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Local communities' willingness to pay for sustainable forest management in Ghana

Michael Ansong^{1*}, Eivin Røskaft²

Abstract

New policies and interventions for forest management are important because preferences of stakeholders and the state of forests continually change. To achieve sustainable forest management there is the need for information and guidelines that help decision-makers understand the economic value of the forests to local communities as these values influence how they respond and support policies and interventions. Willingness to pay (WTP) is a measure of preference that provide information to guide policy development. This study, using the contingent valuation method, estimated the willingness to pay of 300 respondents from 10 communities around Subri Forest Reserve in the Western Region of Ghana. The results show that residents of local communities around the Reserve are willing to pay for forest interventions that ensure sustainable management. The mean monthly WTP per respondent was estimated to be between GHc 2.22 and 2.26 (1.59 – 1.61 US\$, 2009 rate). Older and higher income earning respondents were willing to pay higher amount than younger and lower income earning respondents. The finding indicates that local communities around reserves are likely to support forest management initiatives that promote sustainable use of the forest resources in the reserve.

Keywords

Conservation — Forest policy — Sustainable development — Economic value — Subri Forest Reserve

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Contents

Introduction	80
1 Methods	81
1.1 Study site	81
1.2 The Survey	82
1.3 Theoretical framework	82
1.4 Data Analyses	83
2 Results	83
2.1 Respondents' profile	83
2.2 Response to bid	83
2.3 Factors influencing willingness to pay	84
3 Discussion	85
4 Conclusion	86
Acknowledgments	86
References	86

Introduction

The government of Ghana has introduced new policies and interventions to promote forest values and ensure local communities benefit from, and support sustainable management of forests. Example includes the Voluntary Partnership Agreement (VPA) with the European Union, adoption of the Reducing Emissions from Deforestation and Forest Degradation

(REDD) program, and introduction of modified taungya system for plantation development [1-4]. These policies and interventions recognise that effective forest management largely depends on collaboration and support from local communities, in contrast to the previous policies (such as the 1948 Forest Policy) which, over many decades, focused on timber production [5;6].

Forest policies and interventions need the support of the local community members to be successfully implemented. The extent to which people support and comply with policies and interventions is however linked to the values they attach to the resources [7;8]. For example, local communities that value a forest because of its economic values for subsistence and provision of livelihoods are more supportive of forest protection [6;9;10]. Information about forest values, particularly the economic values, of local community members are therefore critical in the implementation of new sustainable forest management intervention [3;10;11].

Contingent valuation method (CVM), an example of economic valuation methods, can be used to estimate the economic value of forests. It is a stated reference method for eliciting the economic value of goods and services that are not traded in markets [12-14]. Contingent valuation method (CVM) involves directly asking respondents what they will be willing to pay to obtain a non-market good, or what they will be willing to accept to forgo the goods or services [12]. The willingness to pay (WTP) value obtained is theoretical, but provides information about the value attached to the good by the respondents,

which in turn may reveal an individual's behaviour such as compliance and support for the good or service [3;6;9-11]. Reviews of the theoretical and empirical basis of CVM for estimating WTP for various environmental goods have been published in several countries [12-26].

The application of CVM in Ghana's forestry sector is limited. The two studies obtained from literature estimated entrance fees of visitors to Kakum National Park [27] and chainsaw operator's willingness to pay to harvest timber [28]. The study of Navrud and Vondolia [27] estimated that increasing entrance fees from US\$3 to US\$9 for domestic tourists and from US\$10 to US\$37 for foreign tourists will maximize financial revenues for Kakum National Park [27]. In the study of Acheampng and Marfo [28], chainsaw operators were also willing to pay to harvest timber if their activity is regulated. They were willing to pay a mean amount of Ghc 33.90 (USD 24)/tree for high quality trees, a mean amount of Ghc 17.72 (USD 12.7)/tree for medium quality trees and a mean amount of Ghc 9.43 (USD 6.7)/tree for low quality trees. Majority (50%) of the respondents also preferred to pay the amount as a tax on each timber tree they harvest. Contingent valuation method has also been used to estimate WTP for the provision of water [29], sanitation services [16;30], and the National Health Insurance scheme [31] in the country, with respondents willing to pay an amount between 1-3% of their income to support the proposed intervention.

Although it is important to understand the economic value of forest to local communities to guide policy development, until now, there has not been real assessment of the price of environmental services including that of the forest in Ghana. The current study contributes to this knowledge gap by estimating the monetary value that local residents are willing to pay for sustainable forest management and investigates the effects of socio economic variables including gender, education level, household income, and respondent age on their willingness to pay. If a substantial monetary value is stated by the respondents there would be a higher chance that they will support and comply with sustainable forest management interventions. We therefore ask two specific questions 1) are local community members willing to pay for forest management and 2) does gender, education level, household income and age of respondents influence the amount they will be willing to pay. This result is expected to help the sustainable management of Ghana's forest resources.

1. Methods

1.1 Study site

The study was conducted in 10 communities located at the fringes of Subri Forest Reserve (SFR) (Figure 1) in the Western Region of Ghana. The communities were Akyempem, Amanten, Benso, Botodwina, Esikuma, Essamang, Daboase, Nsadweso, Sekyere Krobo and Wassa Nkran. They were randomly selected from a total of 23 known communities around the reserve that form part of the Mpohor Wassa East administrative district, which covers a geographical area of 1880 km²

[32]. The communities selected are located at varying distance (1-12 km) outside the reserve. Subri Forest Reserve is the

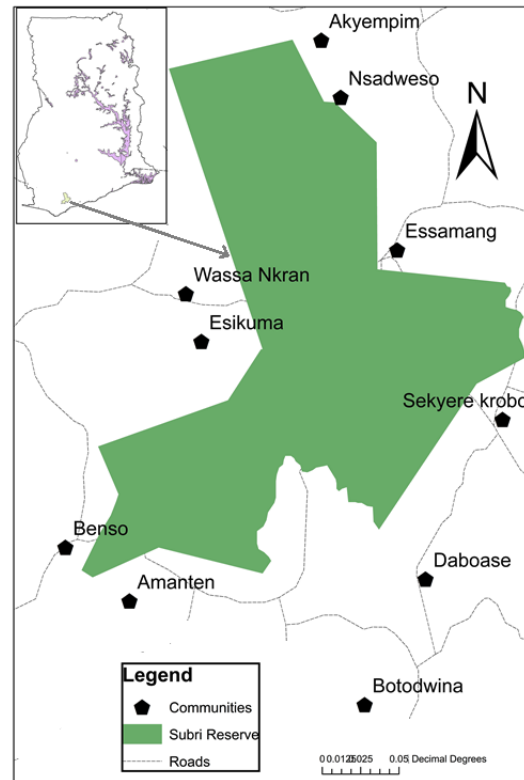


Figure 1. Location of selected communities around Subri Forest Reserve in Ghana

largest forest reserve in the High Forest Zone of Ghana. It covers a total land area of 587.93 km² of which about 160 km² has been designated as a Globally Significant Biodiversity Area (GBAS). SFR was gazetted in 1950, and lies between latitudes of 5°30' and 5°05' N and longitudes 1°35' and 1°55' W. It has generally, an undulating topography with altitudes ranging 60–125 m, but with some steep-sided hills reaching about 300 m [33]. The mean annual rainfall ranges between 1300 and 2000 mm. Vegetation in the area is mostly moist evergreen forest, with some wet evergreen forest. The reserve contains important species such as the plant *Sapium aubrevillei*, and the birds *Criniger olivaceus*, *Ceratogymna elata* and *Bycanistes cylindricus*, which are vulnerable in the country. Management of the reserve is done by the Forest Services Division (FSD) of the Forestry Commission of Ghana in collaboration with local chiefs, the District Assembly, Community Biodiversity Advisory Groups (CBAGs) and other stakeholders [33].

Over the years, illegal logging including chainsaw operations has been reported as a major contributor to the degradation of the reserve [9]. Community members have been accused as responsible for most of these activities since they are closer to the reserve. The government has therefore initiated several interventions including establishing community Resource Management Committees within the fringe com-

munities. Most of the communities have also been selected to undertake the new National Forest Plantation Development Programme being implemented by the government of Ghana to restore degraded forest cover, create employment opportunities and increase food production (personal communication). New interventions and programmes such as REED are being implemented by the government and are also expected to require the support of these communities (personal communication). It is therefore important to obtain information such as economic values of community members to help understand how they would comply and support these interventions.

1.2 The Survey

A survey was conducted in the 10 randomly selected communities around the reserve from June to August 2009. Thirty respondents from each community were randomly selected resulting in a sample of 300 respondents. To avoid bias, the respondents 18 years and older who were permanent residents were selected randomly from market places, houses, and community centres. Potential respondents were approached and asked if they were willing to participate in the study. The minimum age (18 years) was selected based on the constitution of Ghana, which consider only citizens 18 years and above as legally mature to participate in electing legislators and the president of the country.

Structured closed-ended questions were used in the survey. The questionnaires were translated from English into the local dialects (Fante/Twi) and administered face-to-face to the respondents. The first part of the questionnaire collected information including respondents' socio-economic and demographic characteristics: age, gender, marital status, occupation, average monthly income, land entitlement, education attainment, benefits derived from the reserve and level of concern about the current condition of the reserve. Respondents' level of knowledge about sustainable forest management was also assessed. Respondents were asked to state how knowledgeable they think they are about management of the reserve and about the extent to which they agree or disagree on the statement 'forestry practices generally produce long term negative effects on the environment'. Another question asked about the valuation process contained the hypothetical market for eliciting respondents' WTP.

1.3 Theoretical framework

We used the Dichotomous Choice (DC) elicitation method to measure the respondents' WTP in the survey followed by an open-ended question. The DC method has been commonly employed as one of the standard approaches to elicit respondents' WTP in contingent valuation studies. The main reason for the DC is that such a take-it-or-leave-it survey valuation question is more likely to reflect real daily world market decisions which individuals are confronted with. Moreover, the DC reveals itself to be less vulnerable to strategic bidding behaviour than, for example, the open ended elicitation format.

The theoretical approach behind the DC elicitation format used in this paper was firstly proposed by Cameron [18].

Where WTP is modelled as a latent variable, an alternative to a discrete choice problem, as it was proposed by Hanemann [34]. The strength of Hanemann's [34] framework is that it provides a sound theoretical background to the statistical experiment proposed in Bishop and Herbelein [13]. Such background is the Random Utility Theory, which links CVM answers with a utility maximization problem. Under this theoretical framework the respondents' answers to dichotomous choice in the hypothetical market allow to assess the individual demand for environmental quality with appropriated econometric tools and thus, quantify in monetary terms the underlying welfare change. Within this framework, survey respondents were asked whether or not they would be willing to pay some specific monetary amounts for obtaining a change in environmental quality such as sustainable forest management in the Subri Forest. The individual's Willingness to pay (WTP) reveals information about the value placed on the environmental improvements.

We asked respondents to answer YES or NO when asked if they are willing to pay a given amount (bid) for the good or service. After answering (YES/NO), they were not given another bid; they were however, asked an open question about the maximum amount they were willing to pay monthly for three (3) years to support the interventions. We acknowledge the limitation of the single bound but also considered the difficulty in using the double bound in local communities, particularly, when similar studies have not been undertaken in these areas. See Whittington [17] for some of these difficulties. In this situation we believe the single bound offers the opportunity to estimate the respondents' WTP towards sustainable forest management.

Since no study has determined willingness to pay of respondents for forest management in this area, it was difficult to decide the bid amount for the study. Willingness to pay estimates from the contingent valuation studies of Boadu [29], Whittington et al. [16], and Asenso-Okyere et al. [31], were obtained from respondents who have similar social and economic conditions, and therefore guided the current bids used. Three bids were therefore presented: GHc 1 (A), GHc 1.5 (B) and GHc 2 (C). Each bid was systematically offered to 10 randomly selected respondents in each of the 10 communities, resulting in 100 respondents for each bid. The systematic approach was done by offering bid A to the first respondent, bid B to the second, and C to third. The cycle was then repeated in this order until the end of the survey. The bids were not on separate cards but on the questionnaire sheet as the hypothetical market.

The hypothetical market read:

"A reliable independent conservation group with excellent track record is expected to take over the responsibility of managing Subri Forest reserve. The group is going to develop management plans and implement interventions such as tree planting, community participation in monitoring of the forest, prevention of illegal chain-sawing and capacity building to sustainably manage Subri Forest Reserve. This intervention is

expected to result in improving wildlife and tree management, reduce resource use conflicts, protect water bodies, develop access to forest resources, equity sharing of benefits from forest and enhance protection of endangered species. It will also prevent community members without the required license to enter the reserve for commercial exploitation. Are you willing to pay the amount (the bid) I am about to offer you as a contribution each month for 3 years, into an established community fund to support this intervention? You must be aware that the proposed project is specific to Subri Forest Reserve, even though Ghana may have other reserve facing similar challenges. Please consider your income and other important demands you need to satisfy before making the choice”.

1.4 Data Analyses

The data obtained from the interview were analysed using the statistical package R. Descriptive statistical tools such as mean, standard errors and percentage were used to summarize the variables of interest. A Chi squared test was also done to test if an association exists between respondents' socio-economic variables and the response to bid offered. Multiple Regression with a linear model was used to determine the influence of socio-economic factors on respondents' WTP for sustainable forest management. The response to the open question (stated willingness to pay (SA)) was regressed with age, gender, educational level, and average monthly income. These variables were chosen based on findings of previous studies [23-25]. The variable SA was logarithm transformed to ensure normality and homogeneity of variances. Table 1 presents details of the variables used in the regression analysis.

The mean *stated willingness to pay* (MS_A) was derived from simple arithmetic calculation:

$$MS_A = \frac{1}{n} (y_1 + y_2 + y_3 \dots + y_i \dots + y_n) \text{ Equation 1}$$

where n is the sample size, and y_1 and y_i is a stated WTP amount of the first and the i^{th} respondents respectively. To estimate the *true willingness to pay* from the bid we used the dichotomous choice analysis on the random utility [15]; we assume that each i^{th} respondent has a willingness to pay for forest management that is equal to Y_i and is related to the person's characteristics X_i in the following way:

$$Y_i = X_i\beta + \varepsilon_i \text{ Equation 2}$$

where ε_i is an error term representing variables that affect WTP but are not observed by the researcher and β is a vector coefficient of X_i [15;20].

If it is the bid offered arbitrarily to the i^{th} respondent, we assumed that the respondent will state that they are willing to pay the offered amount (i.e. answers Yes to the bid, t_i), if $Y_i \leq t_i$ or $X_i\beta + \varepsilon_i \leq t_i$. On the other hand, they will refuse the bid (i.e. answers No to the bid, t_i) if $Y_i < t_i$ or $X_i\beta + \varepsilon_i < t_i$. The response Y_i is therefore a discrete variable (yes = 1 and No = 0). Using the standard PROBIT model the error term (ε_i) is considered to be independent and normally distributed with mean of zero (0) [15]. A Generalized Linear Model with the binomial family and PROBIT link function was therefore fitted with the dependent variable being a YES/NO response of

respondents to the bid. The model determined the probability of the respondent to accept the proposed willingness-to-pay value. The mean '*true willingness to pay* (MTA) can therefore be calculated as:

$$MT_A = -\frac{\alpha}{\lambda} \text{ Equation 3}$$

where α is the intercept and λ is coefficient of the bid from the PROBIT model [20].

2. Results

2.1 Respondents' profile

The average age of respondents was 37 ± 0.9 years with about 10% more females than males and the majority (72%) married (see Table 1). Most (75%) of the respondents depend on the forest for their livelihood; the resources they obtain from the reserve included firewood and other non-timber forest products. More than half of the respondents (54%) owned land and as a result the major occupation was farming with 46% being crop farmers. About 74% stated that they were highly concerned about the current condition of the reserve. However, few (16%) of the respondents believed they were knowledgeable about forest management practices with most (59%) unable to state whether they are knowledgeable or not. They were also equally divided as to whether forest management practices have a negative impact on the forest or not; 40% disagreed with statement, 39% agreed while 21% had no opinion.

Table 1. Descriptive summary of variables used in the regression analyses (N = 231)

Variable	Description	Min	Max	Mean	SD
Education	Years of education	0	15	6.9	4.3
Income	Respondents average monthly income (GHc)	4	1000	96	136.1
Age	Respondents age	18	80	36.7	14
S_A	Maximum willingness to pay	0.1	10	2.22	2
Gender		Male (0)		Female (1)	
		44.6		55.4	

2.2 Response to bid

The probability of answering 'YES' decreased when the bid amount increased while the probability of answering "NO" increased when the bid amount increased (Figure 2). Two thirds of the respondents (75%) offered the lowest bid (1 GHc) agreed to pay. Also, 66.7% offered the middle bid (1.5 GHc) and 48.5% offered the highest bid (2 GHc) accepted to pay their bid (Figure 2).

A total of 20.3 % of the total observations was considered non-valid for the aim of eliciting respondent willingness to pay for forest management.

Table 2. Association between respondents responses to proposed bids and their demographic characteristics after removing the protest bids (N = 231)

Category	Bid offered GHc																																																																																																																																																																																																																																								
	A = 1					B = 1.5					C = 2																																																																																																																																																																																																																														
	YES (%)	NO (%)	p value	YES (%)	NO (%)	p value	YES (%)	NO (%)	p value	YES (%)	NO (%)	p value																																																																																																																																																																																																																													
Gender													Females	93.3	6.7	0.509	78.3	21.7	0.392	62.2	37.8	0.809				Males	96.8	3.2		85.7	14.3		64.9	35.1					Occupation			0.03			0.625			0.642				Farmers	100	0		83.8	16.2		66.7	33.3					Others	88.9	11.1		79.5	20.5		61.4	38.6					Concern			0.15			0.869			0.808				High	94.7	7.8		81	19		64.3	35.7					Low	100	0		82.6	17.4		61.1	38.9					Derive Benefit			0.415			0.305			0.752				No	91.7	8.3		89.5	10.5		60	40					Yes	96.2	3.8		79	21		64.4	35.6					Owned land			0.616			0.816			0.676				Yes	95.7	4.3		82.5	17.5		65.8	34.2					No	93.1	6.9		80.5	19.5		61.1	38.9					Marital status			0.173			0.641			0.669				Married	96.6	3.4		80.3	19.7		61.7	38.3					Others	88.2	11.8		85	15		66.7	33.3				
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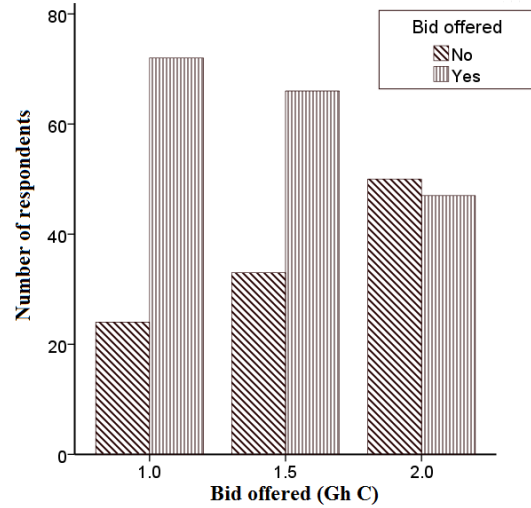


Figure 2. Number of response to the bid

These were respondents who said ‘NO’ to bids offered them and refused to state their maximum willingness to pay (the open ended question), and those who said ‘YES’ to the bid but stated zero as their maximum willingness to pay. These observations were treated as protest bid and excluded together with the missing values from the data, reducing the sample size to 231 for subsequent analysis. The chi-squared-test revealed no significant association ($p > 0.05$) between respondent’s acceptance or rejection of the bid and most of the socio-demographics considered (See Table 2 for details).

2.3 Factors influencing willingness to pay

A significant association between the independent variables and the dependent variable ($F(4, 227) = 25.23, P < 0.05$) was observed from a multiple regression model. About 31% of the variability in the model was explained by the predictor variables. The t statistic for the regression coefficient of age and monthly income were statistically significantly at $p < 0.05$ and $p < 0.1$, respectively. This confirmed our hypothesis that respondents’ age and income positively influence their willingness to pay. Older respondents and higher earning income respondents stated higher amount than their counterparts. Contrary to our hypothesis, however, education level and gender did, not influence the amount stated by respondents (see Table 3 for details). The MS_A was estimated according to equation 1 to be 2.22 ± 0.14 (approximately 1.59 US\$, 2009 rate). From the probit model the estimate of the bid had a negative sign as expected which indicate that, the probability of respondents refusing the bid increased with increasing bid (Table 4). The predictor variable Bid explained about 11% of the variability in the model.

From the model the true mean willingness to pay of respondents was estimated according to (3). $MTA = \frac{-2.8102}{-1.2428} = 2.26$ Ghc (1.61 US\$, 2009 rate).

Table 3. Standard multiple regression showing the effect of socio-economic factors on respondent stated willingness to pay

Variable	Standardized Coefficients (β)	p value
Education level	0.121	0.432
House Income	0.133	0.057
Respondent age	0.403	< 0.001
Gender	-0.059	0.161

Table 4. Probit regression for acceptance of proposed amount with only the bid as the predictor variable

Parameter	Estimate	Standard error	z Value
Intercept	2.8102*	0.44	6.35
Bid	-1.2428*	0.26	-4.7

AIC: 210.24
Pseudo R^2 (Dobson, 2002) = 0.105
Null deviance: 230.63 on 230 degrees of freedom
Residual deviance: 206.24 on 229 degrees of freedom

*p < 0.001

3. Discussion

This study has extended previously published research on contingent valuation of forests. It has shows that the residents of local communities in Ghana are willing to pay some positive value as contributions to manage the forest if the given hypothetical scenario is to be implemented. Each respondent was willing to pay approximately US\$1.60 monthly (US\$ 19.20 per year) for three years to support the proposed intervention. Older people and those with higher average monthly income were willing to pay higher amounts to support such intervention than younger people and those with lower incomes.

The willingness to pay amount was approximately 2.3% of respondents estimated average monthly income, and almost equal to the 2009 daily minimum wage (US\$1.89). It is difficult to compare WTP values of different studies since they were carried-out in times that had different economic conditions. However, for the sake of putting the current amount in context, it is important for such comparison. A study in the USA, estimated that individuals were willingly to make a hypothetical one-time payment of between US\$75 and US\$83 to preserve oak woodlands [19]. Such estimates are not much different to the estimate of this study, considering that high-income countries have a higher WTP for the protection of environmental goods than low-income ones [21]. Studies in Ghana that had respondents with similar demography as in the current study [16;31] estimated WTP for sanitation improve-

ment to be \$1.40 (1-2% of their income), and US\$3.03 for health insurance. Considering health and sanitation, which are of importance to most people, and the WTP value they stated, we can conclude that the amount estimated from the current study is very significant. This significant monetary value indicates the importance of the forest to local economy, consistent with studies that concluded that local households place high economic value on forest [6;9;10]. Multiplying up the respondents mean WTP, we have estimated that from our 231 respondents alone, an amount between \$4407.48 and \$4462.92 could be obtained annually to support sustainable forest management interventions.

Our results further suggest that WTP for forest management of the locals increases with increasing income. This is consistent with previous studies in other countries [22-26] where income level of respondents positively increased with the amount they were willing to pay. Respondents with higher incomes tend to have higher price elasticity, because they have more money to spend. On the other hand those with lower incomes have lower price elasticity, as they can afford to spend less. It should be mentioned that the intrinsic value of the forest is also important as it could influence even a respondent with low price elasticity to willingly pay a higher price. This result confirms the validity of the empirical model in accordance with theoretical expectations.

Respondents with a higher bid were more likely to refuse to pay than those given lower bids. This relationship called demand elasticity, measures how much the quantity purchased changes as a function of price. In the current study and most willingness to pay studies, as the bid increases, respondents are reluctant to accept it, and vice versa. Their demand or quest to sustainably manage the forest seems to have not changed; just the amount they are willing to pay. This can also be linked back to their real income and their purchasing power, which is inversely related to prices (in our case the bids). The relationship observed also provides support for the theoretical validity of the models and estimated willingness to pay value.

The positive relationship for age indicates that increasing in respondents' age effect corresponding increase in the amount stated. This contradicts previous studies where young people had stronger preferences (WTP) for conservation [24-26]. The current findings could be that older people in the area have more income than the younger ones or may have lesser expenses, and are therefore willing to spare more to sustainably manage the forest. It could also be that older respondents have more experience of the effect of unsustainable forest management that influenced their decision to be willing to pay more. Whatever the main reasons are, it is necessary to consider this age group difference when soliciting support for any forest management intervention.

Surprisingly, our study revealed that monetary value attached to forest was not influenced by a respondents' level of education. Thus in the current study, respondents' preference for sustainable forest management was independent of their education level. This contradicts previous studies [22;25] where

people with higher education level have been reported to be willing to pay more than their counterparts. A similar result was obtained for most of the other socio economic variables (Table 2) including the variable gender, where both males and females are willing to pay equal amounts to manage forest.

4. Conclusion

More than half of the residents of local communities on the fringes of the Subri Forest Reserve are willing to pay a substantial amount, about 2.3% of their monthly income, as a monthly contribution for three years to support sustainable forest management. The amount estimated is theoretical, but reflects a high level of tangible concern of the respondents over the forest. This implies there could be high level of support and compliance from local communities if interventions as provided in the scenario are to be implemented in the area. This is a positive indicator of development for forest conservation, particularly for the successful implementations of new interventions such as REDD and VPA that seek to achieve sustainable forest management.

Forest dependent communities may be normally willing to pay for forest conservation or forest management interventions especially if their access rights remain unchanged or improve. Also, as in all economic valuation studies, willingness to pay amount estimated may not reflect the real value of the good and what they will actually pay in the real market. The single bound model used has also been criticised for being too simplistic and studies have recommended the double bound. We therefore made the effort to ensure that respondents well understood the hypothetical market and were willing to accept or decline the bid offered them. All protest bids for example were removed before the estimation of willingness to pay value. We also provided sufficient information and gathered information including respondents' forest resource use, level of awareness of respondents regarding sustainable forest management practices, interventions and management options to be implemented and how they were going to be affected by these in terms of the benefit they derive, to prevent misleading information. Further valuation of forests particularly in the areas that will include other important variables such as institutional and policy wide relevant variables, and respondent's attitudes towards forest would help inform policy and practical application of WTP values to achieve sustainable development.

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