Journal of Resources Development and Management
ISSN 2422-8397 An International Peer-reviewed Journal
Vol.46, 2018

Estimating Willingness to Pay for Forest Ecosystem Conservation The Case of Wof-Washa Forest, North Shewa Zone, Amhara National Regional State, Ethiopia

Tadesse Getachew
Debre Berhan University College of Agriculture and Natural Resource Sciences,
Department of Natural Resource Management

Abstract
Most of the times non use value of forest resources are not clearly stated and their contribution to national GDP is underestimated because of lack of measurement methods and techniques for non use values. The conservation activities are neglected either because of financial constraints or lack of attention. The objective of this study was to estimate the total economic value (TEV) households place on improved forest conservation and protection so as to ensure the provision of improved forest goods and services. The study is conducted on Wof-Washa Forest, North Shewa Zone, Amhara National Regional State, Ethiopia. Data were collected through secondary data, key informant interviews and household survey using a CVM. A total of 353 households were surveyed from four kebeles. In order to elicit the Willingness to pay (WTP) of households for the protection and conservation of this forest, the DBDC value elicitation technique with follow up open-ended question was used. Descriptive statistics and bivariate probit econometric model was used to estimate both mean WTP and to identify factors determining the households' WTP for the forest ecosystem protection and conservation. 65% of the surveyed respondents were WTP for the proposed project so as to improve forest service. The mean WTP for the double bounded bivariate probit estimate ranged from Birr 42 to 35.60 per month for the initial and for the follow up bids, respectively. The bivariate probit model showed gender, age, education level, income, bid price and distance from the forest significantly affecting the WTP for forest conservation. Using the second bid the aggregate mean WTP is estimated at Birr 1.7 million per year. Though, Wof-Washs forest is getting degraded due to illegal activities and encroachment still it supplements the local people's livelihood.
Keywords: Total economic value, Non use values, Contingent valuation, willingness to pay

1. INTRODUCTION

Forests provide humans with a wide variety of ecosystem services, including provisioning, regulating, cultural, and supportive services. These ecosystem services not only deliver the basic material needs for survival, but also trigger other aspects of well-being, such as health, security, good social relations and freedom of choice. More recently, the full extent of the direct and non-cash contribution of forests to livelihoods has received more attention (Ros-Tonen and Wiersum, 2003; IUCN, 2011; UNEP, 2012). The socio-economic, cultural and ecological importance of forests are reflected in their contribution to the national economy, livelihood diversification of rural and urban communities, wood and food security, animal feed; human and animal health care and environmental conservation (Demel, 2004; Shackleton *et al*., 2007).

Furthermore, forest ecosystem resources are important for soil and water conservation, watershed protection, nutrient recycling, nitrogen fixation, amenity and recreation, creation of micro-climate, wild life habitat, gene conservation and carbon sequestration (Roper and Park,1999; Demel,2004). Particularly, natural forests are biologically the most diverse and perform a much broader range of ecological, amenity and recreational and other economic services than do plantation forests (Perman *et al*., 2003). Ecologically intact forests store water for irrigation and purify drinking water. They can also mitigate natural disasters, such as droughts and floods, help store carbon and regulate the climate, they provide food and produce rainfall, and provide a vast array of goods for medicinal, cultural and spiritual purposes (UNEP, 2011).Thus the total economic value (TEV) of forests are not only those directly observable use values which have market price but also the non-use values and services which cannot be expressed in market price system. Some of these services forests provide to economic activity have the characteristics of public goods that cannot be handled properly by a pure market system of economy. In this case, market fails to allocate appropriate price system for the non-use values of natural recourses, so there is a need to quantify the value of these goods and services provided by forests to the economy, provided that there is no direct market price system (Perman *et al.,* 2003).

Valuation of the goods and services provided by forests and nature areas is needed because these areas are under great pressure and are in fact disappearing. Lack of knowledge and awareness of the total economic value (TEV) of the goods and services provided by these resources will obscure the ecological and social impact of the conversion of forests into construction materials, infrastructure, industrial areas, houses or agriculture. Even when these impacts are understood, there is often a lack of financial resources for conservation of forests and nature areas. More information about the ecological, economic and social or cultural values of forests and nature

areas, and the synergy between these values, is necessary in order to feed the public dialogue and to internalize these values as part of policy and decision-making (Lette and de Boo , 2002).

Unlike others ordinary goods, market does not allow efficient resource allocation for their services. Due to this the decision makers' face difficulty in formulating policy options that warrant sustainable use of forest services. Economic valuation deal with estimating monetary value of these resources, it helps decision makers to choose among alternatives and competitive use of the resource to convey sound decision for long term management. Moreover, most of forests and other natural resources in Ethiopia are public goods, hence the ownership of particular resource is not well defined and the exclusion of resource use by non owner is difficult. The study of local household`s WTP for conservation of natural resources to increase the benefits derived from these resources helps to overcome the problem of attaching price to public and common pool resources, thus appropriate pricing and valuation is an inevitable exercise if natural resources especially forests continue to provide its goods and services in perpetuating on a sustain yield bases (Agrawal *et al.,* 2012).

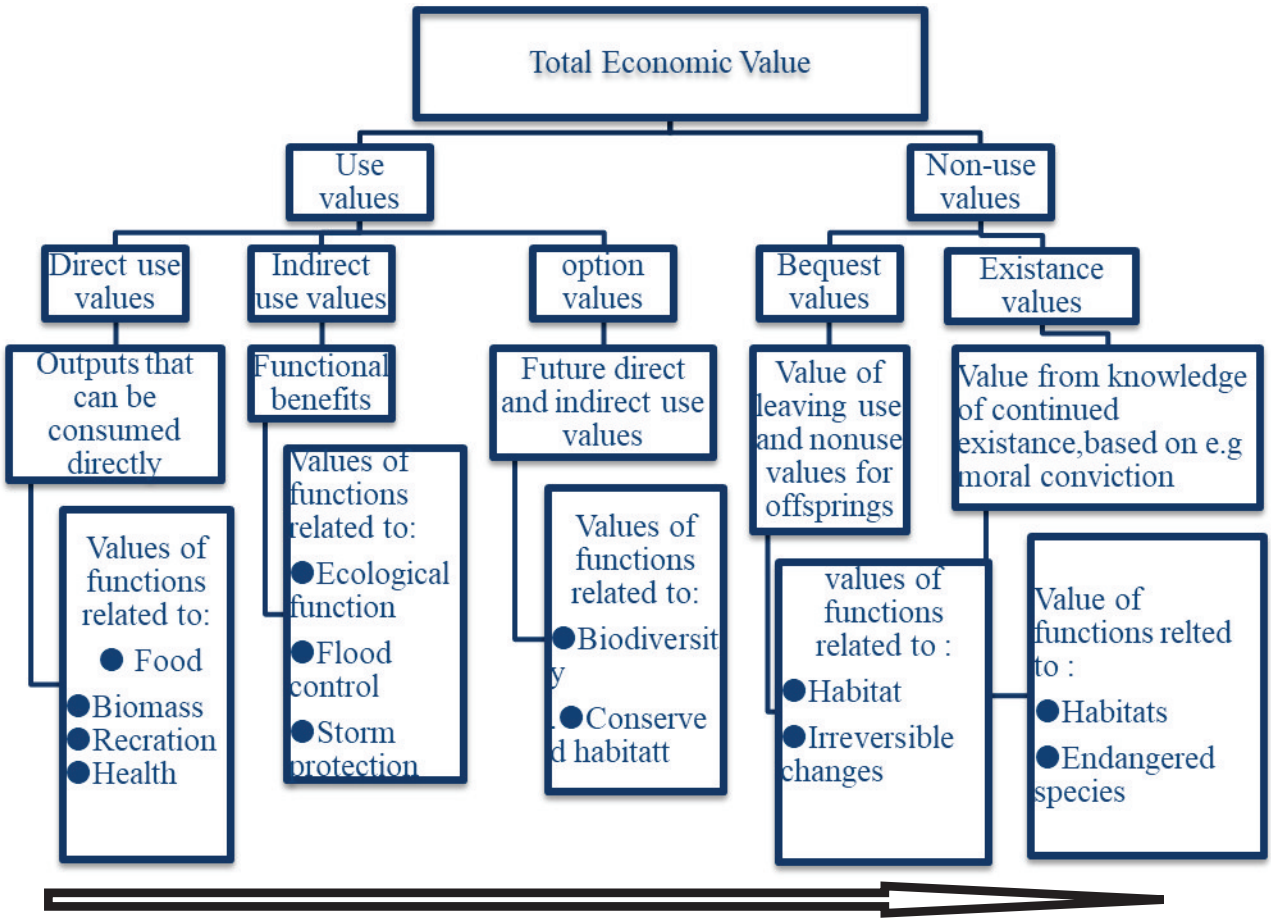
Rapid deforestation and slow reforestation of degraded forest land is due to the failure of market to price forest products to capture externalities and indirect use values of watershed management, wildlife protection and other non-market environmental services functions of the forest and trees (Adekunle *et al*., 2006). When quantifying economic value of a certain nature area, decision-makers usually consider only quantifiable financial costs and benefits related to goods and services traded on the market. However, there are numerous functions of nature for which markets malfunction, are distorted or simply do not exist. Markets only exist for some of the production functions of forests and nature, such as for timber, fuel wood and non-timber forest products. When market fails, to quantify the total benefits generated by forests, the non-market valuation techniques are employed to clarify the true value (TEV) of these resources (Lette and de Boo, 2002). Economists use the concept of WTP to determine the amount of money or labor consumers are willing to pay or contribute for the environmental and natural resources conservation activities. Such estimated monetary values for natural and environmental goods and services which do not normally have market prices are important tools for policy makers and lower level implementers. For policy-makers it helps to set standards related to ecosystem goods and service and to design incentives that encourage ecosystem service protection (Anderson, *et al*., 2010).

Woff-Washa natural forests is found in North Shoa Zone,Amhara National Regional State, being continually degraded but still used as source for timber, non-timber forest products, water and also protects the watershed from flooding and other natural disasters. A hypothetical market scenario for the rehabilitation and conservation of these degraded forests is prepared and presented to the local households to quantify their WTP and to identify determinant factors that influence WTP for the proposed project. The aggregate WTP for this project is believed to be the TEV of this forest as it is measured by respondent's WTP. Total Economic Value (TEV) of natural resources is the sum total of direct use value, indirect use value , option value , existence value and Bequest values

Use value: This value is divided into direct use value and indirect use value. Direct use value is consumptive or extractive use that drives from the environmental services. For example food, drinking water, irrigation, manufacturing, recreation, etc is considered as direct use value. In contrast, indirect use values of hydrological services are ecological function, nutrient cycling and other values that used indirectly for production of goods. Optional value is the value people place on environmental services for the purpose of direct or indirect use in the future time period.

Nonuse-value: This value is intangible benefit that households drive utility. Non use-value is subdivided into bequest and existence. Bequest value is the value households place in conservation of the environmental services for the purpose of future generation. Whereas, existence value is the value derive simply from the knowledge that resource should be exist without relating to current and future use.

Total economic Value Frame work



Decreasing "tangibility" of value to individuals or specific groups
Figure 1: TEV frame work of Forest/environmental resources (source: Lette and de Boo, 2002)

2. MATERIALS AND METHODS

2.1. Description of the Study Area

The study area, Wof-Washa forest, is found in North Shewa Zone of Amhara Region State, Ethiopia. North Shewa Zone is bordered from the South and the West by the Oromia region, from the North part South Wollo and Northeast Tigray and part of Afar regions are bordering. The capital city of North Shewa Zone is Debre Birhan, 130Km to the North East of Adiss Ababa located at 9° 36' 8" N, 39° 10' 29" E and it is situated at elevation 2830 of m.a.s.l. Wof-Washa forest is located around coordinates of $9^0$44'32" – $9^0$46'26"N and $39^0$44'00"-$39^0$47'19"E.With an elevation ranged between 1,650 and 3,700 m.a.s.l and is 30 Km from Debre Birhan. The forest is starched over three districts Tarmaber,Bassona Worrana and Ankober. The agro ecology zone composition of Wof-Washa forest consists of *Weyna Dega* (cool sub- humid), *Dega* (cold and humid) and *Wurch* (cold and moist) regions (MOA, 2010).

2.2. The Socioeconomic Condition of the Study Area

The people of the study area are mainly Amhara ethnic group and the largest proportion of the people practiced Orthodox Christianity. The three largest ethnic groups living in North Shewa are the Amhara (95.73%), the Oromo (2.14%), and the Argoba (1.71%); all other ethnic groups made up 0.42% of the population (CSA, 2007). Mixed crop cultivation and livestock production system is the main agricultural practice in the study area and it is subsistence type of agricultural system. The most widely cultivated crops in the region are maize, teff, onion, wheat, barley, bean, pea and sorghum. The nearest urban centers that benefit from and influence on Wof-Washa forest are Debre Birhan, Ankober, Debre Sina and Shewa Robit. Land resource is scarce due to high population pressure and degradation. Farming activity is carried out using rain fed and irrigation system systems (in the low land areas). Local residents use Wof-Washa forest as source of water, forest honey, fuel wood, fodder, timber, charcoal, medicinal plants, farm implements, edible plants, climber, wooden handle tools and household utensils, wild animal's products as food supplements (Schürmann, 2008).

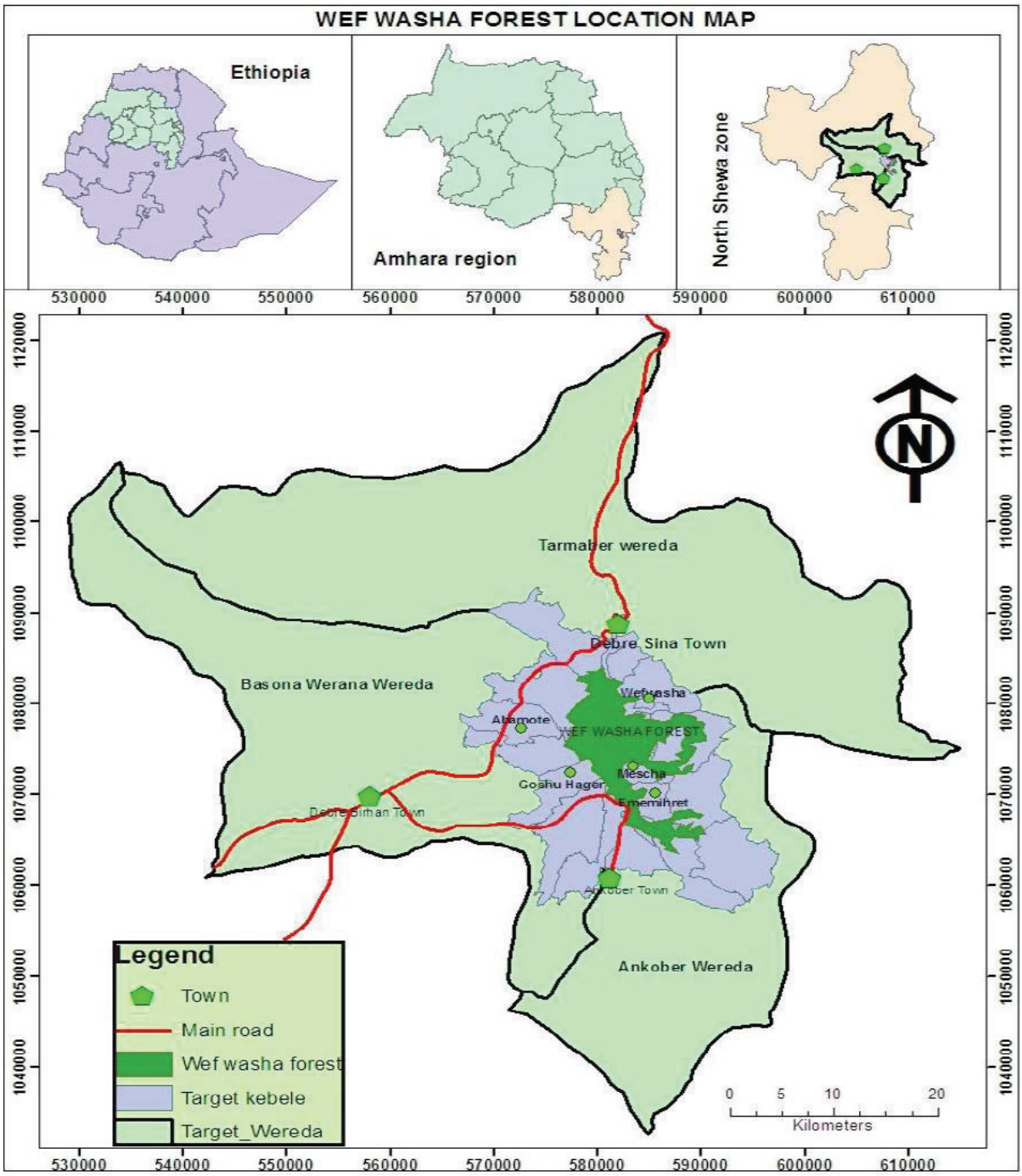


Figure 2: Location map of the study area

2.3. Sampling Techniques and Sample Size

A two stage random sampling technique was used when selecting sample respondent households for this study. In the first phase, three districts (Woredas) were selected, from which four potential user Kebeles (lowest administrative level) were selected purposively due to their proximity and economic dependence to the forest. In the second phase, proportionally with population size, sample households were selected using simple random sampling techniques from each of the selected kebeles. The resulting sampling distribution in selected districts and kebeles is presented in Table1.

Several rules of thumb can be used to determine the minimum sample size required to conduct multiple regression analyses. For this study, the method developed by Green (1991), which is, $\mathbf{N \geq 50 + 8\ m}$, where **N** is minimum number of households and **m** is the number of explanatory variables used in the regression. The explanatory variables taken in this study were nine. So that the minimum sample size is $\mathbf{N \geq 50 + 8 \times 9 \geq 122}$. Hence the minimum sample size will not be less than 122 households, however due to the fact that as the number

of sample size increases efficiency of CVM study increases, 360 farm households were randomly selected using proportional to the total population size sampling techniques.

The explanatory variables which were hypothesized to influence respondents' WTP to support forest protection program, are selected based on literature review and the present situation of the study area. These included in the model are Gender, Age ,Marital status , Education level of the family head , Family size living under a single roof, yearly income of the household, Bid amount offered to the respondent (BID_1 and BID_2) , Level of satisfaction with the currently existing goods and services derived from the forest and Distance from the forest to homestead.

Table 1 Number of households and sample size

District	Kebele	Total household	Sample taken
Tarmaber	Wof-Washa	1163	89
Bassona Worrana	Aba Mote	1244	96
	Gosh Ager	1441	112
Ankober	Mescha	817	63
Total		4665	360

2.4. Data Source and Method of Data Collection

Both primary and secondary data were used for this study. The primary data were collected through Key informant interviews, household's survey using structured questionnaire, and field observation. Key informants who lived in the study area for many years were selected and interviewed to know about past history, ownership of the forest, utilization and management of the forest. Appropriate data enumerators were recruited and trained for three days. Secondary data (such as population data, socioeconomic information) were gathered from the respective Kebele administration offices. The survey data was collected in February, 2018.

Before conducting the final survey pretest pilot survey was done using 30 randomly selected households to set up the starting point bid prices, elicit the payment vehicles and to shape the actual CVM questionnaire. Following the method of Cameron and Quiggin, (1994) open-ended questions from pilot survey were used to set up initial bid prices and the follow-up bids are formed by doubling and halving the initial bids if the response is yes for the first bid and no for the first bid value, respectively in double-bounded referendum approach. From the pilot five starting bids were determined 10, 20, 30, 40, and 50 Birr per month. Using these initial bids, sets of follow up bids were constructed based on whether the response is "no" or "yes" for the initial bid. If the respondent was willing to take the offered initial bid, the follow up bid is doubled 20,40,60,80 and 100; in case of a "no" response the follow up bid, is halved to 5, ,10,15,20 and 25 Birr, respectively and then the respondent is requested to state his/her maximum amount of WTP for the proposed project. Next each bid was randomly assigned with equal probability to each respondent. Thus the total sampled households were divided into five equal groups with five initial bids in the final survey.

Payment vehicle:

The method of payment was proposed to pay as a surcharge with the rural land use tax to support forest conservation and rehabilitation program.

Questionnaire Design:

The survey questionnaire of this study was structured in to three parts. The first part is about demographic and Socio-economic information, the second part asks respondents about their level of satisfaction derived from forest resources and forest related services of the study area and the third part is about the valuation scenario to assess their WTP for the proposed forest protection program. The first part of the question asks about household income, age, gender, education level of the head of the family. This information was necessary in determining the factors affecting WTP. Part two assessed the level of satisfaction of the respondents from forest good and services particularly related to Woff-Wash forest and the last part highlights the hypothetical scenario on the good/service to be valued. The valuation scenario includes descriptions of the good/service (what is being valued); the constructed market (how the good or service will be provided). The double bounded dichotomous choice question followed by an open ended question was also part of the questionnaires. In the double-bounded dichotomous choice elicitation format a respondent is asked about his/her WTP of a pre- specified amount followed by higher or lower bid if his/her answer is Yes or No for the first bid, respectively and finally asked to state his/her maximum WTP using open ended question for improved environmental services (NOAA,1993). Double-bounded dichotomous choice in CVM study is advantageous over single-bounded format in three ways. Firstly the number of responses will increase. Secondly, even if there may be cases with no clear bound on the responses (the case of Yes-Yes or No-No); it is used to constrain the distribution of WTP. Thirdly there will be clear bound in WTP responses in the case of Yes –No or No-Yes responses (Cameron and Quiggin 1994). Bivariate probit econometric model is used to estimate the mean WTP and identify factors affecting the probability of household's WTP for forest conservation to increase its services.

2.5. Method of Data Analysis

The survey data was analyzed using descriptive statistics and econometric models. Descriptive statistics is used to describe the characteristics of sample units, valuation responses, means, percentages, frequency distributions.

2.5.1. Econometric Model Specification

In linear regression model, the dependant variable is represented as linear function of explanatory variables; parameters estimation is done using OLS. However, when the dependant variable is dummy or binary choice, the application of linear regression model has limited use. In binary choice (qualitative response), the basic assumption underling the model is that the individuals express the choice between two alternatives i.e. there exist probability of choice one alternative over the other alternative. Due to this parameters estimation by OLS method leads to bias and inconsistency. In such case Linear probability Model (LPM), logistic, Tobit, Probit and Binary probit regression models are suggested as best alternatives to overcome the limitation (Wooldridge, 2005; Gujarati, 2004).

2.5.1. 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 does not (Werner, 1999). Hence, in this study the bivariate probit model was employed to estimate the mean WTP and determinant factors that affect WTP from the double bounded dichotomous choice.

According to Haab and McConnell (2002), the model takes the following form, the j^{th} contribution to the Likelihood function is given as,

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

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.

$$L_j(\mu/t) = \varphi_{\varepsilon 1 \varepsilon 2}(d_{1j}((t_1 - \mu_1)/\sigma 1), d_{2j}((t_2 - \mu_2)/\sigma_2), d_{1j}d_{2j}\sigma) \quad (2)$$

Where

$\varphi_{\varepsilon 1 \varepsilon 2}$ = 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

This general model is estimated using the standard bivarate probit algorithms using STATA version 11. But, before the bivarate probit model was applied to analyze the effect of explanatory variables on WTP, variance inflation factor (VIF) was applied to test the multicollinearity between continuous explanatory variables. It is computed as:

$$VIF = \frac{1}{1-Ri^2} \quad (3)$$

Where,

R_i^2 is the coefficient of multiple correlations in the regression of one explanatory variable (X_i) on the other explanatory variables (X_j). If there is no collinearity between regressors, the value VIF is 1. A VIF value of a variable exceeds 10, which happened when R^2_i exceeds 0.90, and that variable is said to be highly collinear. In this study the calculated VIF is less than 10, so that there is no problem of multicollinearity .The VIF for continuous explanatory variables and Contingency coefficients (CC) for dummy explanatory variables used in regression models is shown in appendix 1. Contingency coefficients (CC) measure the degree of association between discrete variables based on chi-square estimation. The value of association ranges from 0 to 1. Zero values shows the variables do not have association while 1 indicates a high degree of association between variables (Gujarati, 2004).

$$CC = \sqrt{\frac{\chi^2}{N+\chi^2}} \quad (4)$$

Where

CC= coefficient of contingency,

$\chi 2$ = Chi-square test and

N = total sample size

Finally, the mean willingness to pay (MWTP) from bivariate probit model were calculated using the formula specified by Haab and Mconnell (2002).

$$MWTP = -\frac{\alpha}{\beta} \quad (5)$$

Where, α=coefficient for the constant term, ß = coefficient for offered bids to the respondent.

2.6. Description of Variables and Working Hypothesis

Dependent Variable of the Model:

WTP (for BID_1 and BID_2): The dependent variable for this study is household's willingness to pay (WTP) for the first bid (BID_1) and second bid (BID_2) to improve forest protection so as to increase its services. Both the first and second bids are dummy variable takes the value of "1 "for the households willing to pay for the proposed bid, otherwise 0. WTP is defined as the maximum of amount of money the individuals' willing to pay for protection of Wof-Washa forest to increase goods and services collected from this forest.

Independent variables of the model:

In contingent valuation method (CVM) household's WTP for forest conservation to improve its benefits is influenced by sets of explanatory variables. The variables are related to socioeconomics and demographic characteristics of the households (Yoeu and Isbalita, 2011; Edström *et.al,* 2012; Bamlaku *et al.,* 2015; and Elmi *et.al*, 2016)

Gender (GEND): Refers to the sex of the household head. It is a dummy variable takes the value of 1 for male headed household and 0 otherwise. From this study we expected both gender affects WTP for forest protection either positively or negatively. In some cases male headed households would be more willing to pay than female headed households for forest conservation because mostly males are economically stronger than females so that males have better chance to pay for environmental protection, whereas according to the cultural context of the study area females are more responsive to tackle environmental problems such as shortage of food, water, fire wood etc, in this respect female respondents may have better probability to pay for environmental protection than male counterparts.

AGE: Refers to the age of the respondent (household head). It is measured as continuous variables. The variable is expected to have negative association with payment for forest protection. This is because people at older age might face income and labor constraint to pay for interest.

Education level of the respondent (EDUC): It is measured as the number of years of schooling. Since more educated people have more awareness about the benefits of improved environment (forest) they are more likely to support the program. Education widens horizons of an individual. Educated individuals relatively know more about the negative impact of natural resource degradation, advantages of watershed protection in ensuring sustainable forest services and hence they are concerned more about these resources. In addition, higher educational attainment impresses positive effects on WTP since it indicate a higher ability to pay. Thus, the expected sign of this variable coefficient is positive.

Distance of the homestead from the forest (DIST): It is a continuous variable expressed in minutes of time taken to reach the forest proper. We expect the respondent's distance from forest of interest is negatively related to the WTP for forest protection. Because as the distance between forest and the residence area increases respondents may perceive that they are less benefited from the forest.

Household's income (INCM). It is a continuous variable expressed in terms of Birr which is a yearly sum of the household head's income and the income of other members of the family. This variable indicates the respondents' ability/inability to pay. Economic theory suggests that there is positive relationship between goods/services quantity/quality demanded and income, taking forest goods and services as normal good. This implies the positive relationship between income and demand for environmental quality improvement. Therefore, it is expected that the sign of income variable will be positive for high-income respondents.

Level of satisfaction with existing forest service (LSAT). It is dummy variable taking 1 if the respondent is satisfied with existing forest goods and service, 0 otherwise. The expected sign of this variable coefficient is negative since the respondent who is not satisfied with the existing forest goods and service delivered by these forests would be interested to pay more than the satisfied one to increase his/her satisfaction.

Family size (FSIZE): Family size is measured as the number of people living under a single roof sharing the same income. Household size is one of the most determinant factors of households' willingness to pay for environmental protection that result in improved resource services. Household with large family size of active labor force would be more interested to pay or contribute labor for environmental protection than less family size

whereas households that have more dependent mouth is less interested to pay for resource conservation. So the relationship between family size and the WTP for the forest protection is either positive or negative.

Table 2: Definition and expected effect of variables

Variable	Explanation	Measurement	Expected effect
WTP	Respondents willingness to pay for the proposed change, Dummy variable	1 = Yes 0 = No	
GEND	sex of respondent is a dummy	1= male 0 = female	+/-
AGE	Age of head of the family.	Year	-
EDUC	Education level of the respondent is a continuous variable.	Years	+
DIST	Distance of the forest from the residence is continuous variable	Hours	-
INCM	Yearly income of the household is continuous	Birr	+
LSAT	level of satisfaction with the existing forest services, dummy variable	1 =satisfied 0 =unsatisfied	-
FSIZE	Size of the family, continuous variable	Number	-
BID	Offered bid price to the respondent, continuous	Bid value in Birr	-
MSTAT	Marital status of the respondent, dummy	1 = married 0 = Single	+

Bid price (BID_1 and BID_2): Bid price offered to the respondents. BID1 and BID2 are the first and the second bid price offered to respondents, respectively. The bid price is expected to negatively affect WTP for the proposed change. This is supported by the economic theory that as price increase the demand for the good or service (WTP) decreases. Here we assume the fact that forest protection as a normal good.

Marital status (MSTAT): Refers to the marriage level of the household head. It is represented as a dummy variable takes value of 1 if household head is married (with spouse) and 0, otherwise. It is expected to be positive relates to the household WTP. The possible reason could be married households have strong responsibility to manage the environment.

3. RESULTS AND DISCUSSION

Data collected through CVM questionnaire was analyzed and interpreted using descriptive statistics and econometric models. Descriptive statistics were used to calculate the socio-economic and demographic characteristics of sampled households and the econometric model were used to calculate the mean WTP and to identify the factors determining the WTP for Wof-Washa forest protection. During the data analysis protest zeros, outliers and inconsistence answers were removed from inclusion of data analysis. Inconsistence answerers are cases where the maximum willingness to pay is less than the accepted starting price. Protest bids, as identified by Bateman, *et al.* (2002) are non-responses of households where in the genuine WTP are not provided and respondents either responded with a zero value or with an unrealistically high value instead. Their responses do not represent their true value of the nonmarket good since they are protesting to an aspect of the hypothetical scenario, such as mistrust for the institution who will manage the funds or the belief that natural resources protection is public responsibility. Out of 360 sampled households 7 of them were removed either they were protest zeros, outliers or inconsistence so that that analysis was done with 353 sampled households.

3.1. Socioeconomics and Demographics Characteristics

The socio-economic characteristics of total respondents as well as willing and non-willing to pay of respondents are summarized in Table 3 and Table 4 for categorical and continuous variables, respectively. Independent sample t-test was used to see whether the differences in mean values of continuous variables of willing and non-willing differed significantly. Chi-square statistics was employed to see the associations between categorical variables.

About 65 percent of respondents expressed their willingness to pay for the conservation mainly because their livelihood is dependent upon this forest so that they wanted to protect the forest from damage and maintain their benefit sustainably. Most respondents collect fire wood, fodder, thatch grass, lumber, fruits and other forest products from Wof-Washa forest and it is also home of birds and other wild animals.

Gender: Of the total surveyed farm households the majority of them (82 percent) were male headed households. About 64 percent of female headed households were willing to pay some amount of money for the forest protection program.

Marital status: The survey result showed about 81% of the respondents was married. The share of married respondents was greater (82%) of the willing than the non-willing (79%). But the difference in proportion of willing and non-willing respondents due to marital status did not vary significantly.

Awareness level of a respondent regarding forest protection benefits (AWRE): The data showed that 73 % of the surveyed households were aware of the benefits derived from forest conservation and protection and 88% of the aware respondents were willing to pay for the proposed project. This is because households who know more about the forest ecosystem benefits to their wellbeing are more willing to pay to protect the forest from degradation. The chi-square test indicated that the association between willing and non-willing to pay with awareness level of the respondents was statistically significant.

Table 3: Descriptive statistics of some socio-economic variables

Variable		WTP N= 229(64.5%)	NWTP N=124(35.5%)	Total N=353	χ^2	P -value
GENDER	male	188(82)	101(81)	289(82)	0.1032	0.748
	Female	41(18)	23(19)	64(18)		
MARITAL STATUS	Married	187(82)	98(79)	285(81)	1.278	0.528
	Single	42(18)	26(21)	68(19)		
LEVEL OF SATISFACTION	Satisfied	42(18)	52(42)	94(27)	24.52	0.000***
	Unsatisfied	187(82)	72(58)	259(73)		

Note: Variables in which willing respondents have significant differences from non-willing respondents: *** = at 0.01 levels of significance

The average yearly income of the willing and non-willing respondents was found to be Birr 34962 and 24096, respectively. The result implied that higher income families have higher probability to pay for environmental protection than the low income families. This agrees with the theoretical concept as income has positive effect on demand for the normal good. The difference in mean of the two group is statistically significant ($p<0.001$). Concerning distance of the homestead from the forest, on average it takes 22.81 minutes to walk in to the proper of the forest. The mean time taken to walk to the forest is estimated 17.90 and 33 minutes for the willing and non-willing respondents, respectively. That is, the nearby dwellers to the forest had higher probability to pay for forest conservation as they were more benefited than the furthest dwellers from the forest.

Table 4: Independent sample t-test output of some socioeconomic variables willing and non-willing to pay respondents

Variable	WTP	Sum	Min	Max	Mean	St.Dev	t-value	P-value
AGE	Willing	229	18	73	36.30	10.62	-4.37***	0.000
	Non-willing	124	18	80	42	12.43		
EDUCION	Willing	229	0	12	4.65	2.76	11***	0.000
	Non-willing	124	0	12	1.38	2.64		
FAMILY SIZE	Willing	229	1	12	4.1	1.73	-1.895	0.059
	Non-willing	124	1	10	4.5	2.08		
INCOME	Willing	229	10000	55000	34962	10234	9.621***	0.000
	Non-willing	124	10000	54000	24096	10078		
DISTANCE	Willing	229	10	90	17.30	17.90	-6.89***	0.000
	Non-willing	124	10	90	33.00	21.70		

Note *** = significance at 0.01 level

Level of satisfaction with the currently available goods and services of the forest (LSAT):

The survey data indicated that only 27% of the total respondents were satisfied with the currently available goods and services delivered by the forest. Unsatisfied respondents took the larger share of the willing households to pay for the forest conservation. The reason may be respondents who were not unsatisfied with the currently available services of the forest wished to reverse the environmental degradation and restore the original benefits from the forest. The proportion of willing and non-willing to pay of respondents differed significantly due to their current level of satisfaction.

The independent sample t-test output indicates the average age of the willing and non-willing respondents was 36.30 and 42 years, respectively and the difference is statistically significant. The mean family size was estimated 4.1 and 4.5 per household for willing and non-willing family, respectively. The mean difference is significant at less than 10% level between the willing and non-willing respondents.

The educational level of the respondents varied from 0 (illiterate) to 12 years. The survey results also showed that the average education level was 4.65 and 1.38 years for willing and non-willing respondents,

respectively and the mean difference between the two groups was found statistically significant ($p<0.01$).The result suggests that on average the educational level of willing respondents is higher than that of non-willing respondents. This might be because as years of education increases respondents will become more concerned of environmental degradation and aware of the benefits of forest conservation. In addition, more educational attainment has a positive impact on ability to pay which in turn increases their probability of willing to pay for environmental protection.

3.2. Aggregate Mean WTP and Demand curve

From the results of open ended questions of WTP for forest conservation we can estimate the aggregate mean WTP and draw the demand curve for the conservation of Wof-Washa forest using either of OLS or non-parametric approach.

During the main survey respondent`s maximum WTP for open ended questions ranged from Birr 0 to 120 per month for the proposed project, i.e. the WTP for open ended question is a continuous dependent variable and we can regress it on its determinant variables using OLS to draw aggregate demand curve for the forest protection . The other alternative is calculating the class intervals using simple statistics for the maximum WTP as follows;

$K = 1+3.322(\log N)$ (6)

Where, K represents the number of WTP classes

N is the total number of respondents (N = 353)

$K = 1+3.322(\log 353) = 9.47 \approx 10$

So that we have approximately 10 class of WTP interval and the width of the class is determined by the ratio of range to WTP class. The aggregate WTP of the sampled respondents with non-parametric approach is calculated using the mean WTP of total sample respondents and aggregate WTP of all the total households living in four Kebeles is approximated by multiplying the total number population and non-parametric mean WTP.

The total sample respondents non-parametric mean of open-ended maximum WTP can be calculated using the formula (Habb and McConnell, 2002):

$$MWTP = \frac{\sum (MWTPi) * (ni)}{N} \quad (7)$$

Where, MWTP = Mean willingness to pay for the total respondents

MWTPi = ith Mean WTP (WTP midpoints i.e. column-2 in table…..)

ni = Number of respondents WTP the ith amount (column-3)

N = Total number of sample respondents (N= 353)

Table 5: Non parametric estimation of WTP for forest conservation

Class boundary (1)	Average WTP/month (2)	Frequency (3)	Total number of HHS (4)	Total WTP/month (5)	Total HHs WTP at least that amount (6)
0-12	6	131	1732	10386.99	4665
12.10-24	18.05	81	1070	19320.99	2934
24.10-36	30.05	55	727	21841.09	1863
36.10-48	42.05	41	542	22783.32	1137
48.10-60	54.05	23	304	16428.23	595
60.10-72	66.05	11	145	9601.36	291
72.10-84	78.05	6	79	6188.58	146
84.10-96	90.05	3	40	3570.03	67
96.10-108	102.05	1	13	1348.59	27
108.10-120	114.05	1	13	1507.17	14
Sum		353	4665.00	112976.36	
Max = 120	Min = 0	Mean WTP = 24.20			

Hence, the non-parametric mean WTP from open-ended question computed using equation (11) is Birr 24.20 per household/month. Thus if all households living in these four kebeles have positive attitude towards forest conservation and willing to contribute the average amount , the total amount of money collected would be Birr 1.35 million per year .

The aggregate demand curve of households for the conservation of Wof-Washa forest can be drawn using average WTP/month of households (column 2 of table 5) and the total number of households WTP at least that specified average WTP amount (column 6 table 5). The table indicates that as the price for forest conservation (WTP) increases from Birr 6 to 114.05 the number of households willingness to pay decreases definitely thus the demand curve slops downward. This agree with economic theory demand for normal goods or services is inversely related to its price, thus taking forest protection as a normal good its demand decreases as price (WTP)

increases and the demand curve slops downward.

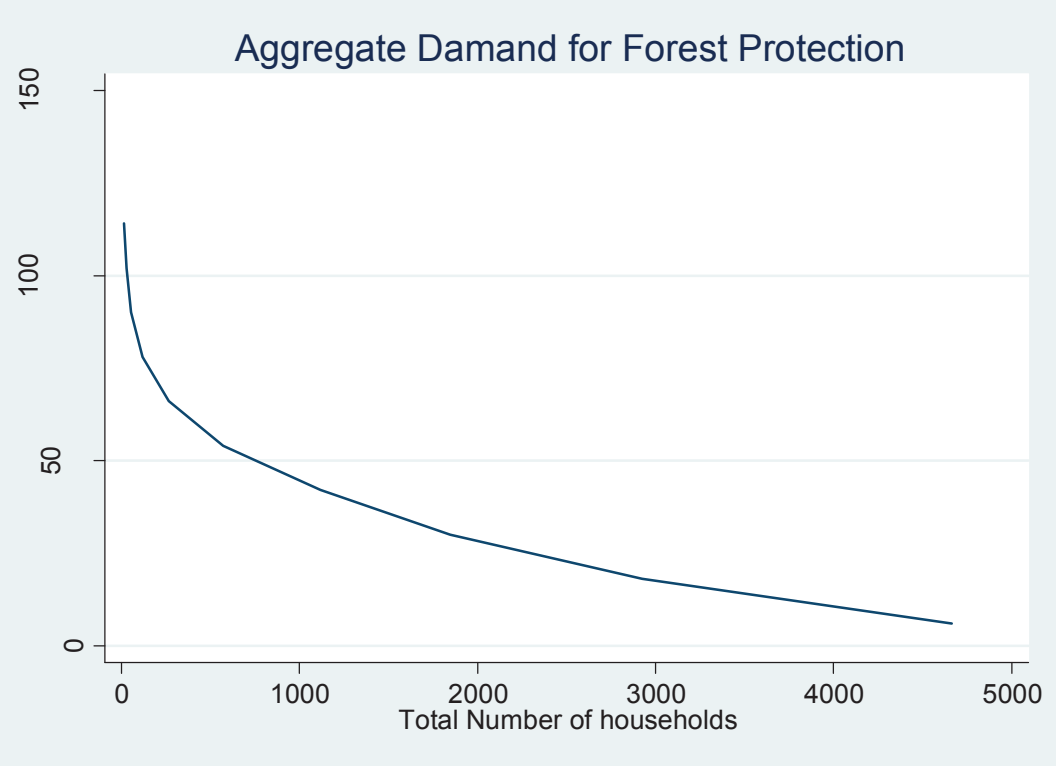


Figure 3: Aggregate Demand Curve for Forest conservation.

3.3. Econometric Data Analysis

3.3.1. Analysis of Determinant Variables of Households' WTP

As it was indicated the objective of this study was to identify the respondent's socio-economic and demographic characteristics affecting household's WTP and to determine the amount of money contributed for forest conservation project. Hence, the econometrics model enables us to identify the most important variables affecting households WTP.

Bivarate probit regression model was used to analyze the factors affecting WTP for BID_1 and BID_2. Prior to running the bivarate probit regression model, the explanatory variables were checked for multicollinearity and the degree of association through Variance inflating factor (VIF) and Contingency coefficient (CC). Based on the VIF, the data had no serious problem of multicollinearity. That is, the VIF of the continuous variables were less than 10 (Appendix 1) so that all the continuous variables were part of the regression analysis. The extent of association between dummy variable was also computed using contingency coefficient. The analysis shows that there is weak association between the dummy explanatory variables (Appendix 1).Therefore, all the dummy variables were included in the regression analysis.

Bivariate probit model as specified in the preceding section has been employed to identify explanatory variables that influence households' WTP for forest protection so as to improve forest benefits. The problem of non-normality and outliers in CV studies could be solved by making use of robust estimators as a way to control the potential bias from this source (Mitchell and Carson, 1989). So we used bivariate probit robust regression to achieve our objective. This form of regression is also helpful to reduce the effects of heteroscedasticity. The chi-square ($\chi 2$) distribution is used as the measure of overall significance of a model in bivarate probit model estimation. The result of our bivarate probit model shows that, the model fits the data well ($\chi 2=80650$, $p<.0000$). So, that, all the variables included in the model expected to explain WTP fits the bivarate probit model. In general, it shows that, the data fits the model very well (Table 6). A total of nine explanatory variables were considered in the econometric model out of which only 6 of them were found significant to affect the probability of WTP for Wof-Washa forest conservation.

Table 6 : Bivariate probit model regression result

	Model output with BID_1			Model output with BID_2		
Variable	**Coeff**	**Robust Std. Err**	**P> /Z /**	**Coeff**	**Robust Std. Err**	**P> / Z /**
GENDER	-1.56002	0.37308	0.000***	-0.82373	0.23535	0.002***
AGE	0.21111	0.01256	0.092*	0.01390	0.00764	0.069*
MARITAL STATUS	0.37458	0.30251	0.216	0.17934	0.18367	0.329
EDUCATION	0.24255	0.05300	0.000***	0.09817	0.02961	0.001***
FAMILY SIZE	0.07623	0.06681	0.254	-0.00343	0.04245	0.936
INCOME	0.00007	0.00002	0.000***	0.00003	0.00001	0.001***
DISTANCE	-0.02283	0.01189	0.055*	-0.01390	0.00774	0.073*
BID1/BID2	-0.05038	0.01566	0.001***	-0.01277	0.00459	0.005***
LSAT	-0.37014	0.36739	0.314	0.26724	0.27725	0.335
- Cons	2.12586	0.74837	0.000	0.45499	0.41656	0.509
Number of obs =353			Prob> Chi2 = 0.000			
Log pseudo likelihood = -250.26		Likelihood-	Wald Chi2(22) = 80680.24			
ratio test of rho=0			Chi2(1) = 0.0002			

Note: ***, ** and * significant at 1%, 5% and 10% probability levels, respectively

3.3.2. Marginal Effect of Bivarate Probit Model Estimates

The coefficients of the bivarate probit model do not indicate the marginal effects of explanatory variables on the dependent variable. That is, in the bivarate probit model only the signs (not the magnitudes) of the coefficients of independent variables are important. In order to analyze the effects of each explanatory variable on the probability that respondents accept or reject the bid value, the partial derivatives of explanatory variables with respect to discrete responses must be taken (Green, 1991). The interpretation of the marginal effect measures the change in probability (likelihood of occurrence) of an event to a unit change in the continuous explanatory variables and the change of dummy variables from 0 to 1 for discrete response. The marginal effects of the bivarate probit model estimation results are reported in the table 5.

Table 7: Marginal effect of explanatory Variables

Variable	dy/dx	Std. Err.	Variable	dy/dx	Std. Err.
AGE	0.004809	0.00294	DISTANCE	-0.00543	0.00294
MARITAL STATUS*	0.027276	0.07696	BID_1	-0.01283	0.00382
EDUCATION	0.056663	0.01302	LEVEL OF SATISFACTION*	0.0067431	0.10981
FAMILY SIZE	0.0125691	0.01481	Bid_2	-0.00378	0.00226
INCOME	0. 0175	0.000	-	-	-
GENDER	-0.21590	0.09372	-	-	-

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

Gender of head of household (GENDER): Sex is represented by dummy variable (dummy = 1 for male; 0 for female). The variable gender of the respondent is negatively related to the probability of respondents WTP for forest ecosystem conservation (Table 6). It is significance at less than 1 % both models. The result revealed that those male headed households were found to be less willing to pay for forest ecosystem conservation practices to improve forest service's than female headed households. This can be explained by the fact that males have less interest to pay for environmental protection activities than females. The result contradicts with the studies done by Elmi*et al. (*2016) and Yoeu (2011) but, agrees with Alebel (2002).

Age of household head (AGE): Contrary to our previous expectation, age of respondents had positive effect on WTP for forest ecosystem conservation practices to improve forest service. The positive and significant correlation (p<10%) between age and willingness to pay might be perhaps because of two reasons. Older people are wise; they took in to consideration the bequest value of the forest so that they are eager to hand over resources to their children and grandchildren, so that the probability of their WTP for the conservation activities may increase. Another probable reason is older people are more financially stable so that they are more willing to pay for conservation. The result agrees with the work of Youe (2011), and Ansong and Røskaft (2014), but contradicts with the findings of Elmi (2012).

The marginal effect estimates of (Table 7) also shows, that keeping the influences of other factors constant, a one year increase in the age of the household head increases the probability of accepting both the first and second bid by about 0.48% and was happened to be significant at less than 10 % probability level in both models.

Education level of head of the family (EDUCATION):- Education of the household head was also significant at p < 1% probability level to say "yes" to both the first and second bid. As expected education had a positive relationship with the dependent variable showing that as the education level of the household head increases,

willingness to pay for forest ecosystem conservation practices to enhance benefits from the forest increased. The marginal effect result show that for each additional increment of years of education, the probability of willingness of a household to pay for the forest conservation practices will increase nearly by 6.0 %, ceteris paribus. The possible reason could be that more educated individuals are concerned about environmental goods forest in our case. This could be possibly because education increases environmental awareness and valuing for environmental goods such as forest. Gebremariam and Edriss (2012), Yoeu and Pabuayon (2011) and Elmi et al. (2016) reported a similar result for the relationship between WTP for natural resources conservation and education level of respondents.

Household monthly income (INCME):

Income of respondent is positively related with the households' WTP and statically significant at 1% probability level for both first and second equation. This effect indicates respondents with higher monthly income were more likely to say yes to the offered bids than those households with lower income. Households with high income tend to reveal a high WTP for the promised system than their counterparts with low incomes. The marginal effect estimate for households monthly income variable shows that a 1 Birr increase in income of the household will increase the probability of households' WTP for protection of forest by 1.75 %. The result is consistent with Yoeu and Pabuayon (2011), Ansong and Røskaft (2014) and Elmi *et al.* (2016).

Bids amount (Bid_1/Bid_2):-

Both bid value one and two has negative coefficient as expected and statistically significant at p< 1% level. As the bid amount increases, the respondents would be less willing to accept the scenario and that is consistent with the law of demand. This is consistent with the findings of Mesfine *et al.* (2012), Bamlaku and Yemiru (2015), Amirnejad*et al*., (2013), and Elmi *et al*. (2016). The marginal effect showed that keeping all other variables constant, the probability of WTP for the first bid decreases by 1.3% as one more unit price (bid value) increased (table 6).

Distance of the homestead from the forest (DIST):

As expected this variable showed negative relation with the WTP for forest conservation and is statistically significant at 10% in both models. This is because the farther the family residence and the more inaccessible the benefits from the forest is, the lower the probability of WTP for conservation of this forest. The result agrees with the works of Yoeu and Pabuayon (2011), Tao *et al*., (2012), Amirnejad *et al*., (2013) and Elmi *et al*., (2016). Some other explanatory variables included in the model which were expected to influence WTP for forest conservation did not show significant effect. Marital status and awareness level of respondents for WTP to conserve forest resources had positive coefficients, which mean households who were married and aware about forest resources showed positive interest to pay for forest protection and conservation but this was not statically significant. Also Family size and the level of satisfaction of respondents with the excising forest service's had showed negative relation with the WTP for conservation practice but they are also not statistically significant variables.

3.3.3. Mean and Aggregate Willingness to Pay for Wof-Washa Forest Conservation

There are two options of independent models which can be used to estimate mean WTP, model with no covariates i.e. WTP checked against the offered amount and with covariates i.e. WTP against socio economic factors that can affect WTP for forest conservation practice so as to improve its service. 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. As a result the mean WTP value to conserve the studied forest was calculated using equation 10 specified in the preceding section was ranged from 42 to 35.60 ETB per household per month, for the first bid value (Bid_1) and second bid amount (Bid_2), respectively. This figure is higher than the mean willingness to pay amount from the open ended question maximum WTP which was Birr 24.20 per month. This may seems to indicate free riding and lack of base for answering WTP questions under open ended format. A similar conclusion was given by Alem (2011) and Bamlaku and Yemiru (2015) from study of economic valuation of forest resources.

According to Haab and McConnell (2002), if the bivariate probit model is estimated on a dichotomous choice CV question with a follow up and if the parameter shows that either the mean, or variance or both differ between the initial bid-price and the follow up, the researcher must decide which estimates to use to calculate aggregate WTP. Since in the present study 56.09 % of the respondent either accepted or rejected both initial and the follow up WTP values (Appendix 3), the follow-up WTP value is closer to the unobserved true WTP. Additionally, even in remaining 43.92% responses (NY and YN responses) each of the two WTP values has the same probability of being closer to the unobserved true willingness-to-pay value. For these reasons, the mean WTP from the follow up question is used to calculate the aggregate WTP. Hence, using the follow up mean WTP (Birr 35.60 per month) the aggregate benefits (WTP) of the society can be estimated. As explained above (Table 3), from 353 sampled households 229(64.87%) of them were accepted the proposed project and willing to pay for the conservation of the forest for the next five years, hence the total revenue (aggregate WTP) generated could be calculated using Turner, *et al*. (2004) method,

Aggregate WTP = NHH x M (WTP) x %HHPV (8)
Where;
NHH = total number of households in the study site
M (WTP) = expected mean willingness to pay
%HHPV = percentage of households with positive valuation or those answer yes

Aggregate WTP = 4665* Birr 35.6 * $\frac{229}{353}$ = Birr 140,668.90 per month

Thus in aggregate for this forest protection and conservation project, Birr 1.70 million per year can be collected from all these four kebele dwellers.

4. CONCLUSION AND RECOMMENDATION

4.1. Conclusion

A double bounded dichotomous choice followed by open ended question, contingent valuation method was used to design a questionnaire to estimate the WTP for forest protection. The findings of the study indicated more than half of the sampled farm households (65%) are willing to pay for forest protection. Most respondents expressed their willingness to pay Brr 42 to 35.5 per month for forest conservation and protection program .This implies that most people give value for forest conservation hence one cannot overlook the importance of natural forest ecosystems to human well-being. The probability of respondents WTP for forest conservation was significantly affected by gender, age, education level, income, distance from the forest and family size. The study indicates Wof-Washa forest supplementing the livelihood of farm households by providing different goods and services, without it economic and social welfare of the people living around the forest will be impaired. Wof-Washa forest is used for local residents as source for water, wood for energy and building, farm implements and tools, meat from wild animals, fodder, thatch grass, honey production, recreational purpose, and protection of the watershed from natural disaster ….etc.

However, the forest is degraded due to forest fire, illegal cutting and encroachment, so it needs immediate attention. In order to protect and sustain its services protection and conservation measures should but this needs financial source. The present study indicates that if the government or some concerned body tries to organize the local residents the financial constraint can be solved. According to our finding only from these four potential user Kebeles households are willing to contribute about Birr 1.70 per year for forest protection and conservation project for the coming five years. Most of the respondents (73%) explained that environmental problems such as soil erosion, land degradation, shortage of water, drought, and loss of soil productivity were caused by forest degradation.

4.2. Recommendations

Based on the findings of the study, we recommend the following points,

Education level of the respondents is positively related to the WTP for forest protection and conservation project, this indicates that investment on education (capacity building) to enhance the awareness level of farm households about forest resources can be used as a strategy to facilitate environmental (forest) protection and conservation. About 65% of sampled households expressed positive willingness to pay for forest protection and conservation. Our finding substantiates payment for forest ecosystem conservation is possible to solve human-induced problems on natural resource. However, implementation of payment for ecosystem Services needs careful design and further study. Higher income households indicated higher probability for WTP for forest conservation so that creating diversified sources of income to improve the livelihood of local community will increase the WTP to sustainably manage the forest of interest. Our study indicates that Wof-Washa forest resources are important to supplement of livelihoods of the people living around the forest, so that the local administration should take in to consideration this livelihood issue before changing the forested area in to other development tradeoffs.

5. REFERENCES

Adekunle, M., Adedokun, M. and Adedoja,A. 2006. Willingness to Pay for Environmental Service of Forest Trees by Cooperate Organizations, Paper prepared for presentation at the Farm Management Association of Nigria Conference, Jos, Nigeria

Agrawal A., Cashore B., Hardin,R.., Shepherd,G., Benson,C.and Miller,D.2012. Economic Contributions of Forests: Background paper prepared for the United Nations Forum on Forests.

Alebel, B. 2002. Analyses of Affordability and Determinants of Willingness to pay for improved water Service in Urban Areas, Strategy for Cost Recovery, Case Study of Nazareth Town, Ethiopia.

Alem, M. 2011. Economic values of water resource under agro forestry land use systems: A case study from Wondo Genet area, Ethiopia M.Sc. thesis. Hawassa University Wondo Genet

Amirnejad.H, Sina, A. K., Marzieh, A. 2013. The Application of the Contingent Valuation Method to Estimate

the Recreational Value of Sari Forest Park.
Anderson, J., Gomez, W., McCarney,G., Adamowicz, W., Chalifour, N., Weber, M., Elgie, S., and Howlett, M. 2010. Ecosystem Service Valuation, Market-Based Instruments and Sustainable Forest Management: State of Knowledge Primer. Sustainable Forest Management Network, Edmonton, Alberta.25 pp.
Ansong,M. and Eivin,R.2014. Local Communities' Willingness to Pay for Sustainable Forest Management in Ghana. Vol. I, No. 2, 80-87
Bamlaku,A., Abrham,B. and Yemiru,T.2015. Economic Value of Wondo Genet Catchment Forest in Domestic Water Supply Services, Southern Ethiopia, Vol 6, No 9
Bateman, I., Carson, R., Day, B., Hanemann, M., Hanley, N., Hett, T and Loomes, G. .2002. Economic Valuation with Stated Preference Techniques.
Cameron, T. and Quiggin, J.1994. Estimation Using Contingent Valuation Data from a "Dichotomous Choice with Follow-Up" Questionnaire. *Journal of Environmental Economics and Management*,*27*(3): 218–234.
CSA (Central Statistics Authority of Ethiopia). 2007. Population and Housing Census of Ethiopia
Demel, T. 2004. Forestry Research in Ethiopia: Past, present and future. Proceedings of a National Conference on Forest Resources of Ethiopia: Status, Challenges and Opportunities.IBC and GTZ, Addis Ababa,
Edström,F., Nilsson,H. and Stage,J.2012.The Natural Forest Protection Program in China: A Contingent Valuation Study in Heilongjiang Province. Journal of Environmental Science and Engineering B 1 (2012) 426-432.
Elmi,N. , Zeleke, E. and Yemiru, T. 2016. Economic Valuation of Forest Conserved by Local Community for Carbon Sequestration :The Case of Humbo Community Assisted Natural Regeneration Afforestation / Reforestation (A / R) Carbon Sequestration Project.
Gebremariam, G. and Edriss, k.2012.Valuation of Soil Conservation Practices in Adwa Woreda, Ethiopia: A Contingent Valuation Study. *Journal of Economics and Sustainable Development*, ISSN 2222-1700 (Paper) ISSN 2222-2855, www.iiste.org.
Green,B. 1991. How Many Subjects Does it Take to Do a Regression Analysis? Multivariate Behavioral Research, 26 (3): 499-510. .
Gujarati, D.2004. Basic Econometrics, 4th Edition. The McGraw−Hill Companies, New York.
Habb,C. and McConnell,K. 2002.Valuing Environmental and Natural Resource: The Econometrics of Non-Market Valuation. New Horizons in Environmental Economics, Edward Elgar Publishing.
IUCN(International Union for Conservation of Nature). 2011. A Good Practice Guide, Sustainable Forest Management, Biodiversity and Livelihood.
Lette,H. and de Boo,H.2002. Economic Valuation of Forests and Nature .A support tool for effective decision-making, the Netherlands.
Mesfin,T.,Vranken,L., Muys,B., Deckers,J., Kidanemariam,G. , Kindeya,G. , Bauer,H. and Mathijs,E.2012. Rural Households' Demand for Frankincense Forest Conservation in Tigray: A Continent Valuation Analysis.
Mitchell, R., & Carson, R.1989. Using Surveys to Value Public Goods: The Contingent Valuation Method. Resources for the Future, Washington, D.C.
MOA (Federal democratic republic of Ethiopian Ministry of Agriculture) .2010. Ethiopia's Agricultural Sector Policy and Investment Framework 2010-2020 Draft Final Report.
Tao Z., Haiming Yan, Jinyan Zhan .2012. Economic Valuation of Forest Ecosystem Services in Heshui Watershed using Contingent Valuation Method,
Turner ,R., Bateman,I.Georgiou,S.,Jones,H, Langford,H , Matias,G.and Subraman, L.2004. An ecological economics approach to the management of a multi-purpose coastal wetland
NOAA. 1993. Report of the NOAA panel on contingent valuation. *US Federal Register*, 58(10): 4601-4614. Pearce, 2002
Perman,R., Ma,Y., McGilvray,J. and Common,M .2003. Natural Resource and Environmental Economics. 3rd edition. Person Education Ltd.
Ros-Tonen,M. and Wiersum,F.2003.The importance of non-timber forest products for forest-based rural livelihoods:
Schürmann,V.2008.Wof -Washa – Cave of Bird: Dynamics of a Forest at the Eastern Escarpment of the Ethiopian Highlands. University of Zurich, Rieterstrasse 67 8002.
Shackleton, M., Shackleton, E. and Bird,N. 2007. The Importance of Dry Woodlands and Forests in Rural Livelihoods and Poverty Alleviation in South Africa. Forest Policy and Economics **9**:558-577.
UNEP .2012.The role and contributions of Montane Forests and Related Ecosystem services to the Keynan economy. Nairobi. 978-92-807-3273-3.
UNEP.2011. Working towards a balanced and inclusive Green Economy, United Nations Geneva.
Werner, M. 1999.Allowing for Zeros in Dichotomous-Choice Contingent-Valuation Models. American Statistical Association Journal of Business & Economic Statistics, **17**, No. 4

Wooldrige, J. 2005. Introductory Econometrics, 3rd edition
Yoeu,A. , Isbalita ,M. and Pabuayon, 2011.WTP for the Conservation of Flooded Forest in the Tonle Sap Biosphere Reserve,Cambodia. International Journal of environmental and rural development (2011) 2-2

6. APPENDICES

Appendix 1: Variance inflating factor (VIF) for continuous explanatory variables and Contingency coefficients (CC) for dummy explanatory variables used in regression models.

Variable	VIF for cont. explanatory variables	Variable	Sex	Marital sta.	Level sat
BID1	1.97	Sex	1		
F. size	1.08	Marital sta.	0.4333	1	
AGE	1.27	Aware	0.1248	0.1258	
EDUC	1.51	Level of sat	0.0382	-0.0327	1
DIST	2.11				
INCM	1.35				
BID2	1.94				

Appendix 2:

Follow up lower Bid	Initial Bid	Follow up higher Bid
5	10	20
10	20	40
15	30	60
20	40	80
25	50	100