Economic Valuation of Soil Conservation in Highlands of Hadiya Zone of Ethiopia: The Case of Soro Woreda Ajacho Watershed

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Abstract
This study was conducted to explore household's willingness to pay for soil conservation practices in Soro Woreda Hadiya Zone Ethiopia. The objective of this study was, to investigate economic valuation of soil conservation in the Soro Woreda Ajacho watershed. The study employed double bounded dichotomous format of contingent valuation method was to elicit respondents' WTP for improved soil conservation practices in terms of labor contribution. Data collated from 321 household heads was used for analysis. Both probit and bivariate model were estimated. Probit model was employed to assess the determinants of willingness to pay. Results of the model showed that family size of respondents, labour shortage, farm land size, education level of the household head and income positively and significantly affected the willingness to pay of the respondents while the level of bids negatively and significantly affected willingness to pay for soil conservation practices in the study area. The study also showed that the mean willingness to pay estimated from the Double Bounded Dichotomous Choice and open ended formats were computed at 137.81 and 78.82 person days per annum, respectively. The respective total aggregate value of soil conservation in the study area was computed to be 2,406,532 (36,097,980 ETB) and 4,207,615 (63,114,225 ETB) per annum for five years, respectively. The survey results implied that most of the respondents have perceived the problem of soil erosion and were willing to pay for conservation practices. As policy implications, an effort would be needed to strengthen literacy, increase farmers' understanding about the importance of soil conservation practices and credit facilities, increase numbers of extension office to minimize the time of farmers to contact development agent workers.
Keywords: Soil Conservation; Probit; *Bivariate*; Perception; Willingness to Pay.

1. Introduction

Soil erosion is a global environmental problem causing the loss of fertile top soil and reducing the productive capacity of the land or soil and thereby raises the risk of the global food security. It also negatively affects the natural water holding capacity, nutrients, organic matter, soil biota, and soil depth of catchment area, manmade reservoirs and dams, quality of surface water ,the aesthetic value of landscape and ecological balance in general (Olana, 2014). Soil erosion is also 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 (Gebremariam , 2012).

Natural resource and environmental degradation is a major concern in Ethiopia, because of its shocking consequences on economic growth and food security status of the people which are both highly dependent on natural resources (Mekuriaw & Hurni, 2015). In Southern highlands of Ethiopia are the one of the most vulnerable to soil erosion. The damage on crop due to sedimentation, the loss of land productivity, amenity value and the destruction of landscape and rural road are the main manifestation of the effects. The needs to control through appropriate mechanism that involve real community participation require evaluation of the resource (Gebremariam, 2012).

Therefore, soil conservation is one of the adaptation strategies which reduce land degradation and increase the production and productivity of the farmland. However, achieving sustainable pathways out of the problem of land degradation and poverty requires active participation of farmers' in conservation practices and understand how farmers value the soil conservation of activities especially soil conservation practices in farmland of the study area.

In Ethiopia very few study employ valuation techniques to understand the farmer WTP soil conservation practices (Kasaye B. , 2015). Examines the determinants of farmers WTP for soil conservation practices in Bale, southeast Ethiopia; Tessema& Holden (2006) assessed farmer WTP for soil conservation practices in southern Ethiopia,(Gebremariam,et al,2012) investigate the value that the farmer have attached to soil conservation practices and the determinants of WTP for it in the Northern part of Ethiopia by using CVM. To the best knowledge of the researcher there is no study previously conducted on valuing the economic valuation of soil conservation from soil erosion applying CVM in Hadiya Zone, if not, in this study area. Therefore, ***the objective of this study is*** to estimate the amount of farmers' willingness to pay for improved soil conservation practices, and to identify the determinants of farmers; WTP for improved soil conservation practices.

2. Methodology of the Study

2.1. Description of the Study Area

The study was conducted in Soro woreda. Soro Woreda is one of the districts in Hadiya Zone, Southern region, Ethiopia. It is located 264 km away from Finfinne, capital city of Ethiopia. It is bounded by Dawuro zone and Tambaro woreda in the West, Duna woreda in the East, Lemo woreda and Gombora woreda in the North and Kambata Tambaro zone in the South. The Woreda was both highland and midland climatic condition. It is situated at 1200-2950 meters above sea level and has an average temperature ranging from 18^oc to 25^oc. The annual rain fall is 2371 mm per year. More than 95% of the population is engaged in agriculture. The type of soil found in Soro Woreda is blackish, and which is suitable for agricultural practice and Ajacho watershed has 13 micro watersheds and 31 kebeles.

2.2. Sources of Data and Collection Methods

For this study both primary and secondary data were collected. Primary data were collected by field observation and face-to-face personal interview using CV questionnaires and the secondary data were collected from Soro Woreda agricultural office, published and unpublished materials and other relevant organizations or offices.

2.3. Sampling Techniques and Sample Size Determination

For this study, purposive and random sampling technique was used to select the watershed and households, respectively. Ajacho watersheds were purposively selected among different watersheds of Soro woreda. Then, three (3) Kebeles were randomly selected from the Ajacho watershed. The total sample size for households' interview was determined using probability proportional sample size technique (Cochran's, 1977).

$$n_o = \frac{z^2 pq}{e^2} \text{...} 1 or$$

$$n_1 = \frac{no}{1+(\frac{no-1)}{N}} \text{...} 2$$

Where

n_o = Desired sample size according to (Cochran's, 1977) when population greater than 10, 000
n_1 = Finite population correction factors (Cochran's, 1977) population less than10, 000
Z = Standard nor mal deviation (1.96 for 95% confidence level)
P = 0.5 (population variability i.e. 50%)
q = is 1-P i.e. (0.5)
N = is total number of population
d = is degree of accuracy desired (0.05)

Accordingly, 119, 90 and 112 respondents were selected from Sibiya, Sonda and Harche Uyaya Kebeles, respectively. Then, a total of 321 respondents from the Ajacho watershed were randomly interviewed.

2.4. Data Analysis

Empirical Model specification

One of the focal point of the model is on the factors that determine the probability of accepting the initial bid. The **i^th^** household will be willing to accept the initial bid **when$Ui^1 \geq Ui^0$**. Therefore, the choice problem can be modeled as binary response variable. Where:

Y;

$$Yi = \{1, if u^1{}_i (R_e - BID, z, q^*) + e_1 \geq u_i{}^o (R_e, z, q) + e_o \text{...} 3$$
$$o, otherwise$$

The probability that a known household is willing to pay for the soil conservation is agreed by

$$prob(Yi=1)=(u_i^{\,1} \succ u_i^{\,o})\ldots\ldots4$$

Then,

$$prob(Yi=1)=prob(\alpha_1 x_i+\varepsilon_{1i})\succ \alpha_o x_i+\varepsilon_{oi})\ldots\ldots5$$

By rearranging Q5 we obtain

$$prob(Y=1)=prob\{(\varepsilon_{1i}-\varepsilon_{0i}\succ xi(\alpha_o-\alpha_1)\}\ldots\ldots6$$

If we assume $\mu_i=\varepsilon_{1i}-\varepsilon_{0i}, and, \beta=\alpha_o-\alpha_1$ we have

$$prob(Y=1)=prob(u_i\succ x_i\beta)=f(x_i\beta)\ldots\ldots7$$

Where, F is the cumulative distribution function (CDF). This provides a basic structural model for estimating the probability and it can be estimated using either a probit or logit model depending on the assumption of the distribution of the error term (ε) and computational convenience (Greene, 2002). Assuming a normal distribution of the error terms the probit model can be specified

As following Hanemann (1994), the probit model can be specified as;

$$Y^*=\beta xi+\varepsilon 1\ldots\ldots 8$$

$$Yi=1\, if Y^*\geq t^*$$

$$Yi=0\, if Y^*\prec t$$

Where β=is vector of unknown parameters of the model

Xi=is the vector of explanatory variables

Yi*=unobserved household actual WTP for soil conservation

Yi*=is simply a latent variable

$yi=$ Discrete response of the respondents for the WTP

εi = Unobservable random component distributed N (0, σ)

The respondents know their own maximum willingness to pay, Y* but to the researcher it is a

Random variable with a given cumulative distribution function denoted by F(Y*, β)

Where, β represents the parameters of this distribution, which are to be estimated on bias of the responses to the CVM survey.

In general, there are four possible outcomes: both answers "yes"; both answers "no"; “yes" followed by a "no"; and “no" followed by a "yes". The bounds on WTP are (Haab & McConnell, 2002)

1. $t^1 \leq WTP < t^2$ for the yes-no responses;
2. $t^1 > WTP \geq t^2$ for the no-yes responses
3. $WTP \geq t^2$ for the yes-yes responses;
4. $WTP < t^2$ for the no-no responses; …… 9

The most general econometric model for the double – bounded data comes from the formulation below (ibid).

$$WTPij=\mu j+\varepsilon ji\ldots\ldots10$$

Where WTPij represents the **i**th respondent's WTP, and j=1, 2 represents the first and second answer. The mean for the first and second responses are represented by μ_1 and μ_2.

The probability of observing each of the possible two-bid response sequences (yes-yes, yes-no, no-yes, no-no) can be represented as follows

$$p(yes,no)=pr(WTP1i\geq t^1, WTP2i<t2)=pr(\mu 1+\varepsilon 1i\geq t1,\mu 2+\varepsilon 2i<t^2)w$$

$$p(yes,yes)=pr(WTP1i\geq t^1, WTP2i\geq t^1)=pr(\mu 1+\varepsilon 1i\geq t1,\mu 2+\varepsilon 2i\geq t^2)$$

$$p(no,yes)=pr(WTP1i<t^1, WTP2i\geq t^2)=pr(\mu 1+\varepsilon 1i<t1,\mu 2+\varepsilon 2i\geq t^2)$$

$$p(no,no)=pr(WTP1i<t^1, WTP2i<t^2)=pr(\mu 1+\varepsilon 1i<t1,\mu 2+\varepsilon 2i<t^2)\ldots\ldots11$$

Each individual respondent ith contribution to the probability function becomes:

$$L_1(\mu/t = pr(\mu_1+\varepsilon_{1i} \geq t^1, \mu_2+\varepsilon_{2i} \prec t^2)^{YN} \chi pr(\mu_1+\varepsilon_{2i} \geq t^1, \mu_2+\varepsilon_{2i} \geq t^2)^{YY} \chi pr(\mu_1+\varepsilon_{2i}, \mu_2+\varepsilon_{2i} \prec t^2)^{NY}$$
$$\chi pr(\mu_1+\varepsilon_{2i} \prec t^1, \mu_2+\varepsilon_{2i} \prec t^2)^{NN} ----------------------------------12$$

Where YY=1for a yes-yes answer, 0 otherwise, NY=1for a no-yes answer, 0 otherwise,
NN=1for a no-no answer, 0 otherwise and YN=1for a yes-no answer, 0 otherwise.
Given the dichotomous choice responses to each question, the normally distributed model is referred to as the bivariate probit model. The likelihood function for the bivariate probit model can be derived as follows. The probability that WTP1i < t^1 and WTP2i < t^2 i.e. the probability of a no-no response is

$$pr(u1+\varepsilon 1i \prec t^1, u_2+\varepsilon_2 i \prec t^2) = \Phi\varepsilon_1\varepsilon_2(\frac{t^1-u_1}{\sigma 1}, \frac{t^2-u_2}{\sigma 2}, \rho ....13$$

Where $\Phi\varepsilon 1\varepsilon 2(.)$ is the standard bivariate normal cumulative distribution function with zero mean, and unit variance and correlation coefficient ρ. Similarly the probability of no- yes response is;

$$pr(u_1+\varepsilon_{1i} \prec t^2, u_2+\varepsilon_{2i} \geq t^2 = \Phi\varepsilon 1\varepsilon 2(\frac{t^1-u_1}{\sigma 1}, \frac{t^2-u_2}{\sigma 2}, \rho) ....14$$

The probability of **yes-no** response is;

$$pr(u_1+\varepsilon_{1i} \geq t^1, u_2+\varepsilon_{2i} \prec t2) = \Phi\varepsilon 1\varepsilon 2(\frac{t^1-u_1}{\sigma 1}, \frac{t^2-u_2}{\sigma 2}, \rho) ....15$$

$$pr(u_1+\varepsilon_{1i} \geq t^1, u_2+\varepsilon_{2i} \geq t^2) = \Phi\varepsilon 1\varepsilon 2(\frac{t^1-u_1}{\sigma 1}, \frac{t^2-u_2}{\sigma 2}, \rho) ....16$$

Defining y_{1i}=1 if the response to the first question is yes, and 0 otherwise, y_{2i}=1 if the response to the second question is yes, and 0 otherwise, $d_{1i}=2y_{1i}$ - 1 and $d_{2i}=2y_{2i}$ - 1, the i^{th} contribution to the bivariate probit likelihood function becomes;

$$L_i(u/t)\Phi\varepsilon 1\varepsilon 2\left(d_{i1}\left(\frac{t1-u1}{\sigma 1}\right), d_{2i}\frac{t2-u2}{\sigma 2}, d_{1i}d_{2i}\rho\right) ....17$$

But, when the estimated correlation co-efficeint of the error terms in bivariate probit model are assume to follow normal distribution with zero mean and distinguishable from the system of equations could be estimate as seemingly unrelated bivairate probit model (Cameron & Quiggin 1994). Hence, in this study a (SUBVP) is used to estimate the mean WTP of the respondents from the double bounded format
Following, (Haab & McConnell, 2002), a Bivariate Probit Model can be specified as:

$$y_1* = \beta_1 x_1 + \varepsilon_1;$$
$$y_2* = \beta_2 x_2 + \varepsilon_2$$
$$E(\varepsilon_1/x_1, x_2) = E(\varepsilon_2/x_1, x_2) = 0; ....18$$
$$\text{var}(\varepsilon_1/x_1, x_2) = \text{var}(\varepsilon_2/x_1, x_2) = 1;$$
$$\text{cov}(\varepsilon_1, \varepsilon_2/x_1, x_2) = \rho$$

Where y_1*=i^{th} respondent unobservable true WTP at the first bid will offered. WTP= $1 if y_1* \geq x1(initial, bid), o, othewise$
Y_2*=i^{th} respondents implicit underlying point estimate at the time the second bid is offered.
The mean (MWTP) from bivairate probite model (Equation 16) can be calculate using the formula specified by (Haab & McConnell, 2002)

$$MWTP = \frac{-\alpha}{\beta} ....19$$

Where α=a coefficient for the constant term β =a coefficient offered bids to the respondents

3. Results and discussion

3.1. Farmers' Willingness to Pay for Soil Conservation Practices

In order to model willingness to pay for controlling soil erosion a double bounded contingent valuation method was used. Before the controlling the actual survey, a direct study was made to design the bid vectors. Consequently, for the final survey bid amounts (25,50 & 80 in ETB per year) were used as initial values and each respondent faced a random initial bid and the follow-up bid was determinate depending on the response for the initial question. Finally respondents are asked to the condition their maximum WTP improve the soil erosion so that inconsistencies are deal with**.**

The test of against the null hypothesis is that the two equations can be independently estimated or the correlation between the two error terms is zero can be checked by looking at the Likelihood-ratio test of the correlation coefficient(i.e. rho=0). The result is significant at 1% level of significance, showing that the two equestions can be estimated simultaneously.

Table 1. The results for the initial and second bid.

	Coef.	Std.Err	Z	P>|z|
WTP1	.80006	.0787304	10.16	0.000
_cons				
WTP2				
_cons	.2971459	.0710871	4.18	0.000
/athrho	.8152452	.1192588	6.84	.0000
Rho	.6724736	.0653275		

Likelihood-ratio test of rho=0: chi2(1) = 57.1197 Prob > chi2 = 0.0000

Using these coefficient in Table 5, the MWTP for soil conservation practices from the double bounded probit estimate was estimated using the formula by Habb and McConnell,(2002) (seen equation(19) to be 137.81 person day per year per household.

Table 2. MWTP for soil conservation practices

MEASURE		MWTP	LB	UB	ASL*	CI/MEAN
MEAN/MEDIAN	WTP1	137.81	103.71	279.99	0.0010	1.28
	WTP2	131.13	112.24	161.40	0.0000	0.37

Where: Achieved Significance Level for testing H0: WTP<=0 vs. H1: WTP>0

LB: Lower bound; UB: Upper bound

As shown in Table 2 the result indicates that the point estimate of the mean WTP for improved soil conservation use MWTP1 and MWTP2 are labour 137.81and MWTP2 131.13 labour person days per annual, respectively. This value is highly significant at 1% significance level with p value 0.0010 & 0.0000

Table 3. Households WTP responses for soil sonservation practices

(WTP) respo	Freq	%	Cum
No	68	21.18	21.18
Yes	253	78.82	100.00
Total	321	100.00	

Source:Own computation from field survey, 2017

Households were categorized based on their joint to the offered bids and the follow-up. The response of the household in the double contingent valuation reveals that the first response is shared by 253(78.82)% of Yes responses and non willing to pay 68(21.18)% of the no responses.

3.2. Welfare Measures and Aggregation

Aggregation of benefit soil conservation measurement of welfare using WTP in the contingent valuation study. An important issue related to the measurement of welfare using WTP is aggregation of the benefit. There are four (4) important issues to be considered regarding sample design and execution in order to have a valid aggregation of benefit population choice bias, sampling frame bias, samples non response bias and sample selection bias should be considered before aggregating a contingent valuation results. This study used random sample method from the recent update lists of households (sampling frame). A face to face interview method is used and protest zero responses were excluded from the analysis and possibility of protest zero was accounted in the analysis in the estimation of the aggregate benefit. Hence, none of the above biases was expected in the analysis. Mean was used as a measure of aggregate value of soil conservation in the study.

Table 4. Welfare Measures and Aggregate Benefis by PAS

Name of kebeles	Total HHS of Kebeles	Sampled of HHS with valid response	Sample HHS with invalid response	proportion of invalid response	Expected total HH with invalid responses	expected total HH with valid responses	mean WTP	Total WTP
Sibiya	723	119	2	0.0168	12.15	710.85	137.81	97,957
Sonda	552	90	1	0.011	6.13	545.87	137.81	75,226
Harche uyaya	682	112	2	0.0179	12.18	669.82	137.81	92,308
Total	1,957	321	5	0.0457	30.46	1,926.54		265,491

Source:Own computation from field survey ,2017

In table 4, The aggregate willingness to pay calculated by multiplying the meanWTP by total number of households who are expected to have a valid response in the selected kebeles. The aggregate WTP in terms of labor days per year was conveted wage rate which is good measure of economic value didn't offered. Therefore, based on the mean from the double bounded ditochomous choice format,the aggregate willingness to pay for soil conservation pratices is (265,491) labor days per year (3,982,365 ETB) in the selected three(3) Peasant Associations. From the opened ended questions, the total WTP for soil conservation practices was(265,491) labor days per year (20,926,001). This shows that there is high level of WTP for soil conservation practices in the study area. There are 31015 households in study area or Soro Woreda. It is therefore possible to calculate the total aggregate value of soil conservation practices for whole woreda. After deducating the 484 protests zeros, the expected total households with valid responses are 30,532 households. The total willingness to pay in the whole study area is simply the product of the respective means and the number of expected households who have valid responses. Hence the aggregate value of the soil conservation in the study area from the double bounded and open ended formats are (2,406,532) person days per annual (39,097,980 ETB) and (4,207,615) person days per annual (63,114,225 ETB) person days per annum for five years respectively.

3.3. Determinants of Households' Willingness to Pay for Soil Conservation Practices

Below Table (Table 5), indicates the determinants of willingness to pay estimation of the probit model, the not significant explanatory variable were less significant the variability in the WTP. The result of the probit model shows that the probability of the chi-square distribution 26 at 152.15 degree is (chi2) is 0.0000 so that significant at 1%, this shows that the variable included in the explaining households' willingness to pay fits the model at 1% significance level. In other words, we reject the null hypothesis which stated that the coefficients of all explanatory variables included in the model are zero.

Table 5. Probit model estimation of the soil conservation

Seemingly unrelated bivariate probit Number of obs = 321
Wald chi2 (26) = 152.15
Log pseudo likelihood = -236.48229 Prob > chi2 = 0.0000

Robust

WTP1 WTP2

Marginal effects

Variable	Coef	Std.Err	Z	P>|Z|	Var	Coef	Std.Err	Z	P>|Z|	dy/dx
BID1	-.0198421***	.0065438	-303	0.002	**BID2**	-.0082996	.0015695	-5.26	0.000	-.0001918
SEX	-.1461869	.3200427	-0.46	0.648	**SEX**	-0353392	.2441439	-0.14	0.885	-.014239
AGE	.0207728	.0149739	1.39	0.165	**AGE**	.0201226	.0092848	2.17	0.030	.007621
MRTS	.3677939	.3864301	0.95	0.341	**MRTS**	.1571229	.3370453	0.47	0.641	.0637446
FAMS	.1708475**	.0748115	2.28	0.022	**FAMS**	.0122498	.0421549	0.29	0.771	.0028658
EDU	.1252728***	.0342956	3.65	0.000	**EDU**	.0364937	.020659	1.77	0.077	.0146679
OCCP	.2672388	.3544345	0.75	0.451	**OCCP**	.0379755	.2095606	0.18	0.856	.0099514
FARSZ	.893646***	.2992319	2.99	0.003	**FARSZ**	.2516002	.1496011	1.68	0.093	.1014156
LSHO	1.224196***	.3289709	3.72	0.000	**LSHO**	.043286	.3185443	0.14	0.892	.0461582
INC	.0019536***	.0005702	3.43	0.001	**INC**	.0006192	.0003419	1.81	0.070	.0002472
FEXTE	-0405116	.0357154	-1.13	0.257	**FEXTE**	.0039652	.0231632	0.17	0.864	.0018537
OFFR	.0709219	.4237383	0.18	0.856	**OFFR**	-.0910772	.2970315	0.31	0.759	-.0335021
TLU	.0709219	.535378	1.32	0.185	**TLU**	.0684868	.0362089	1.89	0.059	.0259401
-Cons	-3.028762	1.264765	-2.39	0.017	**-Cons**	-.868897	.6813712	-1.28	0.202	-.0030605

*, ** & *** represent the significant at 10%, 5%, 1% level of probability of significance respectively.

/athrho | .9001203 .2161889 4.16 0.000 .4763978 1.323843
Rho | .7163565 .105248 .4433541 .8677364
Wald test of rho=0: chi2 (1) = 17.3354 Prob > chi2 = 0.0000

Education level of the households head increase the level the respondents (EDU) is positively and significantly related to WTP. That is, respondents with more years of education likely to be willing pay for soil conservation practices. One possible reason could be that literate individuals were more consened about soil conservation practices. The result also revealed that holding other thinks constant, a unit increase in years of education of the respondents, increases the probability of accepting the first bid1 as well as the follow up bid by about 14%.

Farm land sizs (**FRMLSZ**) of the respondents was found to have positive and significant relationship with the households'WTP. This positive effect indicated that respondents have large size of lands those how willing contribute for soil conservation practices. Keeping the influences of other factors constant a unit of land size increases the probability of WTP by 10%. This is precisely due to soil conservation practices are labor intensive to construct.

The estimate coefficient of the family size(**FMLYSZ)**, which is one of the most important explanatory variable of probability of WTP, was found to be statically significant at the 1% level with the expected positive sing. This shows that the probability of WTP to support the proposed soil conservation practices increases as the total household size increases in hypothetical market scenario. Keeping the influences of other factors constant, a 1 person increase in the total family size increases the probability of WTP by 0.3%. This is precisely due to soil conservation practices are labor intensive to the construct and maintain, hence households with large labor are willingness to contribute more than small family size.

Income of households: It could be seen that total income of households in years **(INCM**) of the of the respondents was found to have positive and significant relationship with the households'WTP. The coefficient of income is highly statistically significant at 1% and positive as can be expected. It indicated that the higher income of the respondent, the more likely she\he to answer yes to the offered and contributed for soil conservation practices. Effect indicated that respondents with higher yearly income were more likely to contribute the first bids than households with lower income.

Concerning offered initial bid **(BID1)** had negative and significance relation to WTP for soil conservation while the second bid **(BID2)** to follow up bid at less than 1% significance level with WTP for soil conservation practices. This shows the probability of yes response to the initial bid increase with decrease in the offered initial bid.

Labor shortage **(LSHORTAGE**): labour shortage play significant role for willingness to contribute labor to soil conservation practices. As expected the variable has positive and significant in 1% it is influence on the farmer's willingness to pay. The shortage of labor increases the probability of farmers' willingness to pay for soil conservation increases by 4.6%. Because development agents intervention is expected to make stronger technology usage of the farmers which further improves the income status and thus resulting increase in the willingness of the households to use soil conservation practices.

4. Conclusion and recommendations

4.1. Conclusion

Soil erosion is the most chronic environmental and economic problems present situation in Ethiopia, in general, and in the study area in particular. Therefore soil conservation is necessary to reduces soil erosion and to improve agricultural productivity ,to use natural resources properly and to bequest for future generation. The main objective of the study was to estimate the economic value of the soil conservation measures and to identify the determinates of farmers' willingness to pay for soil conservation practices program in Ajacho watershed, Hadiya Zone Ethiopia. The econometrics result show that family size of respondents, labour shortage, farm land size, education level of the household head and income positively and significantly affected the willingness to pay of the respondents while the level of bids negatively and significantly influence on the probability of willingness to pay for soil conservation practices program. The study show that the mean WTP estimate from the double bounded dichotomous choice and open ended format was computed at 137.81 % and 78.82% person days per annum, respectively. Base on the doubled dichotomous choice format, the mean willingness to pay was calculated to be 137.35 person days per year annum per household. The total aggregate value of soil conservation calculated to be (2,406,532) person days per year which is equivalent to (36,097,980 ETB) in open ended to. This result shows that farmers of the study area have perceived the problem of the soil erosion damage and willingness to pay for soil conservation practices. This study also reveals that(4,207,615) person days per annual (63,114,225ETB) person days per annum for five years respectively, there are very few protest zeros only (1.56%) which shows CVM is suitable for use in less developing countries like Ethiopia. Therefore, this study finalized that farmers have perceived the problem of soil erosion and to overcome the problem, they are willing to pay in terms of labor contribution for improved soil conservation practices. This study shows that unless planners first increase households recognition of soil erosion damage, it would be very difficult to implement effective sustainable soil conservation practices.

4.2. Recommendations

Finally, based on the study results and findings the following policy suggestion are forwarded:

- Income was found to be one of most important tools for households' WTP for soil conservation practices and to overcome soil erosion problems, access to credited and better marketing systems should be facilitated through government organization to improve househols' income.

- The comparatively more of the households are more willing to contribute to the soil conservation efforts in the study area. Policy makers may target these households especially at the beginnig of the conservation efforts.
- There is a need of developments agents (DAS) to lay more importance on soil conservation practices and also to disseminate information to farmers and address the need pertaining or mobilize to soil conservation practices.
- The level of formal education of the household head was found to be an important variable affecting the probability of willingness to pay for soil conservation practices. This underlines the importance of human capital development in increasing the probability of willingness to pay. The results of the study also show 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 farmers' recognition of soil erosion hazard, it would be very difficult to implement effective sustainable soil conservation projects

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