmer household that have less labour/labour shortage less willingness to contribute labour for soil conservation due to this work needs more labor intensive activities..

Total Income (TINCOME): The coefficient of the variable total income appeared to be significant at 1% probability level with expected sign. The implication of the positive sign is that farmers get higher incomes increases the probability of the farmer to support the proposed voluntary labour contribution. This is due to farmers who get higher incomes get more informaion

Total Livestock Unit (TLU): TLU has an expected positive effect related to likelihood of saying yes to the first bid. The coefficient of this variable was significant at 1% probability level which shows TLU possession increases WTP. Livestock is considered as a measure of wealth and increased availability of capital which make WTP in soil conservation more feasible. The empirical findings by Jonse (2005), indicated that number of livestock in terms of tropical livestock unit plays an important role for willingness to pay. This is consistent with the fact that TLU is one of the wealth indicators and should have a positive contribution to willingness to pay.

Amount of Credit (CREDIT): The result of the bivariate probit model II showed that excess to credit service was positively and significantly related to the probability of yes for the offered initial bid for conservation practices at less than 5 % probability level. Hence, as it was hypothesized the result shows positive relationship for willingness to pay for soil conservation practices.

4.3.2. Households Willingness to Pay for Soil Conservation Practices

Table 4.19 presents the frequency distribution of farm households' WTP in cash per week. The table shows that about 76.7 % of the farmers were not willing to pay any money for soil conservation practices. In the practice of CVM, 0 bidders are presented with follow-up questions to ascertain whether they are expressing a protest bid against the valuation or they place no value on the resource. Since all respondents were presented with follow-up questions and zero bidders were the majority, in this study there is reason to believe that this was their true value and not protest bids. The remaining 30 respondents were willing to pay some amount of money. More specifically, above 10.1 % of the surveyed households were willing to pay less than 8 birr per week, while the remaining 13.2 % were willing to pay greater than or equal to 8 birr per week for soil conservation practices. The average WTP for the proposed service was calculated to be 1.91birr per week. Similarly about 42.6% of the households pay less 1.5 days per week for soil conservation activities and the rest 57.4% of the households contribute 1.5 days and above. The average WTP for proposed labour contribution for soil conservation services were calculated to be 1.68 days/week (see the table 4.20 below).

Table 4.19: Frequency distribution and mean values of WTP money

Birr per week	Number of farmers	Percent
0.0	99	76.7
4.00	1	0.8
5.00	4	3.1
6.00	2	1.6
7.00	6	4.7
8.00	7	5.4
10.00	6	4.7
12.50	3	2.3
15.00	1	0.8
Total	129	100
Mean	1.91	
Standard deviation	3.7	
Maximum	15	

Source: Own Survey 2016

Table 4.20: Frequency distribution and mean values of WTP (days per week)

Labour per week	Number of farmers	Percent
0.0	28	21.7
1.00	27	20.9
1.50	3	2.3
2.00	27	20.9
3.00	44	34.1
Total	129	100
Mean	1.68	
Standard deviation	1.16	
Maximum	3	

Source: Own Survey 2016

4.3.3. Reasons for Maximum Willingness to pay

The respondents were asked to point out their reasons for maximum willingness to pay cash (Table 4.21). 83.3 % of the respondents, who were willing to pay money, reported they could not afford more than what they stated and the rest (16.7%) stated that the government should fill the gap.

Table 4.21: Reasons for maximum willingness to pay money

Reason	Number of farmers	Percent
I could not afford more	25	83.33
The government should pay for it	5	16.67
Total	**30**	**100**

Source: Own Survey 2016

Respondents gave also reasons for their maximum willingness to contribute labor for soil conservation. About 86.14 % respondent households reported they could not afford more due to labor shortage, while 12.86% reported that what they proposed was worth enough, whereas, the remaining 1 % stated that the government should fill the gap. (See Table 4.22 below).

Table 4.22: Reasons for maximum willingness to contribute labor

Reason	Number	Percent
I could not afford more	87	86.14
I think it worth that amount	13	12.86
The government should pay for it	1	1
Total	**101**	**100**

Source: Own Survey 2016

The following table 4.23 presents the farmers' reasons for their non-willingness to contribute cash. Accordingly, of the 99 farmers who were not willing to contribute cash for conservation practices, about 86.9% pointed out that they could not afford because of the problem of cash shortage. About10.1 % indicated that the government should pay for soil conservation practices whereas the rest (3%) reported that, as they did not face the problem of soil erosion on their farmlands and didn't trust in conservation to pay for conservation practices.

Table 4.23: Sample farmers' reasons for non-willingness to pay money

Reason	Number	Percent
I do not trust in conservation	1	1
I could not afford	86	86.9
The government should pay for it	10	10.1
I do not see the problem it self	2	2
Total	**99**	**100**

Source: Own Survey 2016

Table 4.24 presents the reasons for the sample respondents' non-willingness to contribute labor. Accordingly, of the 28 respondents who were not willing to contribute labor, the majority (67.9%) pointed out that the problem of labour shortage to pay for conservation measures. About 32.1 % reported they did not face the soil erosion problem on their farmland to contribute labour for conservation activities.

Table 4:24 Sample farmers' reasons for non-willingness to contribute labor

Reason	Number	Percent
labor shortage	19	67.9
I do not see the problem itself	9	32.1
Total	**28**	**100**

Source: Own Survey 2016

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

In this study, CVM was used to elicit households' willingness to participate for soil conservation in Sabata Hawas Woreda of Oromia Special Zone surrounding Finfinne, Out of thirthy six rural kebeles, the study was conducted on purposively selected five kebeles. (Table 3.1).

Understanding the factors leading to willingness to participate in soil conservation practices would help policy makers to design and implement more effective soil conservation plans. In this respect, this study provides a basis and a point of departure for similar studies in the future.

Male household aware more on the problem of soil erosion and actively willing to participate on the soil conservation by labour contribution. Similarly in the case of marital status of the households, married households were more willing to participate on conserving their environment through labour contribution for soil conservation for model II result.

The social position of the household in the community also affects positively the willingness of the farmers for soil conservation practices. This indicating that, household having some influential power in the community understands more about their environmental challenges and actively contribute their labour and money for soil conservation practice.

Likewise, perception of soil erosion problem was positively and significantly related to the farmers' willingness to participate in soil conservation practices. This implies that farmers' recognition of soil erosion hazard is very important for their decision to participate in soil conservation activities

According to the survey result, the willing and non willing farmer's farmland affected by soil erosion at medium to high level at current condition. Household farmers who perceive the soil erosion hazard on their area and farmland more willingness to participate on soil and water conservation practices. To implement soil and water conservation practices on the farm land the members of family size affect positively the willingness to participate on soil conservation practices.

The labour shortage was the important factors for non willing households for contribute labour for soil and water conservation because this activities demand high labour. Similarly most of the households not willing to pay cash for soil conservation due to they cannot afford to pay for this labour intensive and huge SWC investment.

Farmers get excess to credit service understand problem of soil erosion in the area and more willingness to pay cash and contribute labour for environmental rehabilitation.

5.2. Recommendations

The results of the study have shown that the socio economic characteristics of the household, resource ownership, farmer perception on soil erosion, physical characteristic of farmland, and agricultural extension services are responsible for household's willingness to pay for soil conservation practices. Therefore, policy and program intervention designed to address soil erosion problems in the study area have needed to take in to account these important characteristics for effectiveness.

In order to introduce a sustainable soil management at a household level, the households should be given the right to play the major role in planning, managing, controlling and using their own resources. It is also better for the policy makers to design the participation of the households based on labor contribution than cash contribution, while designing a soil conservation project. The results of this study shows that sex of the household head had a positive effect on willingness to pay decision. This shows that female headed households are less willing to pay for soil conservation practices than male headed households. This is because female headed households have less access to the information on soil erosion problem and limited resource possessions as compared to male headed households. Hence, there is a need to enhance the capacity and resources possession of female headed households so that they can able to take their parts in soil conservation practices as they have accounted for substantial number in the rural families of the study area. To mobilize the community for soil conservation activities, it is better to work closely with household who have some social position in the community. The results of the study also showed that those farmers who have perceived soil erosion as a serious problem were willing to participate in soil conservation practices than those who do not perceived. This implies that unless planners first increase farmer’s recognition of soil erosion hazard, it would be

very difficult to implement effective sustainable soil conservation projects. Furthermore, the results of the study also revealed that wealth indicators such as total livestock holdings have a positive effect to WTP for soil conservation practices in the study area. This implies that for successful management of natural resources such as soil wealth improving programs should target the poor so that they would be able to participate.

Based on 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.

- Similarly farmers having some social position in more willing to participate on the soil conservation. So that during our watershed management planning and implementation we should have to focus on this group for good involvement and mobilization of community in environmental rehabilitation.
- Investment in physical soil conserving technologies becomes more attractive as the area of cultivable land is larger, i.e. farmers make more soil conservation investment in holdings that are wider in area. This suggests a strategy of targeting diffusion of different (alternative) soil conserving technologies particularly to areas relatively having greater area of arable land and to areas having smaller area of cultivated land.
- Local people should be allowed to participate in any activity that concerns them. Participation enhances farmers' perception of the land degradation problem. Those 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.

Policy makers should encourage and provide technical advice to farmers who are practicing soil conservation at their own initiative and using their indigenous knowledge. Research should also develop appropriate soil conservation technologies for each particular situation, incorporating farmers' indigenous knowledge. More specifically, as farmers are well adapted to the local ecology and the farming systems, incorporating their indigenous practices would increase acceptability and sustainability of soil conservation measures.

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APPENDIXES

APPENDIX I: Survey Questionnaire

This questionnaire has been prepared to gather information about farming practices, problem of soil erosion, willingness to pay for soil conservation and socioeconomic conditions of households. The objective of this questionnaire is to collect information related to willingness to pay for soil conservation practices in the selected Woreda. The research is intended to develop a mechanism to help households in improving land productivity through soil conservation practices. In answering this questions, please remember that there are no correct or wrong answers. I am just after your opinion. Hence, I request you honest and fair responses to fill up this questionnaire.

General Information:

Name of the enumerator ---------- Sign. ---------- Date----------

Name of the PA ---------- Name of the Village/Watershed----------

1. THE FARMER HOUSEHOLDS INFORMATION

1.1. Age _____

1.2. Gender Male = 1 Female = 2

1.3. Marital status

Married =1 Divorced =3

Single =2 Widowed =4

1.4. Education Level

No informal education =1

Primary education =2, Number of years ----------

Secondary education =3 Number of years ----------

1.5. When did you start farming for your own? (year)_____

1.6. Did you have some social position (eg elders, religious leader, governmental structure, influential person etc) in the community so far? 1. Yes 0. No

1.7. **If yes**, what is your position in the community? ----------

2. Information about the sample household family

2.1 Information about family member

No	Name	Age	Sex	Education level	Relationship	The average working hour per day		
						On-farm(hr)	Off-farm	On both
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								

NB. Code of family member relation 1=husband 2=Wife 3= Son/ daughter 4=servant 5= other

3. Information about sample household land use.

No	Type of land use	Area in hectare
1	Cultivated land	
2	Grazing land	
3	Forest land	
4	Fallow land	
5	Homestead	
6	Other	

4). AWARENESS TOWARDS EROSION AND EROSION HAZARDS

4.1 Do you perceive the problem of soil erosion in your area? 1.Yes 0. No

4.2 If **yes**, what are the causes for this problem?

(i)----------

(ii) ----------

4.3 Is your farmland prone to erosion? 1. Yes 0. No

4.4 **If yes**, how much of your farmland affected by erosion in (hectar)----------

4.5 How do you measure the likelihood of risks to happen to your plot of land?

1. No risk 2. Medium 3. High exposure to erosion

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

1). < 5 years 2). 5 - 10 years

3). 10 - 20 years 4). > 20 years

4.7. How does the household perceive the soil depth/ fertility since starting farming as compared to the past?

1. Increasing 2. Decreasing 3. No change 4. Do not know

4.8. If answer is increasing 4.7, what measures did the household take to rehabilitate the conditions?

1. Apply manure 2. Apply chemical fertilizer

3. Biological soil conservation 4. Physical soil conservation

4. 9. How serious is the decline in soil fertility on the main plot since started farming with reference to normal year/ adequate rainfall?

1.Very serious 2. Serious 3.Minor 4. No problem

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

1.Yes 0. No

4.11. Slope of the land you have (as perceived by the farmer)

1. Very steep 2. Steep 3. Gentle slope 4.Flat 5. Others (specify)----------

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

1. Abandoned your cultivated land 2. Expanded to marginal land

3. Have taken off farm employment 4. Other (specify)---------

4.13.How is the fertility of your farmland? (As perceived by the farmer)

1. Fertile 2. Moderately fertile

3. Infertile 4. Others (specify)--------.

4. 14. If non-fertile, what was the cause of non-fertility?

1. Intensive cultivation for many years 2. Erosion

3. Do not know 4. Others (specify)--------

4.15. Do you observe change in the level of crop yield on your cultivated land?

1. Yes 0. No

4.16. If yes, indicate the average decline

1. Minor 0. Medium 3. High

5. Farm Characteristics

5.1. Do you have you own farm land?

1. Yes 0. No

5.2. If yes, how you get this farm land plot?

1) Inherited from family 2) Received from kebele 3) Rented in

5.3. How much area of the land for farming in hectar?_____

6. AWARENESS TO TECHNOLOGY

6.1. Do you know the existence of soil conservation practices?

1.Yes 0. No

6.2 . **If yes** to 6.1., have you used any one of the following physical soil conservation practice(s)?

1. Terrace 2. Different bunds 3. Grass strip 4. Moisture harvesting 5.Others

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

1. Lack of money 2. Labor shortage 3. Others (specify)----------

6.4. Have you participated in mass mobilization/community conservation activities this year?

1. Yes 0. No

6.5 Do you use fertilizer on your farm to maintain soil fertility?

1. Yes 0. No

6.6 **If yes**, amount per hectar in kg……..

7. WILLINGNESS TO PARTICIPATE IN SOIL CONSERVATION PRACTICES (Enumerator read the scenario)

1. Would you be willing to contribute money to participate in soil conservation practices
   1. Yes 0. No

2. 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

3. If yes to 1, would you be willing to pay X birr per week?

   Yes=1 if yes go to (4a)

   No=0 if no go to (4b)

4a). Would you be willing to pay BX birr per week? Where BX>X.

   Yes=1 if yes go to (5)

   No=0 if no go to (5)

4b). Would you be willing to pay **CX birr per week**? Where CX<X.

   Yes=1 if yes go to (5)

   No=0 if no go to (5)

5. What is the maximum you are willing to pay per week? ----------

6. Would you be willing to contribute labour to participate in soil conservation practices?

   1. Yes 0. No

7. If no why?

   I do not trust in conservation =1 labour shortage = 2

   I do not see the problem itself =3 others (specify)= 4

8. If yes, would you be willing to contribute X man days per week?

   Yes=1 if yes go to (9a)

No=0 if no go to (9b)

9a). Would you be willing to contribute BX man-days per week? Where BX>X.

Yes=1 if yes go to (10)

No=0 if no go to (10)

9b). Would you be willing to contribute CX man-days per week? Where CX<X.

Yes=1 if yes go to (10)

No=0 if no go to (10)

10. What is the maximum man day you be willing to contribute per week?----------

11. What is the main reason for your maximum willingness to pay money stated in number 5 above?

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

The government should pay for it=3 Other reason =4(specify)--------

12. What is the main reason for your maximum willingness to contribute labour in number 10 above?

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

The government should pay for it=3 Other reason =4(specify)--------

8. LABOUR AVAILABILITY

8.1. Do you have labour shortage for farm activities? 1. Yes 0. No

8.2. **If yes**, for which kind of farm activities?

1. Crop production 2. livestock production

3. Soil conservation activities 4. other (specify) ----------

8.3. **If yes to 8.1**, how do you solve labour shortage?

1. Hiring labour 2. Use communal labour 3. Other (specify) ----------

8.4. If labour is hired, what type of labour do you hire?

1. Permanent =1 2. Casual 3. Both

8.5. If permanent, how much do you pay per annum? (birr)_____

8.6. If casual, how much do you pay per day? (birr)_____

8.7**.** Can you get labour to hire when you are in need?

1. Yes 0. No

8.8. Do you or your family member work on off- farm activities? 1. Yes 0. No

8.9. If the answer to question **8.8 is yes**, Fill in the following table For **2007 E.C**.

No	**Type of off-farm (non-farm) activity**	**Family members working** **1) Men** **2) Women** **3) Children**	**Total income obtained in one year (birr)**
1	Pity trade		
2	Pottery		
3	Weaving		
4	Leather making		
5	Selling of fire wood and charcoal		
6	Labor hire out		
7	Remittance		

9. INSTITUTIONAL CONTACT AND ASSISTANCE

9. 1. Have you received extension advice on soil conservation practices so far?

1.Yes 0. No

9.2. Frequency of visit by development workers per year? ---------- days

9.3. Are there any **governmental** or **non-governmental organizations** working on soil conservation activities in your area?

1.Yes 0. No

9.4. If yes, mention some of them (GOs & NGOs)

GOs NGOs

1. ---------- 1. ----------

3. ---------- 2. ----------

9.5. Have you been advised by any of these organizations to undertake soil conservation practices? 1. Yes 0. No

9.6. In which kind of soil conservation programs have you been involved?

1.Food for work 2. Money for work 3. Free 4. Others (Specify)----------

9.7. Have you attend any soil conservation training in the past?

1. Yes 0. No

10. TENURE OR PROPERTY RIGHT

10.1. For how long have you been with your land? ----------

10.2. Do you feel secure that the land belongs to you at least in your lifetime?

1.Yes 0. No

10.3. **If No**, what are the reasons?----------

10.4. Do you have land use right certificate?

1.Yes 0. No

10.5. If Yes, do you think that having of certificate has contribute to increased productivity?

1.Yes 0. No

11 . INCOME SOURCE OR WEALTH INDICATORS

11.1. What were your crop production per year in quintal 2007 years from rain fed agriculture land?_____

11.2. What were your crop production per year in quintal 2007 years from irrigated land?_____

11.3. What was the estimated amount of off-farm income in birr (in 2007)? ----------

11.4. If the household does not have ox or only have one ox ask how the household plough its farm.

1. Rented ox 2. Pairing with others

3. shared out/rent out the land 4. Other (specify)----------

Animal Ownership

No	Type of livestock	Number	Sold/	Revenue
1	Oxen			
2	Cow			
3	Poultry			
4	Sheep			
5	Donkey			
6	Horses			
7	Heifer			
8	Calve			
9	Mules			
10	Goats			

12. CREDIT

12.1. Did you have formal or informal sources of credit? 1. Yes 0. No

12.2. **If yes,** how much have you borrowed in the last two years?

Commercial Bank (birr)	Oromia Saving and Credit Company (birr)	Cooperatives (birr)	Informal money lenders (birr)	Others	Total (birr)

12.3. If no, why?----------

13. GENERAL OPEN ENDED QUESTIONS

1. What intervention must be used for better implementation of soil conservation practices in the future in your area? ----------
2. Any idea with regard to soil conservation practice? ----------
3. Any idea with regard to the negative impact if soil conservation practice? ----------
   ----

A. Opening Statements for WTP Questions

Scenario 1: This was designed to capture any strategic behavior by the respondent in answering WTP questions.

In your area crop production and livestock grazing are mainly undertaken on hillsides and top of hills. Because of this the ground become bare and the soils are started to be removed by soil erosion. We will ask you a question if you are willing to participate in conservation and rehabilitation of the land. Conserving and rehabilitating the land requires initial investment, running cost and labor. We want to know if you are willing to pay some money or spend some time so that the activity will be undertaken in your area. The activity will be managed by you and people from your village in collaboration with Agricultural Office. The amount of money to be paid and the number of days to be spent are decided by agreement.

Scenario 2: This was specifically designed to discourage strategic behavior.

In your area crop production and livestock grazing are mainly undertaken on hillsides and top of hills. Because of this the ground become bare and soils are removed by erosion. There is a need to undertake soil conservation activities to avoid removal of the soil and further degradation. Before asking WTP discuss the importance of soil conservation and then ask following question. Such soil conservation and rehabilitation activities need initial investment, running cost and labor. We want to know the amount of money you are willing to pay or the number of days you are willing to spend on such activities. Your answer cannot change the plan that the government has to undertake soil conservation and rehabilitation programs in the future. We would now like you to answer the following questions on the amount of money you are willing to pay or the amount of time you are willing to spend on the activities.

B. Open Ended Question Used during the Pre test to Find Starting Points for WTP Questions

Opening statement: Scenario 1 or 2

- What is the most you would be willing to pay per week for soil conservation and rehabilitation activities?
- What is the most amount of time (number of days) you would be willing to spend per week on soil conservation and rehabilitation activities?

APPENDIX II: Variance Inflation Factor (VIF) for continuous explanatory variables

Variable	Adjusted R^2	Variance Inflation Factor (VIF)
AGE	0.131	1.15
MRST	0.056	1.06
EDU	0.015	1.02
FSIZE	-0.002	0.99
FREQEXTENTION	0.042	1.04
TINCOME	0.027	1.03
TLU	0.063	1.07
Mean		**1.06**

Source: Own Survey 2016

APPENDIX III: Contingency Coefficient for Discrete Variables

	SEX	SPOSITION	LTENURE	FINITIALBID1Labr	FPERCEPTION	LSHORTAGE	CREDIT
SEX	1	-.519	-.073	.000	-.072	.000	-.166
SPOSITION		1	.070	.000	-.138	.000	-.037
LTENURE			1	.000	-.250	.000	.174
FINITIALBID1Labr				1	.000	.000	.000
FPERCEPTION					1	.000	-.205
LSHORTAGE						1	.000
CREDIT							1

Source: Own Survey 2016

APPENDIX IV: Probit estimate for the single bounded dichotomous choice model

Variables	Probit coefficient	P>/Z/	SD Error
AGE	-.2410159	0.311	.057702
SEX	-.2324134	0.841	1.158403
MRST	·.6234921	0.134	.4158111
EDU	.1708437	0.735	.505318
SPOSITION	-.2956941	0.636	.6251827
FSIZE	2.596484	0.455	.9338776
FEROSION	-.6110853	0.488	.8808725
FPERCEPTION	1.443717	0.174	.8084056
FINITIALBIDLabr	.4625623	0.521	.1397262
SECONDBIDLabor	.4640079	0.665	.251778
LSHORTAGE	.715053	0.966	.1267637
FREQEXTENTION	.0250703	1.00	.0251154
LTENURE	.2810471	0.58	.4863548
TINCOME	.0001033	1.49	.0000696
CREDIT	.507585	1.35	.3751231
TLU	.1440835	0.72	.1991551
Constant	2.771268	0.99	2.79141

Number of observation	129
Wald $Chi^2(15)$	83.44
Rho(p-value)	0.6452
$Prob>Chi^2$	0.000***
Log pseudo likelihood	-22.936816

Source: Survey result, 2016; Note: ***, **, * indicates significance level at 1%, 5% and 10%.