International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2019): 7.583

Determinants of Farmers Willingness to Participate in Soil Conservation Practice (In Case of Dale Wabera Woreda)

Alemayehu Acha[1], Shimelis Bayines[2]

Lecturer, Department of Economics, Arba Minch University, Ethiopia

Abstract: ***The objective of this study was identifying the determinants of farmer's willingness to participate in soil conservation practice. This research was conducted by using simple random sampling technique. Data were collected through structured interview from a total of 98 farmers. Descriptive statistics were used to describe sample respondents in terms of some desirable variables. Econometrically a binary logit model was employed to analyze determinants of farmers' willingness to participate in soil conservation practices. A total of nine explanatory variables were included in the model of which five were significant at less than 10% probability levels. The significant variables were age , sex, education level, soil fertility forgone and attitude. And all the significant variables were positively related with the dependent variable while the rest four variables (family size, dependency ratio, assistance and technological awareness) were insignificant. Policy makers and government better to encourage and provide technical advice to farmers who are practicing soil conservation at their own initiative and using their 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.***

Keywords: Land Degradation, Soil Conservation, Logit Model

1. Introduction

Soil degradation is a big issue and problem internationally. Even in worldwide; it becomes the main factors for the reduction in agricultural production. Taking in to consideration this issue, environmental specialists are taking many measures to reduce its effects; the same things take place in our continent Africa. 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 climate change in combination with expanding human population, presents a food security worldwide challenge. Population growth and the dynamics of climate change exacerbate desertification, deforestation, erosion, degradation and depletion of water resources (Bangizi, 2012).

Land degradation and loss of biodiversity have put the worlds ecosystems under intense pressure and their capacity to provide vital services is declining while at the same time the demand for these services is growing (Butchart et al 2011).In the predominantly agrarian societies of Africa, one of the most threats to food supply is environmental degradation, the deterioration of crop lands, grasslands and forests(Alemneh,2014).Land degradation and continuous fall in agricultural productivity countries of sub Saharan Africa(SSA)have raised serious concerns in the international level (World Bank,2013). In many agriculture based developing countries environmental degradation takes mainly the form of soil nutrient depletion and loss of production potential. High soil degradation is the main factor most of African countries to be called poor countries still. Ethiopia is one of the countries in the sub Saharan Africa faced with pervasive poverty, high rate of population growth, insufficient food production and degradation of natural resource base (Brhanu and Swinton,2012).This problem in Ethiopia stems largely from weaker land use and management practices and population pressure, especially in the highlands (Shiberu,2013).

The forest land of the country, which once covered 34 percent of the total land has dwindled to a mere 15 percent (Ministry of Natural resource, 2011). The major cause of land degradation in Ethiopia is erosion (Alemneh, 2014).Intensification of cropping lands without suitable amendments to replenish lost nutrients has led to widespread degradation of land. Inadequate land policies and policy applications are a serious constraint on economic and social development. On the one hand, inefficient land institutions discourage overall economic growth (Bereket et al,2012).Available estimates on the economic impact of soil erosion indicate annual on size average productivity loss of 3.5 percent from the 2005 yield level (FAO,2014).Land degradation is a major cause of poverty in rural aria of developing countries. In many areas, farming population has experienced a decline in real income due to demographic, economic, social and environmental changes. Soil erosion is the result of several factors of both physical and socio economic nature. During the past decades, Ethiopia has faced serious ecological imbalance mainly due to large scale deforestation, uncontrolled grazing practice, soil erosion caused by improper farming practice and destructive forests exploitation and wildfire, which results a declining agricultural production, water depletion, disturbed hydrological behavior in the river basins and food insecurity (Daniel, 2010).

The severity of soil erosion in Dale Wabera Woreda area was generally the result of improper soil management, high

Licensed Under Creative Commons Attribution CC BY

rainfall and population density and low vegetation cover. In many area of the Woreda soil erosion is the wide spread problems that damage the cultivated land of the farmers. The conservation measures are implemented in a farm participatory approach. Efforts to install conservation measures on erodible lands were initiated the 1975 land reform and establishment of peasants association, which were instrumental in mobilizing labor and assignment of local responsibilities. In order to combat soil degradation and to introduce sustainable use of resource there was a need to action. At present, Dale Wabera Woreda was facing extreme soil degradation (Agricultural Bureau of Dale Wabera Woreda, 2014).

The principal factors responsible for the problem include low conservation practices and exposure of its topography, especially to water fluid, inherent erodible nature of the soil and expansion of farm lands by clearing forest. The study was aimed at identifying the factors that determine farmers' willingness take part in soil conservation practices, assessing farmers' perception of erosion problems and generating baseline information for policy intervention.

Environmental degradation in Ethiopia was a synonyms with land degradation (Alemneh, 2011).The most sever land degradation occurred on grassland, 40 percent of which experienced degradation (Le et. al, 2014).In response to extensive degradation of the soil resource base, new land conservation technologies have been introduced in some degraded and food deficit areas of the country, mainly through food for work (FFW) incentives since the early 1980's.

The specific study site, Dale Wabera Woreda was dominated by leveled and sloped topographic structure. At present this area was facing extreme degradation by the principal factors being steeps topography, inherent, erodible nature of the soil and expansion of farm land without appropriate conservation measures (Bekele et al 2011).One widely misunderstand subject in Ethiopia was peasant perception of their environment. It was misunderstood partly because an outsider, both experts and policy makers, who write about peasants and formulate policies, often, has limited understanding about the peasant's environment (Alemneh, 2013).

Conservation practices were mainly under taken in a campaign often without the involvement of the land users (Bekele and Holden, 2013).This shows that projects failed to consider local peoples economic, demographic, institutional and technical factors from the very inception of conservation projects. Thus there was a need to take action on technology development and design of policies and strategies that promote resources conserving and use with active participation of local people. In Ethiopia, very empirical studies employ valuation techniques to understand the farmers' willingness to participate in soil conservation practices. Tesema and Holden (2011) assessed farmers willingness to participate in soil conservation practice in southern Ethiopia, by taking some variables in to consideration as a factor determine willingness to participate in soil conservation activities: such like; sex of household head, marital status, educational level, family size, size of farm land, etc. Another researcher Gebre Mariam et al,(2012) also investigate the value that the farmers have attached to soil conservation practice and the determinants of willingness to pay for it in the Northern part of Ethiopia by taking the following variable as a factor determine participation in soil conservation practice. Such as; age of household, education, household size, slope of the land, distance of land from home, dependency ratio, etc. But, they failed to consider or include the variable which was soil fertility forgone by erosion as a factor determine farmers participation in soil conservation practice, that indicates farmers who are highly affected by erosion are more willing to participate to recover their land fertility than those their land is do not eroded. Therefore, the purpose of the study was to fill this gap that was not undertaken by the aforementioned researchers.

2. Review of Empirical Literature

According to Baidu Far son, (2013) factors that motivate level and intensity of specific soil management technologies include; higher percentage of degraded farm land, extension education, lower risk aversion and the ability of short term benefit. This result shows technologies should be targeted to locations that have large percentages of degraded farm land and there is a need to provide extension education that demonstrates risk reduction capacities of conservation techniques.

In the case study by (Lapel et al, 2011) on the adoption of counter hedgerow as a soil conservation practice in the South Africa up lands found that age of farmers, level of education, access to markets, membership in a local organization of farmers with labor exchange arrangements among members and slopes were the significant affecting use of conservation. According to this study, ownership of land is not always a necessary condition for having security of tenure that would lead to investment.

Tianjin et al, (2013) studies that the public preferences for cultivated land protection in Weanling city of china by using the choice experiment approach. The estimation results indicate that the most important attribute for cultivated land protection in Weanling city was land facility, followed by land fertility and then land scope improvement.

Sureshawaran et al, (2013) reported that factors such as orientation to farming, education, and cost sharing or government assistance affected significantly the decision behavior of farmers on soil conservation practices. Moreover they showed that farm size, tenure arrangement and reduction in land intensity measured by land to man ratio, affected farmers' decision on soil conservation practice.

Sombrock (2011) stated that there would seem to be only limited possibility for the success full transfer of modern

Licensed Under Creative Commons Attribution CC BY

land use technologies from other tropical regions to sub Saharan Africa. The author underlined that, the real challenge is to keep rural population settled on the land, allowing them to lead a decent life from consumption and sale of produce of the land under their care on sustainable bases, fair and stable prices, no trade barriers, no competition from subsidized for inputs, assured supply of inputs and effective means of transmit innovations to and farmers nationally and regionally.

Most empirical studies on land degradation analyze the impact of physical factors like topography, climate and soil, farming practices and population pressure on soil erosion (Wagayehu and Drake, 2014). These studies suggest interesting causal relationship that shed light on impact of population pressure on resource degradation. With an increase in population pressure, intensification of crop land is more common (Derege, 2011).

Studies on the determinants of soil conservation decision behavior of farmers in Ethiopia have been limited. Generally the past approach to soil conservation study emphasized technical solutions to soil erosion problems to neglect of socio-economic constraints (Abdu Rohman, 2010).

For decades, it was believed that technological innovations combined with scientific methods were the answers to soil erosion problems. However, regardless of advances in the development and promotion of technologies, the soil erosion problem persists forcing changes in attitudes to the way to tackle the problem. This lead to the realization that soil conservation is not only technical problem, but also socio-economic and behavioral factors influencing soil conservation decision making This evident from the ever increasing literature on this area (Wagayehu, 2014).

According to Lynne (2012), factors such as income and nature of terrain were found to affect conservation behavior. Farmers' attitude influences the amount of effort exerted in conservation. The author stresses that; investment on specific technologies will be enhanced by dissemination of knowledge and demonstration of the level of gains from the technologies and the potential risk reduction characteristic. Even though relatively few conservation projects have been evaluated in Ethiopia, available evidence indicates that extensive conservation works have been initiated since 1945, when the forestry and wild life division of the ministry of agricultural attempted through legal actions, to protect forest areas (Mengistu, 2012).

Conservation works accelerated rapidly following the 1975 Ethiopian revolution, largely due to the creation of peasant associations and nationalization of rural land under the nominal control of the peasant associations. Recent studies made by Bekele and Holden (2013), in western showa 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 the 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 .A study made by Tegegn (2004), as cite in Tadese Moroda (2015) on willingness to participate in 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 'wealthily' farmers instead of poor. In order to convince people to contribute labor during peak season, education can be considered whereas during slack season, large size households and younger people are more likely to spend time on environmental protection. Consequently, he recommended that policy should focus on younger people and households with large labor force.

So far, farmers have not been involved in the soil conservation planning process. This shows that soil conservation programs implemented in the country failed to consider the involvement of local people. In order to design a useful plan of action for environmental protection, it is necessary to understand local people's attitudes towards environmental plans. Moreover important variables such as attitude of farmers, assistance, soil fertility forgone by erosion, are included in this study.

3. Research Methodology

3.1 Sampling Procedures

The study was selected purposively from 5 rural kebeles (peasant associations) from the 25 kebeles of the woreda (districts). This is because of high erosion severity of the area. Further, farm households were selected by using the probability proportional to the size (a number of households) of the peasant associations from the five peasant associations using simple random sampling. From the selected 5 rural kebeles, there is 7680 households (Agricultural Bureau of Dale Wabera Woreda, 2018).But due to time, money and other financial constraints; this research paper was taken only a sample of 98 individual households from the total target population by using simple random sampling technique. The sample size was determined by using Yamane Taro formula.

The Yamane's (1967) sampling formula with 90 percent of confidence level use to determine the sample size for this study with 10 percent of level of precision.
$n=N/1+N(e)^2$ where n = sample size
N =Total number of household , e =Margin of error
n = 7680/1+7680(0.1)2 = 7680/78 = 98

After determining the total size of actual sample, the next task was to determine the total number of households from each kebele to be included in the sample. Farm households

Licensed Under Creative Commons Attribution CC BY

from each kebele are included in the sample proportionately. This is to give equal chance representation to all kebeles in the sample.

3.2 The Analytical Framework: Logit Model

Unlike correlations, however the primary purpose of regression is prediction (Geoffrey M.et al, 2014: 224-225). In this study logistic regression would be employed. This method is used to determine, if the independent variables would be explain the variance in dependent variables. When any of the explanatory variables in regression model are binary one can represent them as a dummy variables and proceed with the analysis using linear regression model when the dependent variable is more complex (Pindyck and Rubin Feld 2011).

Binary choice models assume that individuals are faced with a choice between two alternatives and their choice depends on their characteristics. Thus, the purpose of a qualitative choice model is to determine the probability that an individual with a given set of alternatives would make one choice rather than the alternatives (in this study yes response or no response to the willingness to participate question).

Binary explanatory variables can be represented as a dummy variables and a binary choice model assumes occurrences between two alternatives (in this case being adopter and non-adopter of improved soil conservation practices). There are several methods to analyze the data involving binary out comes. However, for this particular study logit model was selected. The linear probability model (LPM) which is expressed as a linear function of the explanatory variables is computationally simple. The Logit model best fits to the non-linear relationship between the probabilities and the explanatory variables. The dependent variable in this case is a dummy variable, which takes a value of zero or one depending on whether or not a farmer is adopter or non-adopter of improved soil conservation practices.

However, the independent variables are both continuous and binary. In this study, logistic econometric model would be used to identify the factors (the independent variables) that affect farmers' decision of adopting improved soil and water conservation practices in the study area. From households in Dale Wabera Woreda differ in the proportion of cultivated land on which different types of physical soil conservation structures are not used. There are non-users of these improved and traditional soil and water conservation measures. The purpose of this study would be organizing which of the hypothesized independent variables are related to the willingness of farmers to participate in soil conservation practices through labor contribution.

The dependent variable in this case is a dummy variable (binary) which takes a value zero or one depending on whether or not a farmer is willing is to participate in conservation activities by labor. However, the explanatory variables are either continuous or binary.

To examine the determinants of households' farmers' decision on the willingness to participate in soil conservation in the study area, Binary logit model is specified as follow (Gujarati, 2004)

$$\left[pi = E\left(y = {}^{1}/_{xi}\right)\right] = \frac{1}{1+e-(\beta o+\beta 1X1+\beta 2X2+\cdots+\beta n} \ldots (1)$$

Where βi =coefficient of each explanatory variable

Xi= explanatory variable

For simplicity it can be written as

$$pi = \frac{1}{1+e^{zi}} = \frac{e^{zi}}{1+e^{zi}} \ldots\ldots\ldots\ldots (2)$$

Where $zi = \beta o + \beta 1x1 + \beta 2x2 \ldots . \beta nxn$

The above equation represents cumulative logistic distribution function

pi =the probability of households being participant, then

$(1 - pi)$ is the probability of non-participant which is

$$1 - pi = \frac{1}{1+e^{zi}} \ldots\ldots\ldots\ldots\ldots (3)$$

Therefore, it can be re written as

$\frac{pi}{1-pi} = 1 + \frac{e^{zi}}{1+e^{-zi}}$ from this $\frac{pi}{1-pi}$ is the odds ratio in favour of the household being participant or the ratio of the probability that the households are being participant to the probability that the households are being non-participant.

We take the natural logarithm of the above; we obtain what the interesting logit model

$$\ln\left(\frac{pi}{1-pi}\right) = \frac{1+e^{zi}}{1+e^{-zi}}$$

Where $zi = \beta o + \beta 1x1 + \beta 2x2 \ldots . . + \beta nxn \ldots\ldots\ldots\ldots\ldots (4)$

3.3 Model Specification

Mathematical expression of the model:

Y=ß0+ß1EDU+ß2AGE+ß3FS+ß4SEX+ß5ASS+ß6AWR+ß7DR+ß8ATT+ß9SFF

Where; Y = dependent variable, which takes 1 for participants and 0 other wise.

ß0=constant term.

ß1, ß2, ß3, ß4, ß5, ß6, ß7, ß8 and ß9, is coefficients of explanatory variables.

Licensed Under Creative Commons Attribution CC BY

EDU = Education level of the household head's
AGE = Age of household head
FS = Family size
SEX = Sex of household head
ASS = Assistance in soil conservation practice
AWR = Past awareness about technology
SFF = Soil fertility forgone by erosion
DR = Dependency ratio
ATT = Attitude of the farmers towards soil fertility measure
E = Error term
In this study, the above econometric model would be used to analyze the collected data.

4. Empirical Results and Discussion

4.1. Descriptive Results and Analysis

Table 1: Average mean distribution of age

Var	Obs	Mean	St.d	Max	Mini
Age	98	47.25	8.89	64	25

(Source: Survey Data, 2019)

Age is an important factor that must be considered in a given business activity (either in agriculture or industrial sector). It is clear that elders cannot perform hard works, say participating in soil conservation practices. Age is a continuous variable that can be analyzed by descriptive statistics. As a result of study showed in table 4.1 the mean value of 98 respondents is 47 year, where it's minimum and the maximum value is 25 and 64 respectively.

Table 2: Distribution of respondents by sex

Determinant	Participant		Non - Participant		Total	
Sex	Freq	%	Freq	%	Freq	%
Male	48	71	4	13.3	54	54
Female	20	29	26	86.7	46	46
Total	68	100	30	100	100	100

(Source: Survey Data, 2019)

The result of this survey data was indicated that, from the total participant respondents around 71% of participant are male and the remaining 29% are female. While from the total non-participant respondents 86.7% of non-participant is female and the remaining 13.3% are male. This result indicated that majority of male farmers were participate in soil conservation activity and contrary majority of females were not.

Table 3: Distribution of respondent by marital status

Variable	Participant		Non-Participant		Total	
Marital status	Freq	%	Freq	%	Freq	%
Married	54	81	14	45	68	70
Un married	9	13	7	23	16	16
Divorced	4	6	10	32	14	14
Total	67	100	31	100	98	100

(Source: Survey Data, 2019)

The result of this survey data was indicated that from the total conservation participant households around 81% are married, 13% are un married and 6% are Divorced. While from the total non-participant 45%, 23% and 32% are married, UN married and divorced respectively. From the above result the study concluded that, the farmers those who are UN married or divorced have low willingness to participate than that of the married.

Tables 4: Average mean distribution of family size

Determinant	Obs	Mean	Standard deviation	Max	Min
Family size	98	5.15	1.43	8	2

(Source: Survey Data, 2019)

The average family size of the sample farmers was about 5 persons. This average make differences in family size where the largest family size was 8 and the smallest was 2 it was as indicated in table 4.4 above.

Table 5: The average mean distribution of inactive person

Variable	Obs.	Mean	Std.	Min	Max
Dependency ratio	98	2.87	1.047	1	6

(Source: Survey Data, 2019)

The average dependency ratio was about 3 which show that each economically active person in a household supports about three economically inactive people.

4.1.2 Social and Institutional Character

Table 6: Distributions of respondents by educational level

Variable	Participant		Non - Participant		Total	
Educational Level	Freq	%	Freq	%	Freq	%
Literate	55	75	9	36	64	65
Illiterate	18	25	16	64	34	35
Total	73	100	25	100	98	100

(Source: Survey Data, 2019)

The result of this survey data was indicated that, from the total participant respondents about 55(75%) of households are literate and 18(25%) are Illiterate farmers. While, from the total non-participant respondents around 16(64%) are illiterate, and the remaining 9(36%) are literate. Therefore based on the result of this survey data the study concluded that, on the side of participant households the majority of farmers are literate but on the side of non- participant farmers, majority are illiterate .This difference in between the two creates difference in awareness about the effect of land conservation activity on agricultural productivity therefore the more the educated the more knowledge about the effect of conservation activity.

Table 7: Distributions of respondents by extension service

Variable	Participant		Non - Participant		Total	
Did you get Extension service	Freq	%	Freq	%	Freq	%
Yes	50	78	10	29	64	65
No	14	22	24	71	34	35
Total	64	100	34	100	98	100

(Source: Survey Data, 2019)
The result of this survey data indicates that from the total participant households around 50(78 %) of respondents are

Licensed Under Creative Commons Attribution CC BY

get enough knowledge about land conservation activities from extension service agents, and the remaining 14(22%) of farmers does not get enough knowledge about conservation system from extension service agent. While from non- participant respondents majority of farmers are not get enough knowledge from extension service agent about conservation system. Therefore based on the result of the survey data, the study concludes that the farmers more contacted with extension agent gets more knowledge about the implication of land conservation activity than that of not contacted with extension agent.

But their contact with extension was not the same throughout all the year, rather there was more contacts in spring, summer and harvesting season. Households in each kebele undertake their activities even in mass or they have association in which they perform their soil conservation measures jointly to be effective and efficiently use their resources. From 98 sample respondents 66.33% reported that they were willing to participate in so conservation activities, whereas the remaining (33 .67%respondents) reported that they were not willing to undertake any conservation work.

Table 8: Frequency of participants and non-participants

Participation Preference	Frequency	Percent
Willing	65	66.33
Unwilling	33	33.67
Total	98	100.00

(Source: Survey Data, 2019)

4.1.3 Cropping System and Input Utilization

4.1.3.1 Types of crops grown; the major economic activity of the area is mixed farming system mainly crop production and livestock raring. The most commonly cultivated crop in the area is wheat, Teff, maize, sorghum, Tomato and others.

4.1.3.2 Input utilization: They use their inputs as much possible based on advice's given from extension agents. They use fertilizer and others like compost to increase their production.

Table 9: Distribution of respondents by technological awareness

Variable	Participant		Non-Participant		Total	
Technological Awareness	No	%	No	%	No	%
Yes	35	66	15	33	50	51
No	18	34	30	67	48	49
Total	53	100	45	100	98	100

(Source: Survey Result, 2019)

About 51% of the respondents responded that they knew the existence soil conservation activities, the major sources of information being extension agents, where about 49% did not know from their response. Out of the total household participants, about 66% of the farmers were known the existence of technology regarding to soil conservation measures, while the remaining 34% were not. On the other hand as a survey result shows from the total of non-participant households 33% of respondents have awareness and 67% were not.

Table 10: Distributions of respondents by soil fertility forgone

Variable	Participant		Non-Participant		Total	
Does your land was prone to erosion?	Freq	%	Freq	%	Freq	%
Yes	43	78	9	21	52	53
No	12	22	34	79	46	47
Total	55	100	43	100	98	100

(Source: Survey Result, 2019)

Survey result indicates that 53% of the farmers land was eroded severely by erosion; while the remaining 47% show the farmers land which does not affected or eroded. The survey result shows out of the total household participants, 78% of the respondents land was eroded and willing to conserve, while the remaining 22% of the farmers were willing to participate even though their land was not eroded.

Table 11: Distribution of attitude towards conservation measures

Attitude	Frequency	Percent
Positive	64	65.31
Negative	34	34.69
Total	98	100.00

(Source: Survey Data, 2019)

The survey result was shown that, from the total of sample households about 65.31% of the respondents have positive attitude towards conservation measures that captures soil in place and desire to try new conservation measures at own cost and labor. Where the remaining 34.69% of the respondents have negative attitude and like to wait until other land users adopt it. The findings of some empirical studies in Ethiopia show that peasants with a generally positive attitude towards new measures are keen on undertaking and keeping conservation structures (Shiferaw and Holden, 2010).

4.14 Results of Logit Model

As it was discussed earlier, the logit model was used to analyze determinants of farmers' willingness to participate in soil conservation practices. The farm household is either willing or not willing to participate in soil conservation practices. Consequently, the variable willingness to participate in soil conservation practices by contributing labor was used as a binary dependent variable taking a value1 indicating the willingness of the farmer to contribute labor and 0 otherwise.

To identify the determining factors of farmers participation decision towards land conservation activities, a probability model which relates the probability of participation (Y=1) with, household characteristics, farm land characteristics, technological awareness, access to services, is used. That means, a binary logit model is used to identify factors that determine willingness of farmers towards conservation practice (probability of being participant) using data

Licensed Under Creative Commons Attribution CC BY

collected from 98 households in Dale Wabera Woreda. Nine explanatory variables (three continuous and six dummy) were included in the regression. Summary of explanatory variables included in the logistic regression model is given below.

As apparent from regression result shows out of the total nine explanatory variables hypothesized to determine willingness of farmers' to participate in soil conservation practices, five were statistically significant at less than 10% probability level and all the significant were positively related with the dependent variable. More specifically, the coefficients of age of household, education level, attitude of farmers, sex of household head and soil fertility forgone were statically significant.

4.1.5Results of the Logit Regression and Interpretations

Table 12: Logistic Regression Result (Obs. = 98)

wprt	Coef.	Std.Err	Z	P-value
edu	2.577915	1.54247	1.67	0.095*
age	0.678610	0.20489	3.31	0.001***
sex	2.182091	1.25481	1.74	0.082*
fs	-1.05354	0.84339	-1.2	0.212
dr	1.20255	1.1958	1.01	0.315
tech	2.71598	1.7341	1.57	0.117
sff	4.84768	2.1840	2.22	0.026**
ass	2.722372	1.987554	1.37	0.171
att	4.454513	2.113403	2.11	0.035**
cons	-36.87783	11.53878	-3.20	0.001

Note that: *, ** & *** are 10%, 5%, 1% level of significance **(See Appendix A & C).**

Table 13: Marginal Effects after Logistic Regression (Obs. = 98)

var	dy/dx	Std.Err	Z	P-value
edu*	-.133446	.06558	2.03	0.042
age	. 0338636	.0037	9.16	0.000
sex*	.107568	.06176	1.74	0.082
fs	-.025744	.03418	-0.7	0.451
dr	.0375084	.04739	0.79	0.429
tech*	.1405075	.06144	2.29	0.022
sff*	.1936807	.06304	3.07	0.002
ass*	.0414782	.07076	0.59	0.558
att*	.1507336	.06675	2.26	0.024

Note that: dy/dx is for discrete change of dummy variable from 0 to 1**(See Appendix B).**

Sex of Households: Regarding the coefficient of male, which a dummy for gender is positive. And it is statistically significant at 10% level of significance. That means, those farmers who are male headed, have a higher probability of being participant in conservation practice in the study area. This is due to the reason that men have the power to make production decisions in the study area and also control productive resources such as land, labor and capital that motivate them to conserve. When the number of male households increase by one, willingness to participate in soil conservation practice increase by 2.18 whereas the marginal effect show that the probability of being participant of male headed households in the study areas is greater than probability of being participant of female headed households by 10.7%.

Education Level: The maximum level of education within the farm household was found to have a positive relationship with the probability of participation and significant at 10% probability level. When the farmers education level increase by one year, willingness to participate in soil conservation activity increase by 2.58. The probability of participation farmers with education is greater than the probability of participation without education by 13.3%. The implication of this was that farm households with well-educated members are more likely to participate in conservation activity than those without.

Age of Household Head: Age an important factor that must be considered in any given business activity (either in agriculture or industrial sector). It is clear that as the age of household increases, say participating in soil conservation practices in case of this study. As a regression result was shown that, when the age of farmers increase by one year, participation in land conservation increase by 0.678. This mainly due to the reason that as the age of farmers increases from year to year the technique to conserve or experience towards land conservation practice would be improve. From the result of regression, age is positively related with the willingness of farmers' to participate in soil conservation practice and it is significant at 1%, 5%, and 10% probability level. The probability of farmers' willingness to participate in soil conservation practice of oldest (experienced) age group is greater than the probability of farmers' willingness to participate with young age group by 3.3 %.

Soil fertility forgone by erosion: This variable was significant at 5% and 10% of probability level and positively related with the dependent variable. This implies that soil fertility forgone by erosion, which is a proxy for farmers whose land was prone to erosion and affected farmers were more willing to participate in soil conservation practices as expected. When the farmers land prone to erosion increase by one times, willingness to participate or number of being participant to rehabilitation of soil fertility increase by 4.85. This means that farmers whose land affected by erosion were more willing to participate in land conservation practice than farmers whose land were not affected. And the probabilities of farmers willing to participate in soil protection activities by farmers whose land was prone to erosion were more than the probability of farmer's willingness to participate that their land was not affected by 19 %.

Attitude of Farmers: The regression analysis shows attitude of farmers towards soil conservation activities were statically significant at 5% and 10% probability level and positively related with the dependent variable. When the number 0f households with positive attitude regarding to soil conservation measure increase by one person, willingness to participate increase by 4.45. On the other hand, this implies that households with positive attitude

Licensed Under Creative Commons Attribution CC BY

(that believe land conservation activity captures soil in place) are more willing to participate than the farmers with negative attitude in conservation activities. Apart from this the probability of farmer's willingness to participate in soil conservation measures with positive attitude was more than the probability of farmers' willingness to participate with negative attitude by 15%.

5. Conclusion and Policy Implications

This study was conducted to identify and analyze the determinants of farmers' willingness to participate in soil conservation practices in Dale Wabera Woreda. More specifically, the study was designed to identify the variables, which determine farmers' willingness to participate in soil conservation practices and find out how each variable is related to the willingness of farmers to participate in soil conservation practices. The study was also intended to determine the relative importance of participating in soil conservation practice. To achieve the objectives of this study, logit model was employed and 98 sample household farmers were selected by using purposive sampling techniques. Both primary and secondary data were collected from target respondents, different institutions respectively.

Farmers in Dale Wabera Woreda were used mostly traditional soil conservation measures, like the terrace, counter bund...etc. Based on the result of this study sex, education level, soil fertility forgone, attitude of the farmers and age of the household were significantly affected the probability and intensity of participating in soil conservation measures.

A binary logit model and descriptive statistics were employed to determine the effect of different explanatory variables on farmers' willingness to participate in soil conservation practices. From the total of nine explanatory variables that hypothesized to explain farmers' willingness to participate in soil conservation practices, five were significant and used to estimate the econometric model. The results of binary logit model reveal that the coefficients of five variables were significant at less than 10% probability level. The remaining variables were less powerful in explaining farmers' willingness to participate in soil conservation practices. The significant variables included age, sex, education level, soil fertility forgone and attitude of the farmers towards land conservation were significant at less than 10 % probability level.

Among the significant explanatory variables, the age of the household head was found to have a positive and significant impact on farmers' willingness to participate in soil conservation practices, implying that as the age of farmers increase, willingness to participate in soil conservation practice also increase, because of experience. Attitude of farmers towards soil conservation measures was positively and significantly related to the farmers' willingness to participate in soil conservation practices. This implies that farmers' with positive attitude is very important for their decision to participate in soil conservation activities. Education levels were significant at less than 10% probability level and positively affect the farmers' willingness to participate in soil conservation practices. These mean farmers with education more willing to participate in land conservation activity than farmers without education. Sex is also statistically significant and positively related with the dependent variable. This shows that male households more willing to participate in soil conservation activities than male household. This is mainly due to the reason that female headed household have less resource position endowment as well as some cultural constraints. Finally, as analyzed data indicates soil fertility forgone by erosion were statically significant and positively affect the dependent variable. This means farmers or households that their land severely affected by erosion was more willing to conserve the land for the rehabilitation of the soil fertility than that of the farmers which their land was less or not affected.

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 and save natural resources from depletion.

Policy makers and government better to encourage and provide technical advice to farmers who are practicing soil conservation at their own initiative and using their indigenous knowledge. It is also believed that training of farmers could enhance adoption of soil conservation technologies.

Researchers also better to enhance or 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.

Local people would be advisable to participate in any activity that concerns them. Therefore, there may be an effort, from policy makers, aimed at enhancing the awareness of these farmers.

6. Acknowledgment

This study would never be completed without the contribution of many people to whom we would like to express our gratitude.

References

[1] Alemneh Dejene, (2011). *Environment, Famine, and Politics in Ethiopia: A View from the Village*. Lynne Rienner Publishers, Inc.
[2] Anemut, B. (2012). *Determinants of Farmers" Willingness to Pay for the Conservation of National Parks. The Case of Simen Mountains National Park*.

Licensed Under Creative Commons Attribution CC BY

MSc. Thesis, Haramaya University. Haramaya, Ethiopia.
[3] Agricultural Bureau of Dale Wabera Woreda, 2014
[4] Agricultural Bureau of Dale Wabera Woreda, 2018
[5] Baidu-Forson, J. (2013). '*Factors Influencing Adoption of Land Enhancing Technology in the Sahel: Lessons from a Case Study in Niger'. Agricultural Economics.* The Journal of the International Association of Agricultural Economists (IAAE), Vol. 20, NO.3, pp.231-240.
[6] Bekele Shiferaw and Holden, S.T. (2013). "*Resource Degradation and Adoption of Land Conservation Tsechnologies in the Ethiopian Highlands": A case Study in Andit Tid, North Shewa*. The Journal of the International Association of Agricultural Economists, 18(18), 233-247.
[7] Daniel, D., (2010). *Soil and water conservation Manual/Guideline for Ethiopia. Soil and Water conservation Team*, Natural Resources Management and Regulatory Department, Ministry of Agriculture, Addis Ababa, Ethiopia.
[8] FAO. (2010). *Incentives for Community Involvement in Conservation Programs. No. 12, Rome*.
[9] FAO (2004). *Land Degradation in South East Asia:* Its Severity, Causes and Effects up on the People, Rome
[10] Fikru, A. (2009). *Assessment of Adoption Behaviour of Soil and Water Conservation Practices in the Koga Watershed, Highlands of Ethiopia*. MSc. Thesis, Cornell University.
[11] Geoffrey K.(2014). *Determinants of Market Participation among Small-Scale Pineapple Farmers in Kericho County, Kenya*
[12] Gujarati, D. N. (2004). *Basic Econometrics*, 4th edition. New York: McGraw-Hill, Inc.
[13] Holden, S.T., Shiferaw, B., Wik, M. (2014). "*Poverty, Market Imperfections and Time Preference*": Of Relevance for Environmental Policy. Environmental and Development Economics 3, 105-130.
[14] Lucila, M., Lapar, A. and Pandy, S. (2011). "*Adoption of Soil Conservation: The Case of Philippine Uplands*". The Journal of the International Association of Agricultural Economists, 2(3).
[15] Lynne, G.D., Shonkwiler, J.S. and Rola, L.R. (2012). "*Attitudes and Farmers Conservation Behaviour*". American Journal of Agricultural Economics 70, 12-19.
[16] Sureshwaran, S. R. Londhe and P. Franzier, (2013). "*A Logit Model for Evaluating Farmer Participation in Soil Conservation Programs": Slopping Agricultural Land Technology on Upland Farms in the Philippines*. Journal of Sustainable Agriculture, 7(4), 52-69.
[17] Tegegne Gebere Egziabher, (2010). "*Willingness to Pay for Environmental Protection*": An Application of Contingent Valuation Method (CVM) in Sekota District, Northern Ethiopia. Ethiopian Journal of Agricultural Economics , 3(1), 123-
[18] Wegayehu, B. (2014). *Economics of Soil and Water Conservation. Theory and Empirical Application to Subsistence Farming in the Eastern Ethiopian Highlands*: A doctoral Thesis. Swedish University of Agricultural Sciences. Uppsala, 2009.
[19] World Bank, (2013). *Development and the Environment*. Oxford University Press, Oxford, for World Bank, Washington
[20] Yemane T. (1967). *Sample Size Determination Formula*

Appendix (A): Results of the Logistict Regression

```
. logit partion edu age sex fs dr tech sff ass att, level(90)

Iteration 0:   log likelihood = -62.606891
Iteration 1:   log likelihood = -19.808068
Iteration 2:   log likelihood = -13.111923
Iteration 3:   log likelihood =  -11.83558
Iteration 4:   log likelihood = -11.704164
Iteration 5:   log likelihood = -11.702019
Iteration 6:   log likelihood = -11.702018

Logistic regression                             Number of obs   =         98
                                                LR chi2(9)      =     101.81
                                                Prob > chi2     =     0.0000
Log likelihood = -11.702018                     Pseudo R2       =     0.8131
```

partion	Coef.	Std. Err.	z	P>|z|	[90% Conf.	Interval]
edu	2.577915	1.542477	1.67	0.095	.0407662	5.115063
age	.6786105	.2048988	3.31	0.001	.3415819	1.015639
sex	2.182091	1.254817	1.74	0.082	.1181011	4.246081
fs	-1.053542	.8433924	-1.25	0.212	-2.440799	.3337151
dr	1.202551	1.195861	1.01	0.315	-.7644653	3.169567
tech	2.715989	1.734157	1.57	0.117	-.1364461	5.568424
sff	4.847686	2.184056	2.22	0.026	1.255232	8.440139
ass	2.722372	1.987554	1.37	0.171	-.5468624	5.991607
att	4.454513	2.113403	2.11	0.035	.9782737	7.930752
_cons	-36.87783	11.53878	-3.20	0.001	-55.85743	-17.89822

Licensed Under Creative Commons Attribution CC BY

Appendix (B): Marginal Effect after Logit

```
. mfx, level(90)

Marginal effects after regress
      y  = Fitted values (predict)
         =  .66326531
```

variable	dy/dx	Std. Err.	z	P>|z|	[90% C.I.]		X
edu*	.1334467	.06558	2.03	0.042	.025577	.241316	.642857
age	.0338636	.0037	9.16	0.000	.02778	.039947	47.2551
sex*	.107568	.06176	1.74	0.082	.005974	.209162	.44898
fs	-.0257444	.03418	-0.75	0.451	-.08197	.030482	5.15306
dr	.0375084	.04739	0.79	0.429	-.040446	.115463	2.87755
tech*	.1405075	.06144	2.29	0.022	.03944	.241575	.540816
sff*	.1936807	.06304	3.07	0.002	.08999	.297371	.561224
ass*	.0414782	.07076	0.59	0.558	-.074906	.157862	.734694
att*	.1507336	.06675	2.26	0.024	.040936	.260531	.346939

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Appendix (C): Odds Ratio Regression

```
. logit partion edu age sex fs dr tech sff ass att, level(90) or

Iteration 0:   log likelihood = -62.606891
Iteration 1:   log likelihood = -19.808068
Iteration 2:   log likelihood = -13.111923
Iteration 3:   log likelihood =  -11.83558
Iteration 4:   log likelihood = -11.704164
Iteration 5:   log likelihood = -11.702019
Iteration 6:   log likelihood = -11.702018

Logistic regression                               Number of obs   =         98
                                                  LR chi2(9)      =     101.81
                                                  Prob > chi2     =     0.0000
Log likelihood = -11.702018                       Pseudo R2       =     0.8131
```

partion	Odds Ratio	Std. Err.	z	P>|z|	[90% Conf.	Interval]
edu	13.16965	20.31387	1.67	0.095	1.041609	166.5113
age	1.971137	.4038836	3.31	0.001	1.407172	2.761127
sex	8.864822	11.12373	1.74	0.082	1.125358	69.83119
fs	.3487005	.2940913	-1.25	0.212	.0870912	1.396145
dr	3.328596	3.980538	1.01	0.315	.4655828	23.79717
tech	15.11956	26.21969	1.57	0.117	.8724533	262.0209
sff	127.4451	278.3472	2.22	0.026	3.508654	4629.197
ass	15.21638	30.24337	1.37	0.171	.5787629	400.0571
att	86.01424	181.7828	2.11	0.035	2.659861	2781.518
_cons	9.64e-17	1.11e-15	-3.20	0.001	5.51e-25	1.69e-08

Licensed Under Creative Commons Attribution CC BY