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Economic Value of Wondo Genet Catchment Forest in Domestic Water Supply Services, Southern Ethiopia

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Abstract
This study assess the economic value of Wondo Genet cachment forest (WGCF) in domestic water supply of the community. Contingent valuation method was used to determine factors affecting households' willingness to pay (WTP) to conserve the forest for improving of water quality. The Double Bounded Dichotomous Choice technique followed by open-ended questions were applied. Bivariate probit models was employed for data analysis. Samples of 215 households were randomly selected for the detailed face to face household interviews. Results of the study showed that most respondents were WTP for forest conservation. Respondents to this hypothetical scenario revealed that sampled households expressed their WTP from the open ended elicitation method was 26.31 ETB per month added with water bills. The mean WTP for the double bounded bivariate and covariate are estimated from 35 ETB to 30 ETB per month for the initial bid and for the follow up bid respectively. The results of the model revealed that Sex, Education and income have positive and significant effects on WTP while Age, Family size and amount of bid have a negative and significant effect. In conculusion, the economic value of the study forest resources found to be substantial that users are WTP about 1.8 million ETB per year for its conservation and sustained supply of drinking quality water.
Keywords: Economic value of Forests, willingness to pay, contingent valuation method, Wondo Genet catchment Forest

1. Introduction

Forests provide important ecosystem services, beyond supplying direct use products, such as timber, fiber, fuel wood, woody biomass for energy and the non-timber forest products (NTFPs). These provisioning services are often considered to be the main forest ecosystem services. However, the provisioning services depend on soil formation, photosynthesis, and nutrient cycling, which are so-called supporting services, provided by the forests (MEA,2005). However, forests are under severe threat in many part of the world. About 15 million hectare of forest were lost every year during the 1990s, mostly in the tropics Pagiola *et al.* (2002). Ethiopia is among the countries where millions of people depend on forests and forest products for their livelihoods (Gessesse, 2007).

The significant economic growth that Ethiopia has achieved particularly over the past few years could also mean that unless the forest resources are managed properly and attempts are made to increase their size, the pressure on forests would increase, which would worsen the problem (EEPFE/EDRI, 2008). Loss of forest has been accompanied by a loss of ecosystem services that forests provide (FAO, 2005). As a result, more than one billion city-dwellers in the world lack access to clean water (Stolton *et al,* 2007) So, multilateral agencies and nations (World Bank 2003, Miranda, *et al.*, 2007) are promoting and adopting new approaches to finance forest and watershed conservation/protection so as to develop sustainable use and management of water resources.

To improve watershed management and sustain water resources, sustainable forest management is considered as a key factor for water resources management in particular and upland resources development in general (Kerr *et al,2002* and Stolton *et al.* 2007) study shows that much of the world's drinking water comes from forested catchments. Payment for Environmental Services (PES) approaches attempt to use economic incentives within regions to protect forest and increase , drinking water supply and tourism (Wunder, S., 2007). Watershed PES programs have been designed to use direct payments to compensate upstream resource users for their natural resource stewardship and changes in land use that result in ecological services to downstream beneficiaries (Wunder, S., 2006). Direct payment approaches such as PES have been found to be cost-effective means for resource conservation and sustainable ecosystem management (Ferraro *et al.* 2002). In Ethiopia, this

PES program has started at Nile Basin Initiative (NBI) and this project is supporting local communities for managing their smaller watersheds (Gete Z., 2010).

Wondo Genet catchment forest is considered as a place water source for surrounding areas, including Hawassa and Shashemene towns (Demel.T, 1997b, Belaynesh. Z, 2002,Tefera, M, 2006). However, sever degradations include illegal felling of trees for fuel wood and construction materials, charcoal making, pit-sawing, expansion of agriculture and human-induced fire are considered to be the main threat of this forest. For instance, during the past three decades, 72% of this forest became shrinked (Gessesse et al. 2007). This has led to substantial decline and deterioration of the most valuable ecosystem services of the forest to the surrounding people and it is affecting the hydrological cycle and ground water provision of the catchment creating massive impact on the domestic water users of the two nearby towns; Hawassa and Shashemene. As a result, quantity and quality of the available water is being seriously affected. The potential reason for decline of forest and ineffectiveness of the various efforts is lack of critical knowledge on the economic value of the forest for community livelihoods.

This led to the undervaluation or negligence of the valuable forest ecosystem services. However, the intangible nature of these services coupled with market failure for ecosystem services has limited the main economic values of the forest to timber and fuel wood. In addition the domestic water supply service of the forest is not economically valued and remains unknown. Therefore, the potential economic contribution and participation of local water users in Shashemene town for ensuring the sustainability of the forest ecosystem services would be identified. Thus, this study investigated the economic value of Wondo Genet catchment forest in ensuring improved domestic water supply service for the community of Shashemene town, using CVM.

2 Methodologies

2.1 Discrpition of the Study area

Shashemene is found in West Arsi Zone, Oromia Regional state, Ethiopia about 250 Km south of Adis Ababa. Geographically, the town is situated at $7^0$11'09"N to $7^0$13'19" N latitude and $38^0$35'02" E to $38^0$37'05" E Longitude.. Its altitude ranges from 1,672 - 2,722 m a.s.l. and meteorological station records show that average annual temperature varies from 10-25 C^o while annual rainfall varies between 500-1200mm (ORS, 2004). The main source of water for the Shashemene town inhabitants is coming from Wondo Genet catchment forest watershed and Sola ground water. The water coming from the two areas is distributed to the consumers through 1,290 connections and six public fountains.

2.2 Sampling Techniques and Sample Size

For this study random sampling technique was used to select target households who are water beneficiaries. The required sample sizes were administered based rule-of-thumb i.e. ≥50 +8m**.**Where N=sample size, m=number of explanatory variables (Greene, W.H., 1997). Then, sample households from each PAs were distributed randomly using probability proportional to size sampling technique. Finally, atotal of 215 physically identified households have been contacted for the detailed socio-economic survey.

2.3 Data sources

Both secondary and primary data were used for this study. Secondary data was obtained from published and unpublished documents and reports. The primary data were collected using face to face interviews with the heads of the households. Contingent valuation method (CVM) in the form of double-bounded dichotomous choice elicitation method with open ended follow up question was also employed to explore households' WTP for conserving the forest and improving the supply of quality water. The double-bounded dichotomous choice format (yes-no, no-yes responses) makes clear bounds on unobservable true WTP and the yes-yes; no-no response sharpens the true WTP (Haab *et al.,2002)*. The double-bounded dichotomous choice format also helps to elicit more information about respondent's WTP than single bounded format Arrow *et al.,* 1993; Hanemann *et al*.,1991)

2.3.1.Preliminary Survey and Bids

Before the final survey, pre-test have made to determine the potential bid level.. In the this pre-tes phase,40 households were participated those who wouldn't appear in the final survey . finally, the starting prices that have identified for WTP were 5, 15, 25, 35, and 55 birr per month added with water bill. Using these initial bids, sets of bids were determined for follow up questions based on whether the response is "no" or "yes" for the initial bid. If the respondents were willing to take the offered initial bid, the follow up bid were 15,25,35,55 and 75 birr; in case of a "no" response to the initial bid, the follow up bid were 2.5, 5, 15, 25, 35, birr respectively. Given this, the actual survey was undertaken by dividing the total sampled households randomly into five groups.

The survey was successfully completed with relatively small number of protest zeros (about 2%). These protesters provided wrong value and after checked for sample selection bias, they were excluded from the data set. The criteria for selecting protest zero was based on the report of the NOAA Panel on contingent

valuation (Cameron *et al*., 1994. According to Cameron *et al*., (1994) suggestion, respondent are willing to pay the stated amount but if the respondent believes that the proposed scenarios were distributed unfairly; one can refuses to accept the hypothetical choice.

2.4. Empirical Model Specification and Analysis

Bivariate normal probability density functions are commonly using in statisticians .these functions are applicable for non-zero correlation, while the standard logistic distribution does not to do so (Cameron *et al.*,1994) Hence, the bivariate probit model was employed for this analysis to estimate the mean WTP from the double bounded dichotomous choice. For estimation of WTP, the bivariate probit Model was employed. Double bound dichotomous choice model is depicted as the following form (Haab *et al.*,2002).

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

$$L_j(\mu / t) = \Pr(\mu_1 + \varepsilon_{1j} \geq t_1, \mu_2 + \varepsilon_{2j} < t_2)^{YN} * \Pr(\mu_1 + \varepsilon_{1j} > t_1, \mu_2 + \varepsilon_{2j} \geq t_2)^{YY} * \Pr(\mu_1 + \varepsilon_{1j} < t_1, \mu_2 + \varepsilon_{2j} < t_2)^{NN} * \Pr(\mu_1 + \varepsilon_{1j} < t_1, \mu_2 + \varepsilon_{2j} \geq t_2)^{NY} \quad \ldots\ldots(4)$$

Where: μ = mean value for willingness to pay

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

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

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

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

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

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

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

ρ = correlation coefficient

σ = standard deviation of the errors.

3. Results and Discussion

3.1. Awareness about Watershed and Forest Benefit

The result of this study showed that, about 80% of from the total respondents believe that their potable water come from Wondo Genet catchment forest springs. On the other hand about 7% of the sample population perceived that the water comes from water pump station from their surroundings. The remaining 13 % of the respondents have no Idea about the sources the potable water. More than half of the contacted households have good perception about the services of the forest to their environment and they ranked according to their preferences (Table 1).

Table 4: Respondents' rank order of benefit and services of forest

Forest benefits and services	Ranks (% of respondents)[1]						
	1st	2nd	3rd	4th	5th	6th	7th
Local weather maintenance and prevent occurrence Prevention of natural hazard	46	15	11	10	8	9	6
Recreational value	2	1	3	11	2	26	14
Protect the soil erosion	18	41	13	12	10	16	11
Increase water percolation and thus improve water availability	12	20	40	15	9	11	16
Carbon sequestration , mitigating global warming	10	7	10	12	26	13	21
`Shade, cool and clean air	3	6	14	27	7	9	18
Residence for wild animals	9	10	11	13	38	16	14
Total	100	100	100	100	100	100	100

Source: Survey result, 2013

3.2 Perceptions on Forest Cover Change in the Watershed Area

About 93% of sampled households responded that the forest coverage in WGF watershed is declining. Respondents acknowledged that the cause of forest declination are human induced fire, iligal encroachment ,agricultural expansion , lack of environmental education and socio-political factors were picked as the main driving cause of deforestation. This result is consistent and supporting the findings in which, 13% of the Catchment forest was conserved under natural forest and the pressure has reduced to 2 %. (Tefera.M, 2006)

From this study one can perceive that forest degradation is continuing in study area due to a number of

[1] *Select the largest figure among the lists while moving down the column of table 7*

internal and external factors noticed by local community which could be the problems and the cause declining for the supply of quality and quantity water nearby areas. Similarly study conducted by Wickama, *et al.*(Undated) indicates that such type of problem has been occurred in Baga waterhsed Lushoto District, in Tanzania. According to this study, the local community in Lushoto district faced scarcity of water in their village after forest land was cleared for cultivation. Consequently, this makes the enlightenment of the valuation scenario and the hypothetical market easier because they valued closely and clearly. Hence, this was the call for community to and other stakeholders to look for solution.

Likewise, the sample households were asked about the solution to be taken and; about 41 % of the respondents suggested that strong natural forest protection and managing rules and regulations as a means to control forest depletion. About 27 % of them have a choice to tree planting and other conservation activities; while 22 % of the respondent supported that wider provision of environmental education is preferable. Besides, about 7 % of them suggested that for creation of another source of income as a solution, and 3 % suggested family planning and reconciling of population growth with economic/welfare improvement as a solution to reduce deforestation to be sustained the forest conservation activities.

3.3. Households' Responses of the Double Dichotomous Choice Valuation

Respondents were asked about the proposed project to sustain the forest management and about 27% of them have negative idea to the proposed project as stated in two main divisions(table 2); whereas the remaining 70% respondents were willing to pay for the project. Among the willing respondents, 58 % and 37% of them accepted "yes" for first and second bid, respectively.

Table 2: Reasons for unwillingness to pay for Wondo Genet catchment forest conservation

Valid zero bidder	No.	%
I can't afford to pay any additional amount to what I am currently paying in the form of water bill	21	9.76
Shortage of money to pay	24	11.16
I did not get piped water came to WGF area	2	0.93
I don't know the importance of forest for water service	4	1.86
Protest Zero bidder		
I think it should be the government that should finance the forest protection and management so as to improve water service	4	1.86
I do not trust the institution who will manage the funds for this activity	2	0.93
Those who consume more water must pay to protect and manage forest areas	1	0.46
Only the rich households should pay	1	046
Total	59	27

Source: Own survey result, 2013

The distribution of "yes" and "no" responses for the first and second bids across the different initial bids reveals that as the initial bid gets higher while the frequency of acceptance become decreases. This is due to the fact that, as the number of households rises, the bid value declines as shown in the demand curve (Fig. 1). By the same indication the average amount of the 1st bid is 32.22 ETB per month but 2nd bid amount, the value was increased to 34.45 ETB.

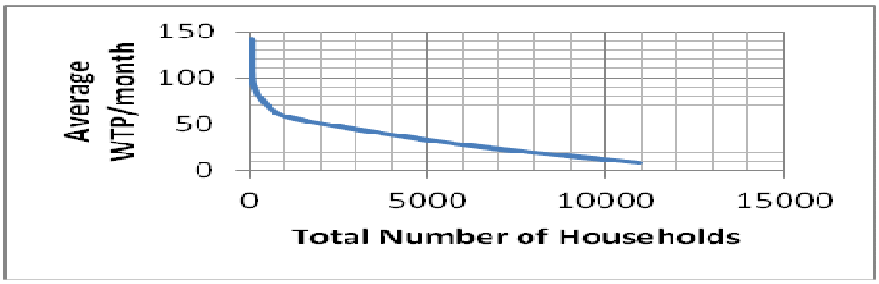

Figure 2: Aggregate demand curve of Households WTP for forest conservation by domestic water users

Another interesting result is that 63.79 % of the respondents who have accepted the1st bid gave similar response for the follow up question and 69.05 % of those who have rejected the 1st bid again rejected the 2nd bid. This indicates that the effect of the first response for the follow up question is consistent with prior studies done by (Solomon J., 2004) on valuation of multi-purpose tree resource using DBDC elicitation format (Cameron *et a.,*1994).

After the dichotomous double bounded question, a follow up open ended question was asked independently. About 27 % of the respondents gave t less amount than what they already agreed to pay in the dichotomous choice questions About 64% of respondents said that their bids level to be offered was due to

government enforcements so, that they decided to agree they voluntary based contribution, that lead to reflect their 'true' willingness to pay. However, about 18% respondents gave an amount higher than the amount they already agreed to pay in dichotomous choice question offered bids. The main reasons of those respondents were they seeks to have a reliable water supply for future generations (29.53), and it is a good project idea because forest produces safe environmental services (70.47). While the rest 55 % of the respondents reported that they could not afford more than what they stated because of inadequate income, and they reported that the amount they agreed to pay was satisfactory.

3.4. Determinants of Households' WTP

Multivariate regression analysis helps us to analyze WTP responses by determining if WTP estimates are internally consistent or theoretically valid. This model would permit identification of the factors that influence respondents' WTP and check if directions of effects are consistent with theoretical expectations. However, prior to running the bivariate probit regression model, the explanatory variables were checked for multicollinearity and the degree of association through Variance inflating factor (VIF[1]) and Contingency coefficient (CC[2]). Based on the VIF, the data had no serious problem of multi co linearity. That is, the VIF of the continuous variables were less than 10 (table 3) 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 (table 2).Therefore, all the dummy variables were included in the regression analysis. Table 3: Variance inflating factor for continues and contingency coefficient for dummy explanatory variables used in regression models.

VIF of continuous explanatory variable		Contingency coefficients for dummy explanatory variables			
variables	VIF	variables	Sex	Awer	last
Age	1.37	Sex	1.0000		
Income	1.51	Awer	0.0415	1.0000	
Education	1.55	last	-0.0235	-0.0549	1.000
HHsize	1.31				
Reys	1.60				
Bill	2.49				
Bid 1	3.44				
Bid 2	3.29				

Source: Own survey result, 2013

The estimated result on factors affecting the households' WTP for forest protection/conservation that could be improve water is presented in (table 4) and only the significant variables are discussed since the result from the bivariate probit model in is not indicating the magnitude effect of the explanatory variables on the probability that respondents accept or reject the initial bids. Therefore, the estimated marginal effects of the variables on the WTP are depicted in (table5)

.

[1] $VIF = \frac{1}{1+Ri^2}$ Where, R_i^2 is the coefficient of determination in the regression of one explanatory variable (X) on the other explanatory variables (X_j).

[2] $C = \sqrt{\frac{\chi^2}{N+\chi^2}}$ where, C= coefficient of contingency, $\chi 2$= Chi-square test and N= total sample size

Table4: Bivarate probit model result

	Model one			Model two		
variables	coef	Rebust. Std. Err	p>z	coef	Rebust. Std. Err	p>z
Age	-0.01682	0.0974	0.061*	-0.0266	0.1111	0.017**
Sex	0.78	0.2691	0.004***	0.5866	0.2373	0.013**
HHs	-0.1477	0.0488	0.002**	-0.04464	0.0544	0.413
Educ	0.047744	0.0291	0.026**	0.5829	0.0259	0.025**
Aware	0.2451121	0.249206	0.325	0.068039	0.2334	0.771
Income	0.00036	0.0001	0.020**	0.00012	0.0001	0.036**
Lsat	0.85088	0.2845	0.139	0.2977	0.2178	0.123
Reys	0.0130332	0.008559	0.128	-.00124	0.0083	0.882
Bill	0.0036	0.0042	0.362	-0.0013	0.0040	0.748
Bid1/2	-0.012673	0.0162	0.000***	-0.0061	0.0178	0.001***
-cons	0.4431	0.5162	0.431	0.182	0.53622	0.934

Number of obs = 200 Prob>Chi2 = 0.000
Log likelihood = -143.202 Chi 2 (1) = 67.66
Wald chi2(18) = 39573.85 Roh(p-value) = 0.87

Source: Own survey result, 2013

Table 5: Marginal effect of explanatory variables

variables	Dy/dx	Std. Err.	Variables	Dy/dx	Std. Err.
Age	-0.0082	0.00354	Income	0.0010	0.00004
Sex	0.1928	0.06915	Lsat	0.1051	0.07877
HHs	-0.0171	0.01768	Bill	-0.0020	0.00133
No. years residence	-0.0024	0.003	Awareness	0.0515	0.08030
Educ	0.0201	0.00846	Bid1/2	-03430	0.00578

Source: Own survey result, 2013

Age of the household head (AGE) had negative effect on the willingness to pay of households for forest ecosystem conservation practices to improved water supply service. The negative and significant correlation between age and WTP might be perhaps because of two reasons. Older age may shorten planning time horizon and reduce WTP i.e. they expect less benefit from the investment relative to young household heads, given that the benefits are generally longer term in nature. On the other hand, older households head might face constraint of money to pay for conservation of forest i.e. adult households are more financially stable than old households. The marginal effect estimates of (table 4) also shows, that keeping the influences of other factors constant, a one year increase in the age of the household head reduces the probability of accepting both the 1st and 2nd bid by 0.82% and e significant at less than 10 % and 5% probability level in the 1st and 2nd bid respectively. The empirical finding of the study is consistent with pervious empirical studies (Calderon *et.al.,* 2006).

Sex: - Sex is positively related to the probability of respondents' WTP for forest ecosystem conservation practices to improved water supply of the town (table 3). It is significant at less than 1 % and 5% in the 1st and 2nd bids respectively. The result revealed that those male headed households were found to be willing to pay than female headed households. This can be explained by the fact that males have participated more too outdoor activities in relation to forest protection activity and others compared to females. The result contradicts with the study by (Bogale *et al.,* 2012) and similar with (Alebel.B, 2002).This is because femal headed households have not the exposure as that of male headed household to participate natural resources conservation practices and that why they are reluctant to accept the higher bid value.

Family size (HHsize):- The result of the model showed that there was significant at 1% to affect the probability of accepting the initial bid and negative association between family size and WTP for forest ecosystem conservation practices to improved water supply. The estimated marginal effect showed that all other factors kept constant, as the family size increase by one , the probability of willingness to pay is decreased by 1.71 %.

Education level (educ.)**:-** Education of the household head was also significant at 5 % probability level said "yes" to both the 1st and 2nd bid. It 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 increases. The marginal effect result show that for each additional increment of education, the probability of willingness of a household to pay for the forest will increase by 2.0 %, ceteris paribus. One possible reason could be that more educated individuals are concerned about environmental goods including forest in our case. This could be possible because education increases environmental awareness and value for environmental goods such as forest. The findings of Whittington *et al.*,1990) which have done on developing countries; with regard to

households WTP for improved water services indicated that better educated households are more WTP for improved water services.

Household income: - Income has a positive relationship with the households' WTP and statically significant at 5% both in the 1st and 2nd bids. This effect indicated that respondents with higher monthly income were more likely said yes to the 1st and the 2nd bid than households with lower income. The results indicate that 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 showed that a unite increment of the household income increase the probability of households' WTP by 1.0 %. The result is consistent with (Griffin *et.al., 2000).* In contrary with these finding (Baltodano *et al. 1989)* has reported income did not have an effect on the household WTP for improved water quality improvement.

Bids amount (bids**)**: Both bid values, one and two, have negative coefficient as expected and statistically significant at 1% for the follow up question. 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 also evidenced that, as one more Yes response given for the second bid it resulted in a decrease of WTP by 0.034 marginal effects (table 4).

3.5 Mean willingness to pay for forestry conservation

Double-bounded contingent valuation model is used to estimate the mean WTP and its determinants. There are two options of independent models which can be used to estimate mean WTP. The models are bivariate model with no covariates i.e. WTP checked against the offered amount and bivariate model with covariates i.e. WTP against socio economic factors that can be affecting WTP for forest conservation to improve water supply service. Thus, before deciding on which model to apply, it seems important to compare the results which would help to capture the true behavior of people that expressed through their preferences.

Cameron *et al.*(1994) indicated that, the model which runs with determinant factors to estimate mean [1] WTP are more preferred for its high marginal value accuracy estimation for environmental changes. As a result the mean WTP value of conserving forest to improved water provision was ranged from 35 and ETB to 30 ETB per household per month, for the initial bid (Fbid) and the follow up bid (Sbid) amount respectively. This figure is higher than the mean willingness to pay amount from the open ended question maximum WTP was 26.31 ETB. This indicates that free riding and lack of base for answering WTP questions under open ended format.

3.6 Aggregate WTP for Conserving Forest to Improved Water Availability

According to Baltodano *et al.(2004)* there are four important issues to be considered regarding sample design and execution in order to have a valid aggregation of benefits: population choice bias, sampling frame bias, samples none response bias and sample selection bias. Stratified random sampling method was used for selecting respondents' domestic water user other than source from the target. Protest zero responses were excluded from the analysis and a face to face interview method were used. Hence, none of the above biases was expected in the analysis.

Bivariate probit model was estimated on a dichotomous choice CV question and the parameter shows that either the mean, variance or both differ between the initial bid-price and the follow up, it is decided to e to calculate the WTP measure (Haab et al.,2002). Hence, e the appropriate WTP among the two bivariate estimates were examined and the total amount for the YY and NN responses accounted about 66.5 % of the total responses. This means that the 2nd bid amount was closer to the unobserved true value of the individual. For example, if the first random bid for the individual is 5 ETB and the respondent accepts the first bid, then the 2nd bid becomes 15ETB and again the respondent accepts the second bid. This indicates that the respondents' true WTP is greater than or equal to 15 ETB so, the 2nd bid will be a better estimate than the 1st one and the same is true for NN answer. Even for the rest 33.5 % of the NY and YN responses, both the first and the second bid amounts will have equal chances to be closer estimates of the true value. Hence, using the second estimate of the double bounded bivariate model to calculate as mean willingness to pay for forest ecosystem protection the aggregate benefits of the society is summarized in (Table 5).

[1] The mean WTP from bivariate probit model was computed using the formula specified by [18] that is

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

Where a = coefficient for the constant term
ß = coefficient offered bids to the respondent

Table 6: Average and aggregate willingness to pay of households for conserving WGF

Site	Population size	Mean WTP /month	Total WTP/year
Didaboki	944	30	339726.3
Abosto	973	30	350336.8
Bulchana	961	30	345884.2
Total	2878	30	1035947
Total households of the Town	39474	30	14210640

Source: Own survey result, 2013

Aggregate WTP of the participants for conservation of forest to improve water supply was found to be 1, 035, 947 ETB per year. Whereas, the aggregate WTP amount for the population of Shashemene town to improved targeted forest ecosystem conservation was about 1, 421, 0640 ETB per year. This is the amount that the whole households in entire town are expected to pay per year when the suggested improved forest ecosystem conservation program comes true. When single bounded and open ended WTP were used the estimate becomes 1, 657, 9080 ETB and 1, 246, 2731.28 ETB per year respectively.

4. Conclusion and recommendation

Wondo Genet catchment forest resource is shrinking from time to time due to different factors. The main cause of this incidence are human induced fire, population growth, lack of environmental education and socio-political factors, illegal felling of trees for fuel-wood and construction materials, charcoal making, pit-sawing, and expansion of agricultural land. These also affect other resources such as, the hydrological and soil resources of the catchment, which will have a massive impact on the domestic water users of nearby towns. Most of the water beneficiaries have perceived about the value of forest being as the key sources of potable water and they are willing to pay up to 1.4 million birr per year for marinating this forest services.

The findings indicated that the main determinants of WTP for this forest services are t monthly income, age, household size, bids, and formal education are key factors influencing the WTP. Therefore, actions to be made towards these socio-economic aspects that significantly influenced households WTP is a first step conserving forest to sustain quality and quantity of water.

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