How do local communities valuate forest conservation through participatory management? A case of Amhara Region, Ethiopia

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Abstract: Effective implementation of participatory forest management requires understanding of the needs of local communities and their valuation of forest resources conservation. Hence, this study used a contingent valuation method to estimate forest conservation value as hold by local community using data collected from 450 households in Amhara Region, Ethiopia. The findings reveal that most households (83.9%) are willing to pay for forest conservation practices. The estimated average willingness to pay (WTP) for forest conservation is found to be 121.17 birr per household per year. The binary probit model result reveals that education, access to extension services, farmland ownership, dependency on forest resources, and membership in community forest management organisations favourably determine WTP for forest conservation. The result indicates that a significant economic value is attached to forest resources conservation, and hence, this study suggests that participatory forest management approach is important in sustainable forest management and the livelihood of the local community.

Keywords: contingent valuation method; CVM; dry forest areas; sustainable forest management; probit model; willingness to pay; WTP; conservation; Ethiopia.

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1 Introduction

In Ethiopia, there is a substantial deforestation with an estimated reduction in forest area coverage from 15.11 million ha in 1990 to 12.5 million ha in 2015 (FAO, 2015). The major causes are increasing population, overgrazing, expansion of farm land, fuel wood extraction and unchecked human settlements (FAO, 2015; Lawry et al., 2015). Furthermore, absence of strong forest policy, inefficient institutional arrangement in forest resources management, and lack of knowledge on the significance of local institutions in forest resources management have negatively affected sustainable forest conservation practices (Lawry et al., 2015). Forest priority areas in Ethiopia have been established with little community involvement, which resulted in loss of motivation of the community to sustainably conserve forest resources (WBISPP, 2004). Over the past years, the forest management arrangement which restricts access and use rights to the local people has resulted in forest deforestation (Engida and Teshoma, 2012).

Although the need for conservation of forest resources is increasingly recognised; degradation of these resources has continued throughout the world. One of the major reasons of forest resources degradation is that values of forest resource are often underestimated in development and conservation policy design and implementation (Tilahun et al., 2015). The total economic value (TEV) of the forest resources, which is the combination of timber and non-timber forest products (NTFPs) provision value, environmental services value, existence value, option value and bequest value, is not completely taken into account in development and conservation policy decision making process (Sutcliffe, 2009). An appropriate solution to this problem requires sufficient knowledge on the value of forest resources among the different forest stakeholders and official decision makers. Estimation of the TEV of forest resources helps to reveal and determine their actual value, which could lead to optimal decisions about the forest land use system. Moreover, information with regard to economic value of forest resources hold by the local communities is essential for decision makers as this value influences how they respond and support policies and interventions. However, studies that address bequest and option value of dry forest resources are still rare in Ethiopia (Tilahun et al., 2015); and most analyses focus on timber and NTFPs resources of dry forest (Mamo et al., 2007; Worku et al., 2014). Households demand not only current use of forest resources but they do have a desire in the sustainable flow of the resource goods/services for themselves and future generation too. Hence, for the sustainable management of forest resources, it is required to examine demand of households for environmental

service values (like water supply and soil erosion protection) and their willingness to pay (WTP) in terms of option prices associated with option values (ensuring future sustainable supply of the forest resources including NTFPs regardless of whether households actually demand or does not demand these services in future) of dry forest resources (Smith, 1983; Nayak et al., 2018).

Valuation of forest resources is not only used as an input for policymakers but as potential local solution to understand the perceptions of the local people towards their involvement in forest conservation. The arrangements of community-based forest management would fail, if these are planned and implemented without prior consultation of the community as in the past. The performance of common property resources conservation depends highly on how their management is planned and implemented (Ostrom, 1990; Baland and Platteau, 1996). Gebremedhin et al. (2003) discuss that absence of participatory approach in designing and implementing community forestry programs has been one of the most important cause for the failure of forest conservation practices in Ethiopia in the past. They suggest that "the initiative for community forest development should emanate from the farmers themselves" and the role of external organisations should be demand-driven.

Over the past decade, Ethiopia has changed its forest conservation strategy from centralised top-down approach which was prevalent since the time of Menelik — the then emperor of Ethiopia to community-based forest conservation approach to ensure effective forest resources management and improvement in livelihood options of local communities (Ameha et al., 2014). Under the participatory forest management (PFM) program in Ethiopia, natural forest resources are state property, but the rights to use and manage them have been devolved to local communities, organised into forest user groups (Lemenih et al., 2011). In contrast to previous state managed forest policy, these policies and interventions promote the value of forests and recognise that sustainable forest management largely depends on the participation of local communities. But to ensure sustainability of the PFM practices, policymakers and decision makers must understand whether the envisioned benefits provided by the PFM program are economically and ecologically valuable for the local communities to conserve forests efficiently. Furthermore, NGOs have helped the local communities in planning and implementing PFM groups in the study area. However, after the completion of the projects by NGOs, it is necessary to understand whether the efforts by NGOs can be carried forward and maintained by local communities for sustainable PFM. This information can be reflected by the value people attach for conservation of forest resources or household's WTP for PFM.

In addition, a shift in approach to PFM requires understanding of local community needs and their valuation of forest resource conservation for sustainable conservation of forest resources. Since several forest areas are still under state ownership, efforts are needed in establishing PFM cooperatives. Given that a large magnitude of benefits and costs associated with forest conservation fall upon the local community (Bawa et al., 2004) and taking into account the fact that the sustainable conservation of forest resources highly relies on the support of local community, it is important to estimate value of forest conservation hold by local communities. Tucher and Ostrom (2005) opine that involvement of local communities in forest resources conservation could improve the sustainability of forest management. Therefore, the support and collaboration of the local community members is desirable for successful implementation of forest polices and interventions. However, the extent of the support by local communities and their

collaboration, and attitude towards forest policies and interventions is related to the economic values they attach to the forest resources (Bengston, 1994; McFarlane and Boxall, 2000). Hence, the analysis of economic valuation of dry forest resources is necessary for the successful implementation of new PFM interventions to enhance ecological and economic benefits.

Therefore, the objective of the study is to examine preferences of local communities for improving forest ecosystem in the dry forest resource areas of Amhara Region, Ethiopia by estimating households' WTP through PFM project that will ensure sustainable conservation of forests and improve the livelihood of the community. The study also investigates factors that influence households' WTP.

2 Study area and methodology

2.1 The study area

The study is conducted in two districts (Metema and Quara) in the lowland dry forests of Amhara Region located in northwestern Ethiopia (Figure 1). The study area receives an average annual rainfall of 955 mm. The annual minimum and maximum temperatures are 19.1°C and 35.6°C, respectively. According to CSA (2011), the total population of the districts is 225,290 inhabitants with 182,979 (81.2%) living in rural areas and the remaining 42,311 (18.8%) living in urban areas. Most of the people in the study area practice mixed crop-livestock production system as a dominant mode of livelihood (Lemenih et al., 2011).

Figure 1 Map of the study area (see online version for colours)
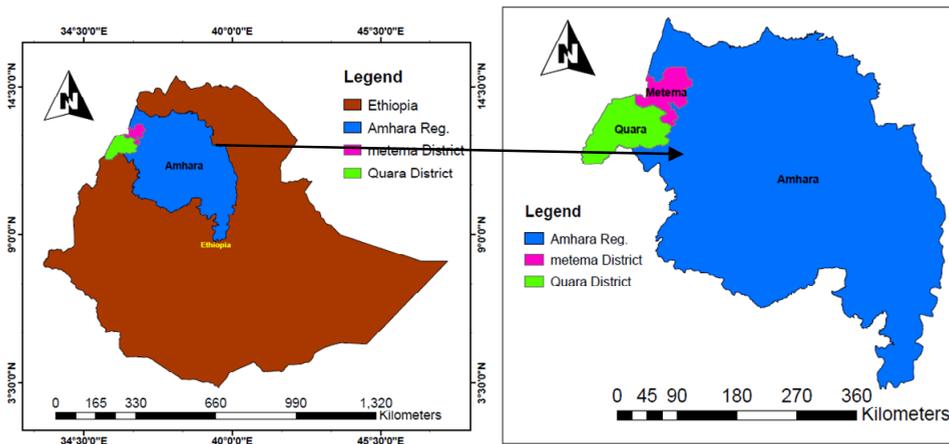
The study area which is largely covered with Combratum-Terminalia broad-leaved deciduous woodlands, is one of Ethiopia's dry forest resource area which host valued vegetation species (Lemenih et al., 2011). This vegetation provides socio-economic and ecological services both at local and international level. Some of the benefits include source of rural livelihood, fight against desertification, biodiversity conservation, protection of wetlands, and improve soil fertility and carbon sequestration. Particularly,

the dry forest resources are vital source of commercially valuable goods for instance frankincense and gum arabic or *acacia senegal* (Lemenih et al., 2011).

2.2   Sampling design and data collection

To assess households' WTP for forest conservation, a survey was conducted with contingent valuation (CV) questionnaire administered to 450 sample households from two purposefully selected districts between October 2018 and December 2018. Quara and Metema districts were selected purposively based on the extent of dry forest resources availability, representativeness and easy access. Then, from these districts, six *Kebeles*[1] were selected. From these Kebeles, 450 households were randomly selected applying proportional-to-size technique, based on the total number of households in each *Kebele*. Lists of household heads obtained from the local administrations were used as a sampling frame.

Primary data have been mainly collected using structured CV questionnaire through face to face interview with the heads of the households to obtain information associated to households WTP for forest conservation. In contingent valuation method (CVM), the researcher is required to go through various stages to design the final survey instrument. The guiding principle approved by the National Oceanic and Atmospheric Administration (NOAA) panel and other literature referenced in this study are followed while conducting this survey to address the issue of reliability on data generated from CV studies.

2.3   Contingent valuation method

People derive value from an environmental resource in various ways. The TEV of an environmental resource is the sum of all values people attach to it, i.e., use, option, existence and bequest values (Hussen, 2004). Non-use values consist of existence, bequest and option values. Markets exist for use values and market-based methods can be used for their valuation.

However, providing non-use values deal with the conservation of future products of forest resources, markets are not available for such products. Hence, the present demand for sustainable forest resources conservation activities cannot be measured through market forces. In addition, the public good attribute of some use values of forest ecosystem services makes their valuation difficult (Perman et al., 2003). Hence, economists apply various valuation methods to quantify the value of non-marketed environmental goods and services.

The CVM helps to measure the preference of people, in terms of monetary units, for any change in quantity and/or quality of non-marketable natural resource. In CVM survey, individuals are requested to reveal the amount of money they would be willing to contribute to secure goods and services from the resource or the amount of money they would be willing to accept to compensate for the loss of the resource. This method is named CV since the valuation depends on the proposed market scenario given to respondents about a specific environmental service that is going to be provided (Mitchell and Carson, 1989). Spash (2008) is of the opinion that CVM is widely applied to valuation of environmental resources because of the following three main reasons. The first thing is its simplicity. Secondly, the application of CVM seems unlimited in the sense that questions could apparently be asked concerning the provision of any

environmental services. The last and obvious reason is the CVM deals with both the use and non-use values of environmental resources.

This technique can be applicable to forest ecosystem which are not marketable. In such a case, it creates a hypothetical market, and estimates the possible values of forest resource goods and services if they could be marketed. In our case, demand side information is required for the implementation of the forest management program as participation of the resource users is desirable in different aspects such as financial contribution. In view of the required data and the nature of dry forest resource goods and services to be valued, we have applied CVM for the study.

2.4 Questionnaire and survey design

The household survey questionnaire consists of different sections which inquire the respondents about the household's demographic characteristics, their income and wealth, household's assessment of WTP for participatory forest conservation program and others. The last section of the survey highlights the hypothetical market scenario on the forest resources to be valued. Specifically, the valuation scenario includes descriptions of the good (what is being valued), the constructed market (how the good will be provided) and the method of payment (how the price will be paid). We have designed the hypothetical market scenario based on the development of existing forest condition of the area by presenting an option to participatory forest conservation program. This scenario was explained as the participatory forest conservation program that can ensure to the local community – an option of meeting future demand for the various goods and services from the resource, for the existence of the resource and protects from extinction; and improves the wellbeing of the future generation.

It is essential to carefully draft and pre-test a CV questionnaire in order to ensure that it reflects the pertinent attributes of the actual market and that respondents have understood well the hypothetical market scenario (NOAA, 1993). So, questionnaire development in this study involved a focus group, a key informant interview and a pre-test. The pre-test has also helped us in determining the bid vectors which we used in the single bounded value elicitation format in the final survey. The starting bid values generated from group discussions and pre-test were 39, 51, 79, 100, 116, 145, 190 and 250 birr[2] per household/year.

In this study, we have used single-bounded dichotomous choice (SBDC) value elicitation format with a follow up open-ended maximum WTP value elicitation format. In the SBDC format, the respondent is requested to state only 'yes' or 'no' to a randomly assigned bid value from various predetermined bids which possibly reveal the maximum WTP amount of the respondent for a good to be valued. Then, the respondent reply 'yes' if she/he is willing to buy the good and 'no' otherwise (Mitchell and Carson, 1989).

The SBDC value elicitation format has been recognised and recommended by the NOAA (1993) panel. The format is widely popular among researchers because it resembles the situation in the actual marketplace. The respondent makes a decision about the price of a good or service in the same way she/he decides whether or not to purchase a given commodity in the market, with a stated market price. The format provides incentive for the respondents to honestly show her/his preference of the good by stating the actual WTP (Carson et al., 1996). That is, it is the respondent's planned interest to

accept the initial bid offered if her/his WTP is greater than or equal to the price requested and reject it otherwise.

Moreover, in addition to single dichotomous value elicitation question, the application of an open-ended follow up valuation question has been recommended and applied by Mitchell and Carson (1989). Actually, this type of value elicitation format is similar to what people in Ethiopia used in actual marketplace, as compared to the single dichotomous choice format only. An individual as a buyer of a product expects the seller to state the price first and then after negotiation the buyer would state the final amount she/he would pay (Asrat et al., 2004).

2.5   Empirical model specification for measuring WTP

The random utility theory of Hanemann (1984) is the base for our econometric model analysis of respondents' binary choice valuation response. The core idea in this theory is that though a respondent knows her/his utility definitely, some components are unobservable from the researcher point of view. Thus, the analyst can only make a probability statement about respondent's 'yes' or 'no' response to the proposed forest management project. According to the theory, utility (U_i) arising from 'yes' or 'no' responses to a WTP question consists of observable component (V_i) and unobservable component ($\in_i$):

$$U_i = V_i + \in_i \tag{1}$$

If the response of the household is 'yes' for randomly assigned initial bid value, it obtains the non-marketable environmental good or service (forest conservation benefits in our case) and household's income is decreased by the bid amount. The dichotomous choice model is based on the hypothesis that households maximise their utility function. In economic theory, there exists an indirect utility function which relates household maximum utility with their income (Y_i), the level at which the non-marketable environmental good such as forest conservation program (W) will be provided, and other household socio-economic characteristics (Z_i). A household utility level will be influenced by a change in one of these variables. Hanemann (1984) assumes that the jth household will accept the proposed initial bid value to maximise her/his utility from the forest conservation program given that the following condition is satisfied:

$$V_{1j}\left(W^1, Y_{1j} - t_{1j}; Z_{1j}\right) + \in_{1j} \geq V_{0j}\left(W^0, Y_j; Z_j\right) + \in_{0j} \tag{2}$$

where V_{1j} is the household indirect utility function after improved forest conservation W^1 and V_{0j} is the household indirect utility function at the status quo W^0. W^1 is greater than W^0, which indicates greater non-marketable environmental benefit from the forest resources in a state of improved forest resources conservation than the status quo level. Y_j is household income, t_j is the initial bid value, Z_j represents other household demographic and socio-economic variables, $\in_{0j}$ and $\in_{1j}$ are random variables which are expected to be distributed identically and independently with zero mean.

The household certainly knows which alternative maximises her/his utility. But what the researcher observes is the 'yes' or 'no' response of the respondent for the randomly assigned initial bid value either supporting the improved forest conservation program or stay at the existing condition. The dependent variable is single binary choice, and the jth

household response will be 'yes' to the proposed initial bid value only if the condition in equation (2) is fulfilled and the probability distribution of a 'yes' response is given by:

$$\Pr_j(yes) = \Pr\left\{V_{1j}\left(W^1, Y_{1j} - t_{1j}; Z_{1j}\right) + \in_{1j} > V_{0j}\left(W^0, Y_j; Z_j\right) + \in_{0j}\right\} \tag{3}$$

The probability statement [equation (3)] is a base for dichotomous response analysis assuming the utility function is additively separable with deterministic and stochastic preference components.

Let $\eta = \in_{0j} - \in_{1j}$ and $F\eta(.)$ be a cumulative distribution function of η. This gives the basic structural model for probability estimation. The probability can be estimated either using a logit or probit model depending on the assumption on the distribution of the error term or computational simplicity (Greene, 2003). In the probit model, $F\eta(.)$ follows the normal cumulative distribution functions, while in logit model $F\eta(.)$ follows the logistic cumulative distribution function. Assuming the normal cumulative distribution, we express the probit model as follows:

$$Y_j^* = F\left(\beta_i X_i + \in_i\right) \tag{4}$$

where β_i represents the parameters of the model, X_i represents the explanatory variables, $\in_j$ represents the random error term which assumes to have random normal distribution with mean zero and common variance δ^2, and Y_j^* is unobservable households actual WTP for forest conservation and it is simply a latent variable.

Then, according to Hanemann (1984), the response probabilities associated to the underlying WTP distribution are:

$$\Pr\left\{yes\ to\ t_j\right\} = \Pr\left\{t_j = Y_j^*\right\} = F\eta(.)$$
$$\Pr\left\{no\ to\ t_j\right\} = \Pr\left\{t_j > Y_j^*\right\} = 1 - F\eta(.)$$

In single bound dichotomous choice, respondents indicate their WTP by answering 'yes' or 'no' to a set of bid values. With single dichotomous choice valuation approach, the likelihood function can be expressed as a series of Bernoulli trials [equation (5)].

$$L = \sum_{j=1}^{n} WTP_j \ln P_j + \left(1 - WTP_j\right) \ln\left(1 - P_j\right) \tag{5}$$

where $P_j = P(WTP_j / X_i, \beta_i)$ is j^{th} individual's response probability, and WTP_j is dummy variable indicating individual's choice 1 for 'yes' and 0 for 'no' (Hanemann and Kanninen, 1998).

Given the above justification, the probit model for households' preferences for the forest conservation is specified as follows:

$$\begin{aligned}
WTP_j &= \beta_0 + \beta_1 BID + \beta_2 AGE + \beta_3 EDUCATION + \beta_4 HHSIZE + \beta_5 LANDSIZE \\
&+ \beta_6 REGPROVENANCE + \beta_7 PARTNTFP + \beta_8 AWAREDEFORST \\
&+ \beta_9 RECEIVEDEXT + \beta_{10} MEMBORG + \beta_{11} BENCOMMUNITY \\
&+ \beta_{12} DISTMARKET + \in_j
\end{aligned} \tag{6}$$

The econometric regression probit model [equation (6)] is used to identify factors influencing the WTP of a household for the forest conservation.

Where WTP_j represents WTP for forest conservation = 1, if the respondent accepts the proposed bid value; = 0, otherwise, β_0 is an intercept term, β_i, i from 1 to 12, are parameters of the regression model, $\in_j$ represents the random error term. The independent variables of the probit regression model [equation (6)] are defined and described in Table 1.

Table 1   Description and summary statistics of the independent variables in the binary probit model and their expected relationship with WTP for forest management

Variables	Description	Mean	SD	Expected sign
BID	Initial bid value (birr/household/year)	121.05	66.79	–
AGE	Household age (years)	41.01	10.4	+/–
EDUCATION	Years of schooling	1.64	2.73	+
HHSIZE	Household size	4.7	1.58	+
LANDSIZE	Landholding size in hectares	4.98	2.65	+
REGPROVENANCE	Regional provenance, 1 if the household is native, 0 otherwise	0.33	0.47	–
PARTNTFP	Participation in NTFPs collection, 1 if yes, 0 otherwise	0.91	0.28	+
AWAREDEFORST	Awareness of deforestation, 1 if yes, 0 otherwise	0.71	0.45	+
RECEIVEDEXT	Received extension services, 1 if yes, 0 otherwise	0.45	0.49	+
MEMBORG	Households involvement in community-based forest management organisations, 1 if yes, 0 otherwise	0.69	0.46	+
BENCOMMUNITY	1 if the household believes in forest beneficiary community responsibility in conservation, 0 otherwise	0.59	0.49	+
DISTMARKET	Distance to nearest market in hours	0.95	0.35	+/–

One of the objectives of empirical probit model estimation is to compute the mean WTP distribution of the households (Hanemann et al., 1991). We have estimated mean WTP using Cameron (1988) approach. According to this approach, the mean WTP using single-bounded probit regression model is defined as follows:

$$\text{Mean WTP} = \frac{-\left[\beta_0 + \sum_i^n \beta_i \mu_i\right]}{\beta_1} \tag{7}$$

where β_0 is the intercept term, β_i is the parameter of the ith independent variable, μ_i the mean of the ith independent variable, and β_1 the coefficient of the initial bid (BID).

3 Results

3.1 Socio-economic and demographic characteristics of sample households

The majority of the respondents (67%) are migrants who came from different areas of Ethiopia through either self-initiated migration or state supported resettlement program or self-initiated migration (Table 1). Most of the households are headed by males (96.8%). The age of the household heads is within the age ranges of 20–69 years, with average 41 years. The average household size is 4.7. While 48.6% of the household heads are illiterate, only 29.3% can read and write, 18% completed primary school, and 4.1% completed secondary school. A large proportion of the households (99.1%) own land. Size of landholding varied between 0–15.75 ha, with mean about 5 ha per household. Livestock is another asset of households. About 93.6% of the respondents practice livestock rearing. Livestock holding ranges between 0–31.3 TLU[3], with average 10.5 TLU. The majority of the sample households (91.1%) are forest dependent households with diverse livelihood systems. The main income sources of the households include crop and livestock production, NTFPs collection, off-farm employment and transfer payment. Income from crop accounts for 50.3% of the average aggregate household income. Income from NTFPs has been the second most significant source of income for households and constituting 23.3% of the total household income. The majority of the households (71.1) perceive the presence of deforestation in the area.

3.2 Perceptions of households regarding forest resource benefits and deforestation

The majority of the households (80.9%) report that forest resource-based activities are important for the improvement of their livelihoods. The study result reveals that households value different types of dry forest benefits. The major benefits of dry forests for households are identified as source of fuel wood (47%), environmental services like soil and water conservation (26%), and source of household income (13%) (Figure 2).

Figure 2 Perceptions of households regarding forest benefits (see online version for colours)
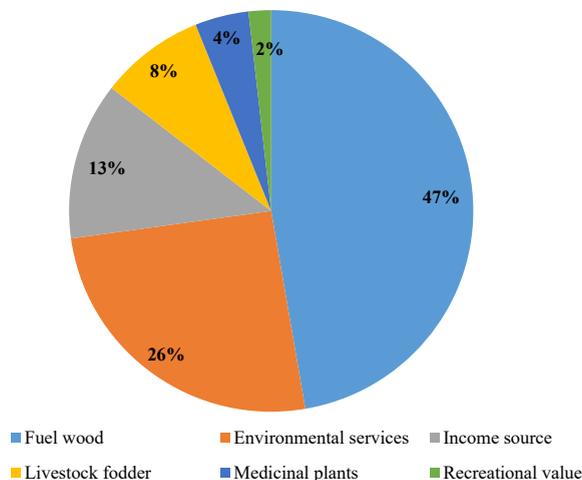
The dry forest resource of the study area is one of the extremely deforested dry forest areas in Ethiopia (Lemenih et al., 2007, 2014), and as expected, the majority of the sample households (71.1%) perceive that the dry forest status is deteriorating. The respondents state that the dry forest resources of the area are facing the tragedy of the commons because of absence of a responsible body who could manage it properly. Even though the forest is owned by the state, the state administration at local level failed to sustainably manage the forest resources. Poor forest management/use, agricultural land expansion, settlement expansion, human induced fire, fuel wood cutting and forest grazing are the major drivers of forest degradation in the study area (Table 2). Most of these factors also coincide with the causes of forest degradation by other study in Metema District (e.g., Lemenih et al., 2007).

Table 2   Causes of dry forest resources degradation

Causes of forest degradation	Perceptions of households (%)
Poor forest management/use	64.2
Agricultural land expansion	46.7
Settlement/population pressure	41.0
Human induced fire	36.7
Cutting for fuel wood and charcoal	26.6
Forest grazing	14.4

3.3   Analysing WTP of households for forest management

3.3.1   WTP response

All households report that they want forest resources in their locality to be managed sustainably and most of the households (83.86%) are willing to pay to assist the improved forest management practices. As presented in Table 3 while most households (73%) accept the randomly assigned initial bid value to support forest conservation program in the single dichotomous choice valuation question; the remaining 27% reject the initial bid value. Of the total respondents (119) who rejected the initial bid offered, 48 (40.34%) gave some lower value when they are asked to state their maximum WTP in the follow up open ended valuation question. Those households who are not willing to contribute any amount for the forest conservation management are asked their reasons. Accordingly, 71 (16.14%) are not willing to pay because of inability to pay which is taken as a valid 'no' answer or zero bid.

The share of households who accepted the proposed initial bid value declines as the proposed initial bid value rises (Table 3). The share of 'yes' response ranges between 89.1% and 53.7%. Thus, the bid vector seems to have been appropriate. The proportion of WTP across the initial bid values is found to be in line with the prediction of economic theory, which states that for normal goods and services, as the price of the good or service increases demand for it declines.

Table 3   Distribution of households 'yes' response to the initial bid values

Initial bids (in birr)	Number of households/bid	% share of 'yes' response per bid
39	55	89.1
51	55	87.3
79	55	87.3
100	55	76.4
116	55	74.9
145	55	62.9
190	55	51.8
250	55	53.7
Pooled	440	73

3.3.2 Determinants of WTP for forest conservation

In this study, we have estimated the probit regression model to identify the main factors which determine the probability of households' WTP for forest conservation program (Table 4).

Table 4   Determinants of households' WTP for forest conservation (use of probit model)

Variables	Coef.	Std. err.	z-value	P > |z|
BID	–0.009	0.001	–6.32	0.000
AGE	–0.003	0.009	–0.31	0.759
EDUCATION	0.078	0.036	2.14	0.032
HHSIZE	0.045	0.060	0.76	0.450
LANDSIZE	0.359	0.049	7.20	0.000
REGPROVENANCE	–0.498	0.192	–2.59	0.010
PARTNTFP	0.879	0.348	2.53	0.011
AWAREDEFORST	0.086	0.188	0.46	0.647
RECEIVEDEXT	0.427	0.185	2.31	0.021
MEMBORG	0.898	0.181	4.96	0.000
BENCOMMUNITY	0.640	0.186	3.43	0.001
DISTMARKET	0.007	0.004	1.60	0.110
_cons	–2.20	0.738	–2.98	0.003
Number of observations	440			
LR chi2(12)	232.34			
Prob. > chi2	0.01			
Log pseudo likelihood	–140.66			
Pseudo R2	45.23			

Our result reveals a significant (P < 0.01) negative relationship between the proposed initial bid value (BID) and probability of households WTP for conservation; indicating that likelihood of WTP for conservation activities declines as the initial bid values rises.

Education level of the respondent (EDUCATION) is found to have a significant (P < 0.05) positive influence on the likelihood of respondents WTP for forest conservation as expected. This finding suggests that respondents with a higher educational achievement have a higher probability of WTP for forest conservation than those with lesser educational achievement. The wealth indicator, land size (LANDSIZE), is found to have a highly significant (P < 0.01) and positive influence on the probability of WTP to support the forest conservation practices.

The variable regional provenance (REGPROVENANCE) is negatively and significantly (P < 0.01) associated with household's probability of WTP for forest conservation program. This implies that compared to the native households, immigrants are more likely to support the forest conservation project in their locality. As expected, the variables household forest dependency (PARTNTFP) and extension service access (RECEIVEDEXT) are positively and significantly (P < 0.05) associated with households' WTP for improved forest conservation program.

The regression result showed that individuals with prior experience as a member in community-based forest management groups (MEMBORG) have a significant (P < 0.01) positive influence on the probability of households WTP for improved forest conservation practices in their locality. The perception of the respondents on the responsible body for forest management (BENCOMMUNITY) is found to have a significant (P < 0.01) positive influence on respondents' WTP for forest conservation. This result implies that respondents who believe that forest beneficiary community is responsible for forest conservation are more likely to pay for improved forest conservation.

3.3.3   Calculating mean WTP: single bounded model estimate results

As we discussed in the methodology part, one of the objectives of estimating probit model is to calculate the welfare statistics (probit mean WTP) from the single dichotomous choice valuation responses. The mean WTP is estimated using equation (7) and the parameters of the probit model used in this equation are given in Table 4. Accordingly, the mean WTP for forest conservation is estimated to be 121.17 birr per household/year. This result is mainly essential when researchers and policy makers have to estimate the aggregate benefit of a resource in a cost-benefit framework.

4   Discussion

4.1   Local community's characteristics and their perception regarding forest benefits

The sample households in this study have various income sources. Income from NTFPs collection has been the second most essential income source. Relatively poor households depend more on NTFPs than wealthy households for their livelihood. This may be an indication that relatively poor households are engaged in NTFPs extraction to mitigate their vulnerability to unexpected income shortfalls, and as such involvement in NTFPs extraction may be seen as safety nets. These results highlight that forest resources are highly important in the study area. Hence, the provision of 'forest resource use rights' to local community is a key element of effective forest governance in any forest

management project designed to promote involvement of local communities in forest management. Moreover, since most households' value forest resources as important source of livelihood, they may think that the forest conservation program will have a negative impact on their livelihood. Hence, promoting alternative income generating ways is also believed to motivate the local community to contribute for improved forest conservation.

Most of the local communities perceive that the dry forest status is deteriorating, and poor forest management has been one of the major causes of forest deterioration. The respondents state that the dry forest resources of the area are facing the tragedy of the commons because of absence of apt institutions which could manage the resource properly. Even though the forest is owned by the state, the state administration at local level failed to sustainably manage the forest resources. This condition highlights the need for proper forest management arrangement that secures local communities, the ultimate forest protectors, and forest use and management rights.

Generally, information with regard to socio-economic features of local community, their awareness about benefits of forest resources and forest degradation can support the decision in determining better approaches to promote PFM programs in the dry forest resource areas of Amhara Region.

4.2 Households WTP for forest management

In spite of the fact that Ethiopia is a low income country, the results show that local communities are willing to contribute for management of natural resources, in which 83.86% of the households are willing to pay for management of dry forest resources so as to secure the option, existence and environmental service values of the resource. This result is consistent with the outcomes of other studies in Ethiopia that examine the WTP of the local community for forest resources conservation (Tilahun et al., 2015). The mean WTP of the households for forest conservation has been estimated as about 121.17 birr/household/year. Extrapolating this value to the entire households of the study area, i.e., 56,320, aggregate WTP for forest conservation come to be 6,824,294 birr/year. This result implies the considerable significance of forest resource conservation to the local community. Thus, to improve the welfare of the community financial assistance to forest conservation program, from government, NGOs and local community, must continue. What is interesting here is that, this aggregate WTP amount is much higher than the annual budget allocated (1,000,000 birr per year on average) by district environmental protection office and other organisation for the management of the forest as informed by the key informants. It is also essential to note that the budget allocated for dry forest resources conservation by these organisations is intermittent. Thus, this aggregate WTP has the potential to improve the efficiency of forest resources management as it is sustainable and much higher than what is allocated before for forest conservation management practices.

The validity of WTP estimation results of CVM is confirmed by whether WTP is influenced by the factors suggested as significant by economic theory and whether the direction of influence is consistent with prior expectations. The analysis of the bid function helps us to identify the main determining factors of households WTP for forest conservation. WTP increases with household wealth, and but declines in the price of the forest conservation program. In other words, participatory forest conservation program is

considered as a normal good. Moreover, the demand for forest conservation is consistent with the law of demand.

Respondents' education level is found to have a significant positive relationship with the probability of its WTP for forest conservation. This finding confirms the significance of education in enhancing awareness and knowledge about environmental issues. The underlying argument is that individuals with better education level can easily recognise the forest resource conservation benefits and the adverse effects of forest degradation. Thus, they are more likely to give higher value for forest conservation than those with lower educational level. The finding of this study is supported by previous studies (Jumbe and Angelsen, 2007; Bogale, 2011; Tilahun et al., 2015; Tonin, 2018).

The land holding size is found to have a positive significant impact on WTP of households. This indicates that forest management is a normal good for which individual's demand rises as income rises, validating economic theory. This result is in line with the theoretical prediction that asset ownership motivates people to contribute for improved environmental resource conservation. Furthermore, low landholding households are less willing to contribute for forest management perhaps since they are dissatisfied with their current landholdings, and thus they may have a desire for expanding their land holdings before the implementation of forest management practices. From the group discussion, we understand that new settlers coming to the area are clearing forest lands to get more farm lands illegally in addition to legally acquired land. According to Köhlin (2001), wealthy households are more likely to cooperate in social forestry projects, that is, adoption to new initiatives and technology is highly easier for rich households. Mekonnen (2000), Girma and Beyene (2012) and Bogale (2011) found a similar result in their study of people's willingness to contribute for forest management in Ethiopia. This finding has important policy implications with regard to having farmland distribution balance, which could otherwise result in conflict between the forest management project and local people with less farmland. This policy will ensure the likelihood of households' willingness to cooperate for collective forest management to persist.

The finding of our study show that immigrants are more likely to pay for forest conservation activities compared to native households. According to the information obtained from key informant interviews, the majority of immigrants came from areas where the issues of environmental degradation are serious. Hence, immigrants who have experienced environmental degradation are more willing to contribute for improved forest management practices since they are aware of the consequences of environmental degradation and recognise the need for improved forest management.

Households who depend on NTFPs are more likely to contribute for forest management than those who do not depend. This is perhaps because people dependent on forest resources are more likely to recognise the significance of forest resources, value forest provisioning services and are more interested in conserving forest resources. Various literatures pointed out high dependence on forest resources and higher expectation of benefits from quality of forests stimulates people to contribute for forest management. Our study result is consistent with the findings of other studies (Jumbe and Angelsen, 2007; Bogale, 2011; Coulibaly-Lingani et al., 2011; Soe and Youn, 2019). The finding highlights the necessity of providing forest resource use rights to motivate people for cooperation since forest users consider the present and future benefit flows in their decision to participate in forest conservation.

The study result revealed a positive association between household's access to extension service on forest management and its WTP for forest management. This is because effective extension services could enhance their knowledge on sustainable forest resources management, which improves their perceptions and attitudes about forest resources conservation. Our finding reveals that attitude of local people towards improved natural resource conservation is highly associated to their understanding levels on the issue of environmental resources, consistent with the results of Htun et al. (2012). Bogale (2011) reveal that households having access to training are more likely to contribute for forest management. Hence, to increase local community's contribution for forest management, information sharing and environmental education is required to enhance the awareness of the community.

In line with the hypothesis, we found that individuals' prior experience of membership in community-based forest management organisations have a positive influence on their WTP for forest conservation. This finding is consistent with the finding of Bogale (2011), who found households who are members of forest user group are more likely to contribute for forest management. According to the finding of McCarthy et al. (2004) and Girma and Beyene (2012) households past experience of involvement in local community organisations improves their cooperative behaviour in natural resources management. Similarly, the findings of our study reveal that a respondent who perceives that forest beneficiary community is responsible for forest management has positive attitude towards forest conservation and more willing to cooperate in forest management activity. This is in line with studies like Girma and Beyene (2012), which report that people who believe forest management is a responsibility of the local community are more willing to cooperate in collective forest management. Usually, most people realise environmental resources conservation is the responsibility of the government (Grafton, 2000). If local forest dependent communities do not consider forest management as their obligation, they might not be ready to accept the responsibility.

5   Conclusions and policy implications

In this study, CV survey responses are analysed to get more insights on the value of forest resources to the local community and to examine the prospects for forest management devolution. The study has provided information regarding the awareness and valuation of the local people of dry forest areas of Amhara Region in Ethiopia about improved forest conservation practices. The estimation of WTP using the survey data on the local community resulted in a mean WTP of 121.17 birr per household, and a total annual WTP of the local community in the specific study area 6.8 million birr. This result proves that the local communities are aware of the significance of dry forest resources. Moreover, it is clearly shown that a significant WTP in terms of money exists in rural communities in Ethiopia for improved conservation of forest resources. The major factors found to have influence on local communities' WTP for sustainable forest management practices are the initial bid price, education level of the respondent, size of farm landholding, respondent's regional provenance, forest resources dependency, access to extension service, community organisation experience, and perceptions on community responsibility in forest conservation.

Local forest dwellers knowledge and valuation regarding forest resources management must be systematically considered in the designing and implementation of PFM programs. It is necessary to promote the significance of environmental education in the local community within different extension services such as natural resources extension service, agricultural extension service and rural development extension service. Moreover, we suggest extension services to be provided with a prior understanding of local situations and local community perceptions. Ensuring the participation of local community in forest resources management to enhance their livelihood and to improve the condition of the forests is an important forest policy agenda in Ethiopia in recent decades. The result of this study supports this forest policy program with respect to designing effective community participation strategies in the dry forest resource areas.

The significance of this study lies in its empirical evidence that the aggregate benefit related to improved forest resource conservation practices are much higher than the total amount of money allocated by the forest department for forest conservation, i.e., 1,000,000 birr per year on average. The result is useful for policymakers and decision makers to increase the acceptability of dry forest conservation projects in the study area.

Membership to community-based forest management groups reveals a strong positive correlation with WTP for forest conservation, which implies that PFM improves the wellbeing of forest users and sustainable conservation of the resource base. In addition, the empowerment of those households who have adequate experience in community organisations may enhance the sustainable management of forest resources. These would smooth the process of establishing sustainable PFM arrangements and form a foundation to initiate PFM.

The major positive and significant determinants of WTP found are related to knowledge about environmental issues. This finding confirms the economic literature on the significance of knowledge in influencing respondents WTP (Turpie, 2003). Furthermore, this study provides some insights concerning the potential of encouraging a proper educational campaign on dry forest resources protection particularly about the endangered frankincense tree species. From the group discussion, we understand that most people are not aware of the value of dry forest resources and are not aware of endangered species or species in the verge of extinction in the area, but the local communities are willing to pay for its improved conservation. This means that if the forest department and even researchers are able to disseminate the existing status of resources and their importance if conserved well, people will recognise its value and will attach more value to efforts to conserve it.

In general, interventions such as PFM projects must be sensitive to the local community demand. From sustainable forest resources management point of view, the local communities in the dry forest resource areas of Amhara Region, Ethiopia are aware of the significance of forest conservation and should be organised for the sustainable management of state owned dry forest resources as they are willing to contribute for the improved management of the dry forest resource. However, mobilisation of demand of local communities for forest management necessitates policy interventions for its sustainability. The forest policy of the country should institute policy incentives, like provision of necessary trainings and credit services, to encourage communities to participate in collective forest resource management. Moreover, our findings suggest that in collective forest resource management, there should not be state interferences and the local people will pay for forest management interventions. However, local community payment for forest management should be based on their WTP and considering different

socio-economic factors of the households. In organising local communities, individuals with more years of education, households with more farm land, having community organisation experience, access to extension service and households who believe in the role of the local community in forest management should be considered potential contributors of improved collective forest resources management.

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Notes

1 Kebele is the lowest formal administrative unit in Ethiopia.

2 Birr is Ethiopian unit of currency which during the study year 1 USD = 26.10 Birr.

3 TLU is Tropical Livestock Unit which is used to aggregate total livestock in a household.