Beneficiaries' willingness to pay for the conservation of Meteka wetland in Afar National Regional State, Ethiopia

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ABSTRACT

A study was conducted to estimate the willingness to pay (WTP) of residents in Gewane wereda (district) to conserve Meteka wetland and to investigate determinants of WTP using Contingent Valuation Method (CVM). The result revealed that 88.3% of the respondents are willing to pay for the conservation of the wetland, which was presented to the respondents with the bid ranging from 5 to 20 Ethiopian Birr (ETB) per month. The mean WTP is estimated at 90.48 ETB per year per household in Gewane wereda, which in aggregate generates 535,922.88 ETB per year in the study wereda. Respondents WTP is significantly influenced by the number of kebeles, government aid program (safety net), age, income and level of understanding of the respondents about future generation without Meteka wetland. This study showed how much the respondents were willing to pay (88.3%) for the conservation of Meteka wetland and identified the determinants of the willingness to pay

Keywords: Willingness to pay, Contingent Valuation Methods, Wetland, Meteka

1. INTRODUCTION

Wetlands; defined as *"areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters"* (Ramsar Convention Bureau, 1997), provide invaluable uses and benefits to human beings. According to Roggeri (1995), they use as groundwater discharge and recharge, flood control, shoreline stabilization and nutrient retention, source of water, food, fuel wood, wildlife, fisheries, forage and agricultural resources. Meteka wetland, found in Gewane wereda of Afar National Regional State is the only source of water both for human and livestock in the study area. However, it is facing tremendous pressures in a number of ways. The livelihoods of the pastoralists dwelling there are almost entirely dependent on the wetland.

They are using it intensively as a source of water and feed for their animals, charcoal production, fuel wood, and above all; as a raw material (*Typha angustifolia*) for locally made mattress called Gadeta, which exacerbates the situation as it is the only available commodity that generates immediate cash.

Moreover, the washing of heavy duty trucks (chemical pollution) just at the mouth of the wetland on the main Addis Ababa - Djibouti highway and the invasion of the area with invasive alien plant species (*Prosopis juliflora*) are another vivid dangers for different biodiversity of the wetland, which needs an immediate action. Economic valuation considers the weight of conservation and management activities of any threatened environment vis - a - vis the interest of the whole society (UNEP, 1995), and hence policy makers are increasingly recognizing the role of environmental valuation to guide and support the management and conservation of biodiversity (Beaumont *et al*., 2008).

Economic value is a measure of what the maximum amount an individual is willing to forego in other goods and services in order to obtain some good, service, or state of the world (Lipton *et al.,* 1995). A value measured in monetary terms can be seen as the willingness to commit resources to biodiversity conservation (Bra¨uer, I., 2003). Contingent valuation is a method where by responses are sought from individuals as to their actions contingent on the occurrence of a particular hypothetical situation (Cho *et al.*, 2008). It is a simple, flexible non market valuation method that is widely used in cost – benefit analysis and environmental impact assessment (Venkatachalam, 2004). This study is, therefore, proposed to estimate the willingness to pay (WTP) of residents in Gewane wereda to conserve Meteka wetland and to investigate determinants of willingness to pay.

2. MATERIALS AND METHODS

2. 1. Study Area

Meteka wetland is located in Gewane wereda (district) of administrative zone 3 of the Afar National Regional State. The wereda has a total human population of 31,318 with 6,708 households (CSA, 2007). The wereda capital, Gewane town, is 371kms from Addis Ababa. Three kebeles (localities) of Gewane wereda bordering Meteka wetland, namely: Meteka (Latitude N 90 59' 12'', Longitude E 400 32' 44'', Altitude 582.7m), Adbaro (Latitude N90 56' 18'', Longitude E 400 25' 28'', Altitude 568.5m) and Bieda (Latitude N 90 56' 19''Longitude E 400 29' 29''Altitude 580.7m) were sampled in this study.
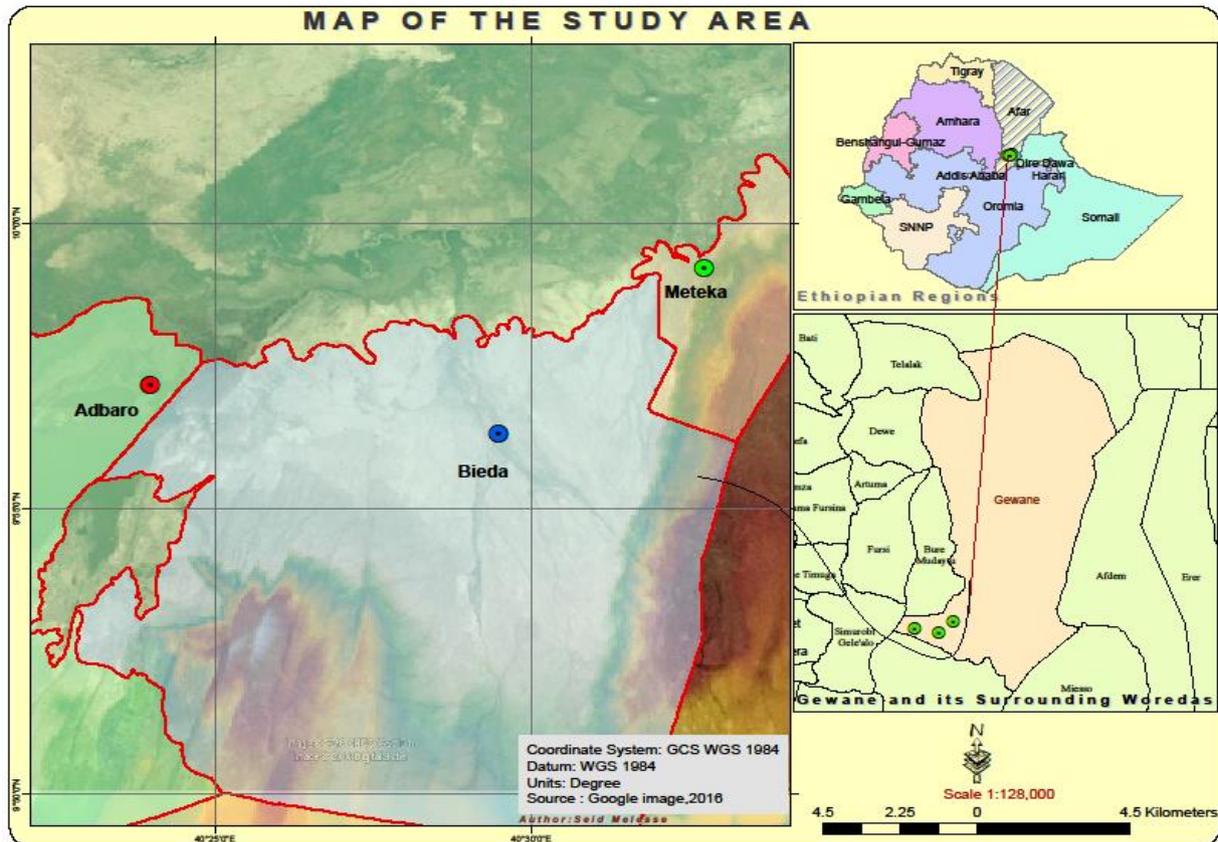
Figure 1. Map of the study Area

2. 2. Methodology

Purposive sampling methods were used to select kebeles (localities) that are bordering Meteka wetland, and respondents were selected randomly. A sample size of 145 respondents from three localities was used in the study. Data were collected through group discussions with key informants and individual pastoralist interview using semi structured questionnaires.

2. 2. 1. Nature of Questionnaire

This study applied the Contingent Valuation Method (CVM) to measure the non-market value of conserving Meteka wetland. The respondents (N = 145) were presented with a hypothetical conservation and management program for Meteka wetland that contained a set of information about the issues that need to be addressed for the conservation of the wetland including: trainings to create awareness on purposes of conserving the wetland, benefit/uses, flood protection (construction of ditches), eradication of invasive alien species (water hyacinth, prosopis), identification and use of traditional knowledge regarding the wetland, promotion of women's participation for the conservation, management and wise use of wetland, tree plantations, protection of pollution (e.g. heavy duty truck washing at Meteka). The respondents were also presented with the issue of participation in the planned program which requires the contribution of the residents around the wetland to undertake a proposed

conservation program, for which they have to pay in cash. Moreover, the respondents were also informed of possible benefits that they would be getting after the successful implementation of this program vis-a-vis a) ensuring food security b) getting employment opportunities, c) income generation, d) greater possibilities of conserving the wetland in their locality. Then, respondents were presented with the contingent market valuation question: "Are you willing to contribute for the conservation of Meteka wetland?" This was presented as a double-bounded dichotomous choice question.

2. 2. 2. Administration of the Interview

A face-to-face survey was conducted to gather information through an interview. The interview schedule contained personal profile of the respondents which was designed to gain information about the respondent's social, economic and demographic characteristics. It also contained questions that were designed to assess the attitudes of the respondents on 'development' and 'environment', and the last part contained a question where respondents were presented with dichotomous choice elicitation, so as to assess their willingness to pay for the conservation of Meteka wetland in cash *(money that respondents could be willing to pay for conservation activities per month)*. Respondents were provided with offers (5–20 Ethiopian currency, which is Birr; ETB hereafter) from which they were to choose a single choice. Socio-economic data of the respondents are presented in Table 1. A total of 145 respondents were involved in this study. To explore factors that affect respondents' WTP for Meteka wetland conservation, binomial logistic regression analysis was carried out. Whether a respondent was willing to pay or not was framed in a binary choice model. Assuming y to represent a dichotomous variable that equals 1, if the respondent is willing to pay and 0 otherwise.

The model of the probability of WTP, $P(y_i = 1)$, was represented as:

$$\text{In}\,[P(y_i = 1)/1 - P(y_i = 1)]$$
$$= \beta_o + \beta_1(Age) + \beta_2(Safety\,net) + \beta_3(Income) + \beta_4(Kebele) + \beta_5(Future) + \beta_6(Sex).$$

2. 2. 3. Data Analysis

The collected data was analyzed (frequency, descriptive statistics and regression analysis) with SPPS, and the study area was mapped with ArcGIS.

3. RESULTS

3. 1. The study Areas and frequency of the respondents

In this study, residents of 3 localities that are found in Gewane wereda have been involved. Out of the total 145 respondents that participated in the study, 73 (50.3%), 32 (22.1%), and 40 (27.6%) were residents of Meteka, Adbaro and Bieda localities, respectively.

3. 2. Socioeconomic Characteristics of the Respondents

Out of the total of 145 respondents, 94 (64.8%) were males and 51 (35.5%) were females. The range of age of the respondents was between 18 and 89 years. Among these, 72 respondents (49.7%) were found between 18 and 35 years of ages (the dominant age group).

Table 1. Socio-economic data of the respondents

Variables		Frequency	Percent (%)
Age Group	18 – 35	72	49.7
	36 – 53	47	32.4
	54 – 71	23	15.9
	72 – 89	3	2.1
Sex	Male	94	64.8
	Female	51	35.2
Marital status	Married	106	73.1
	Single	21	14.5
	Divorced	9	6.2
	Widow	9	6.2
Family Size	1	9	6.2
	2	11	7.6
	3	22	15.2
	4	20	13.8
	5	25	17.2
	6	15	10.3
	7	9	6.2
	8	11	7.6
	9	8	5.5
	10	8	5.5
	11	3	2.1
	12	2	1.4
	13	0	0
	14	1	0.7
	15	1	0.7
Level of Education			
	Illiterate	101	69.7
	Informal schooling	10	6.9
	Elementary	23	15.9
	High School	9	6.2
	College/University	2	1.4
Household income			
	< 100 ETB	68	46.9
	101 – 200 ETB	4	2.8
	201 – 300 ETB	16	11.0
	>300 ETB	57	39.3
Total		**145**	**100**

The majority of the respondents (106) were married (73.1) and with average family size of 5.39. Out of the respondents, 101 have an educational level coded as illiterate (69.7%) dominating the other groups. Their average monthly household income, which was categorized into four was dominated by those earning below 100 ETB (68, 46.9%). Out of the total of 145 respondents, only 7 of them (4.8%) said that they are a member of organization working on environmental issues. The majority of the respondents' livelihood depends on animal husbandry (73, 50.3%), trade (34, 23.4%), farming (17, 11.7%) and other (21, 14.5%). Besides, 87 (60%) of the respondents said that they are benefiting from a safety net program (aid) of the government.

When asked about the major benefits, services and/or functions they are getting from Meteka wetland, they listed them as the following; water supply both for human and animal (34, 23.4%), source of raw material (*Typha angustifolia*) for handmade carpet locally called as gadeta (29, 20%), source of fuel wood (25, 17.2%), animal feed source (grazing/browsing) 20, 13.8%, source of medicinal plants (15, 10.3%), flood/erosion control (12, 8.3%), habitat/shelter for wild animals (10, 6.9%). Of the total respondents, 113 (77.9%) of them agreed that Meteka wetland and its natural resources are not properly managed, but the remaining 32 (22.1%) believed otherwise.

The major problems listed by those who believe that the wetland is not properly managed include deforestation (11,7.6%), over grazing (7, 4.8%), pollution i.e. washing of heavy duty tracks that drains grease, soap and other chemicals in to the wetland (35, 24.1%), seasonal flooding of rivers Awash and Gerealo (23, 15.9%), agricultural land expansion (private cotton farm) (10, 6.9%), and invasive alien plant species namely: water hyacinth (*Eichhoria crassipes*) and prosopis (28, 19.3%). A total of 113 (77.9%) respondents strongly agree that Meteka wetland is under high pressure (decrease in area and drop in water level), while 32 (22.1%) of the respondents disagree with the former idea. Of the total respondents, 128 (88.3%) strongly agree on the need to participate in Meteka wetland conservation program.

3. 3. Willingness to pay

Table 2. The frequency of the bids of WTP in Ethiopian birr (ETB)

Amount in birr	Frequency	Percent
5	75	51.7
10	21	14.5
15	8	5.5
20	24	16.6
Unwilling to pay	17	11.7
Total	**145**	**100**

The respondents' willingness to pay for the conservation of Meteka wetland conservation program was very high. Out of the total 145 respondents, 128 (88.3%) were willing to pay. However, 17 (11.7%) were not willing to pay. The mean and median of WTP are 7.54 and 5 ETB per month per household, respectively. The main reasons stated by the respondents that are not willing to pay are, "I do not have enough money to pay for the program" 16 (11%) and, "only people who directly benefit from Meteka wetland should pay for the program" 1 (0.7%). The mean willingness to pay is estimated at 90.48 ETB per year per household in the wereda, with an aggregate benefit of 535,927.88 ETB/year.

The statistical mean, median, minimum and maximum of willingness to pay for Meteka wetland conservation program (N = 145) were 7.54, 5.0, 5.0, 20 ETB, respectively.

3. 4. Factors affecting willingness to pay

Result of the logistic regression model is presented in Table 3. Among the group of respondents who were willing to pay; age, government safety net program (aid to extreme resource poor families), income, kebele and whether or not respondents are concerned with the fate of future generation (future) had a positive effect on the respondents WTP. Sex of the respondents didn't affect their WTP. The percentage of correct prediction of the logit model was 93.8.

Table 3. The results of logistic regression analysis (N = 145), * = significant at 0.05, ** = significant at 0.01

Variables in the Equation	B	S.E.	Wald	Df	Sig.	Exp (B)	95% C.I. for EXP(B)	
							Lower	Upper
Age	1.279	.544	5.537	1	.019*	3.593	1.238	10.426
Safety net	-4.434	1.811	5.996	1	.014*	.012	.000	.413
Income	-.735	.341	4.643	1	.031*	.480	.246	.936
Kebele	2.426	.650	13.942	1	.000**	11.314	3.166	40.427
Future	2.958	1.436	4.246	1	.039*	19.266	1.155	321.292
Sex	.795	1.139	.488	1	.485	2.215	.238	20.635
Constant	-6.806	3.035	5.031	1	.025	.001		
-2 log likelihood	53.417							
Percent of correct prediction	93.8							

Note: Age, Safety net (government aid), Income, Kebele (locality), future (the level of understanding for the future generation), Sex

Table 4. Economic value of Meteka wetland conservation

Wereda (A)	Total households (B)	Percent of Protest zero (C)	Expected households to have a protest zero (D)	Expected households with valid responses (E)	Mean WTP (F)	Aggregate benefit in Birr (G)
Gewane	6,708	11.7	784.836	5923.164	90.48	535, 927.87872

A. Name of the wereda (district)

B. Total households of the wereda/district

C. Percent of protest zeros (not willing to pay) in the wereda/district for the planned Meteka wetland conservation activities

D. 11.7% of our 145 sampled households were protest zeros, so they were excluded from further analysis. It is calculated by multiplying the percentage of sampled protest zeros with the total households (C*B)

E. The expected number of households which are expected to protest for the proposed project. It is calculated as (B – D)

F. The mean willingness to pay calculated from the maximum amount of money that a respondent could pay for Meteka wetland conservation activities in a year

G. Mean multiplied by expected households with valid responses to the proposed program measured in cash (F*E)

4. DISCUSSION

The result of this study revealed that there is a high willingness to pay (88.3%) for the conservation activities of Meteka wetland. The high positive response might be related to the ongoing deterioration of the wetland and an invasion of the area by alien plant species, prosopis, (*Prosopis juliflora*), that frustrates the pastoralists who may run out of their grazing land by invasion of prosopis. There are some variables indicating how much pressure is being exerted on the wetland, in addition to what is physically observed in the area. The livelihood of most of the respondents (73, 50.3%) depend on animal husbandry, which in a way, relied on the wetland for feed and water supply. They have also an average family size of 5.39, depending in one way or the other on the wetland. Besides, 101 (69.7%) of the respondents are illiterate with less or no knowledge at all about environmental activities. Moreover, only 7 (4.8%) of the respondents said that they are a member of organization working on environmental issues. With all these shortcomings, 113 (77.9%) of the respondents were able to identify the problems and agreed that Meteka wetland and its natural resources are not properly managed. They even agreed to contribute an average of 90.48 ETB per year per

household for the planned conservation activities that has an aggregate benefit of 535, 922.88 ETB per year. In this study, age significantly (0.019, P < 0.05) affected the WTP. Holding other things constant, as the age of a respondent increases by one unit, the probability of the amount of money he/she could pay for Meteka wetland conservation activities increases by 3.593 among the sampled population. This result is in line with what other authors reported (Togridou, 2006), (Lee, C., and Mjelde, J. W. 2007), (Baral *et al.,* 2008), (Bhandari, A. K., and Heshmati, A. 2010), whereby age of the respondents positively contributed for their willingness to pay for conservation activities. Governments' aid program (safety net) which is given to extremely resource poor families like those in the study kebeles, also significantly (0.014, P< 0.05) but negatively affected the WTP of the respondents. Out of a total of 145 respondents, 87 of them (60%) said that they are benefiting from this Aid program.

The safety net program in the study areas, which was given to the resource poor respondents, doesn't consider their potential to conserve the wetland. They were given the aid just to survive on it without contributing any cash or labour to conservation works. Setting other things constant, therefore; this aid, which is not related to any environmental conservation activities, affected the WTP of the respondents negatively.

Household income is another variable that affected the respondents' willingness to pay for Meteka wetland conservation. It significantly (0.031, P < 0.05) and negatively affected the WTP. As indicated in the result section, majority (68, 46.9%) of the respondents are earning average monthly income below 100 ETB, so it is logical to say that as long as they keep on earning too small (< 100 ETB) monthly income and there is no any economic activity which increases their income, their willingness to pay for the conservation activities will be limited. The same effect of household income was reported by (Sara Kaffashi *et al.,* 2015) where by higher household income increases the probability of paying for the preservation of wetlands. Kebele (locality) significantly (0.000, P < 0.01) affected the WTP of the respondents. An increase in the number of kebele (locality) with one unit results in an increase of probability of WTP for Meteka wetland conservation by 11.314 among the total population. This indicates how willing the residents of the remaining kebeles might be for the conservation of threatened Meteka wetland. Respondents level of understanding about the future of the area without the wetland also positively and significantly (0.039, P < 0.05) affected their WTP for the conservation activities, indicating their concern for the coming generation. In this study, sex of the respondents didn't affect their decision on WTP.

5. CONCLUSION

This study showed how much the respondents were willing to pay (88.3%) for the conservation of Meteka wetland. The mean WTP was estimated to be 90.48 ETB per year per household in the wereda, which in aggregate generates 535,922.88 ETB per year in the study wereda. Age, safety net aid program, average household monthly income, kebele, and the respondents level of understanding about future generation without Meteka wetland affected their WTP significantly. However, sex of the respondents didn't affect their WTP.

5. 1. Recommendation

Awareness raising on environmental conservation issues of all the community members of each and every kebele (locality) surrounding the wetland sounds a primarily achievable

remedy for the ongoing destruction of Meteka wetland. Resource poor pastoralists (safety net program beneficiaries) could also gain a moral support if they were able to participate (at least in labour) on any conservation activities in their locality.

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