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Valuing local bread wheat farmer's varieties (*Triticum aestivum L.*) for conservation and sustainable utilization in goro and agarfa CSBs, bale zone OF Oromiya regional state

Abstract

The perception of farmer's verities, scientists and government officials regarding the conservation of bread wheat (Triticum aestivum L.) farmer in Bale zone **CSBs** is examined during 2019. Agricultural development and the reasons why the Bale zone is marginal in terms of wheat production are discussed. The de facto conservation of the local wheat farmer's varieties analyzed in light of stakeholders' opinions on agro biodiversity bread wheat conservation within the two community seed banks of Goro and Agarfa. CSBs retain local wheat farmer's varieties because of their own interpretations of the value of these varieties. While formal opportunities for supporting farmers' perceptions of local diversity with effective policy initiatives are available, they will require ongoing support from both international and national organizations Therefore, the objectives of this were to estimate households' willingness to pay (WTP) value for conservation bread wheat and analyze the determining factors that affects willingness of households to participate the conservation bread wheat in the study area. To attain the stated objective contingent valuation survey questionnaires were distributed to elicit farmers WTP for improved conservation bread wheat. A total of 160 households were randomly selected from two CSBs of two Woredas of the study Zone. The result indicated that 153 (92.29%) were willing to pay the given bid amount for bread wheat conservation. Logistic regression model result was shows that the statistically significant determinants of participation of WTP in bread wheat conservation were availability of labor for farm activities, distance from market, households' livestock holding, initial bid1 offered and productivity of the land of at 5% significance level, and total farm agricultural income and perception about the importance of bread wheat conservation at 1% level. The mean willingness to pay for the sampled respondents was 9.23 ($9. 034.67) labour day per year. Hence, the aggregate economic value of bread wheat conservation 3,098,644.46 (12,394,577.84) person days per annum for five years. Therefore, policy should give emphases at levels for production, conservation and sustainable utilization of bread wheat, farmer's verities hence, the communities shows willingness to pay for the bread wheat conservation works.

Keywords: bread wheat, community seed bank, conservation, farmer's verities, economic value, WTP

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Wubeshet Teshome, Nesru Temam
Ethiopian Biodiversity Institute, Crop and Horticulture Directorate, Ethiopia

Correspondence: Wubeshet Teshome, Ethiopian Biodiversity Institute, Crop and Horticulture Directorate, P.O.Box 30726, Addis Ababa, Ethiopia, Email twubehet@gmail.com

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Introduction

Agricultural biodiversity, is one of the most precious genetic resources that smallholder farmers have to improve their livelihoods. Which serves as a means to attain food, nutrition security, income generation, to build critical and fragile ecosystems services. Thus the land races Primitive or antique variety usually associated with traditional agriculture are known by highly adapted to local conditions.[1] Community level seed saving initiatives have been around for about 30 years in conserving the existing land race varieties. These efforts have taken various forms and labels, including community gene bank, farmer seed house, seed hut, seed wealth center, seed-savers group, association or network, community seed reserve, seed library and community seed bank. We use the latter as an umbrella term. Broadly speaking, community seed banks are local, mostly informal institutions whose core function is that of collectively maintaining seeds for local use.[1–3] Usually they serve as part of farmers' informal seed systems, in which the various stages of seed management viz: selection, conservation, exchange and improvement take place without involvement of or control by research, development or government agencies.

Generally, community seed banks began to establish at the end of the 1980s with the support from international and national nongovernmental organization (NGOs). Countries that pioneer various types of community seed banks include Ethiopia, Bangladesh, Brazil, India, Nepal, Nicaragua, the Philippines and Zimbabwe.[4] Through difficult to pinpoint the origin of CSBs, but NGOs have played a key role and continue to do so in many countries (BI, 2015). In recent years, in a number of countries, government agencies at the national level have become interested in establishing and supporting CSBs, often as part of a national on-farm (in - situ) conservation strategy. In Ethiopia, (including Goro and Agarfa) were begun to be establish the Community seed banks since 1997 after a technical cooperation agreement was signed with UNDP/GEF in 1994 with a $2.5 Million financial initiative.

Community seed banks are often understood as community-based stores used for the distribution of seed and grain to the local communities

on a loan basis. In some cases, they are designed as income generating activities where high external input seeds with chemical packages are distributed to the farming community. Hence, community seed banks should be a part of a community managed crop-germplasm conservation and utilization practice[5,6] Community-managed seed banks and on-farm conservation are important components that serve as a source of sustained seed of supply system and source genetic materials for improved cultivar selection and enhancement as well. In situ conservation of farmers' varieties provides a valuable option for conserving crop diversity.[7] Moreover, wheat is considered as a back bone of their economic asset in study area as well. Thus, it has high social, cultural, nutritional and economic values for the community living in study areas as well to the national level. Besides, due to many reasons the bread wheat farmer's varieties in study area were under threat of extinctions that is why, we need to study the value of this crop in order to show its status for policy makers.

Thus, for sustainable use of this resource, the users demand for conservation through utilization needs economic value estimation. There are different types of economic value estimation –for non-marketed environmental and public goods. Hence, in this study researchers were applied the Contingent Valuation Method which normally is used to elicit Willingness to Pay (WTP) for non-marketed environmental resources/ goods. Despite the country's favorable environmental condition for its production, the bread wheat economic valuation estimation for the conservation crop through utilization was remained unevaluated. Moreover, the households willing to pay value for suitable conservation of this crop in the study area was not yet studied.

Besides, the determining factors for conservation of bread wheat were also not identified. Therefore, this study was aimed at filing this gab particularly in the study area since the study CSBs are one of the potential area production. Therefore, the objectives of this was to estimate household's willingness to pay value for conservation of bread wheat and analyze the determining factors that affects willingness of households to participate the conservation bread wheat in the study area.

Materials and methods

Description of study area

Bale zone is one of the 18 administrative zones in Oromia national regional state which is located in south-eastern Ethiopia on the 430 km from capital city, Addis abeba. It has 18 districts out of which nine are located in highland agro-ecology whereas the remaining nine are located in mid and lowland respectively. The area receives an average annual rainfall of 400-2500mm and min and max temp 3.5^0c and 35^0c and altitude ranges from 300 to 4377masl.[8] Based on the CSA,[9] report Bale zone has an estimated total population of 1,741,197 out of which 881,559 are male and 859,638 are female. Goro and Agarfa are the CSBs in the Goro and Agarfa district of Bale zone of Oromia Region of Ethiopia. Agarfa and Goro CSBs were established in Agarfa and Goro districts since 1997 after a technical cooperation agreement was signed with UNDP/GEF in 1994 now 198 males and 51 female farmers are involved. The CSBs are conserved about 15 crop species by many land race varieties under each of species.[10]

Sampling techniques and sample size

In this study, a multistage sampling technique was used. In the first stage from the two CSBs was selected purposively based on production potential farmer's varieties of wheat. In the second stage, equal number of men and woman were selected randomly from the existing CSB members of the Agarfa and Goro CSBs. Finally, farm households were selected using the probability proportional to size using simple random sampling technique from selected farmers.

Method of data collection

The interest of obtaining reliable information from farmer's survey is an issue to be given top priority in the smallholder farmers during January 2019. In order to gain their trust, the in formants were carefully informed about the objectives of the survey and the direct and indirect benefits from the conservation activities. Initially, the respondent farmer's schedules were conducted at the farmer level of 160 randomly selected farmer households. Second from these, each CSBs will get nearly 80 respondents among this 50 male and 30 female informant households were participated by systematic sampling methods.

Sampling design

This study was uses the[11] sampling technique formula in order to select 160 sample households among the total households in the area. During the initial step of the sampling out of the two CSBs were been purposively selected by their potential of the study crops grown well than the other.

Methods of data analysis

In order to analyses the data, both descriptive analysis and econometric analysis was employed. Econometric model was applied for the estimation of contingent valuation (CVM). Following this binary Logistic model was applied for contingent valuation survey of this study.

Contingent valuation Method (CVM): is a well-established technique to measure the benefit from changes in the quality of the environment. Respondents to a contingent valuation survey represented with a realistic but hypothetical scenario and asked questions about the maximum amount of money that they would be willing to pay (WTP) for an amelioration from a status quo.

The "yes/no" response to the willingness to pay (WTP) questions, the offered amount and the additional information about the respondents' characteristics are used to fit binary response models such as[12] Farmers' decision to pay or not to pay for better conservation of bread wheat at any time is influenced by a complex set of socio-economic, demographic, institutional and biophysical actors. Modeling farmers' response to bread wheat preservation is important both theoretically and empirically.

WTP value is in form of binary choice dependent variable, either 1 for 'YES' response or 0 for 'NO' response. Also, the bid amount is varied across respondents and the only information obtained from each individual is whether his/her maximum WTP is above or below the bid offered. Following,[13] logistic regression model was used to estimate WTP. Considering the WTP estimation in logistic distribution function, the probability of accepting the offered bid is estimated as:

$$P = \left(1 - e^{-z}\right)^{-1} \quad (1)$$

Where pi the probability of accepting the offered bid is estimated as:

$$Zi = \beta o + \sum \beta i x i + ui \quad (2)$$

Where, P is the probability of accepting the price, z is a vector of explanatory variables (xi) including the bid offered, socio-economic variables and potential motivation variables, β0 is the intercept, βi is the coefficient of estimated parameters and εi is the random error.

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Result and discussion

Socio-economic characteristic of sample respondents

The survey result indicated that out of the total of the 160 respondents, 100 (62.5%) were males and the rest 60 (37.5%) were females. The range of age of the respondents was between 18 and >66 years. Among these, 106 respondents (88.26%) were found between 36 and 55 years of ages (the dominant age group). The majority of the respondents (144) were married (90%) and with average family size of 8.4 (81.8%). Out of the respondents, 71 have an educational level coded as elementary (44.3%) dominating the other. The average land holding of the sample respondents was 2.29 hector and the livestock in TLU was 4.96. Furthermore, the total mean of agriculture income was 76,887.91A ETB for the study respondents (Figure 1).

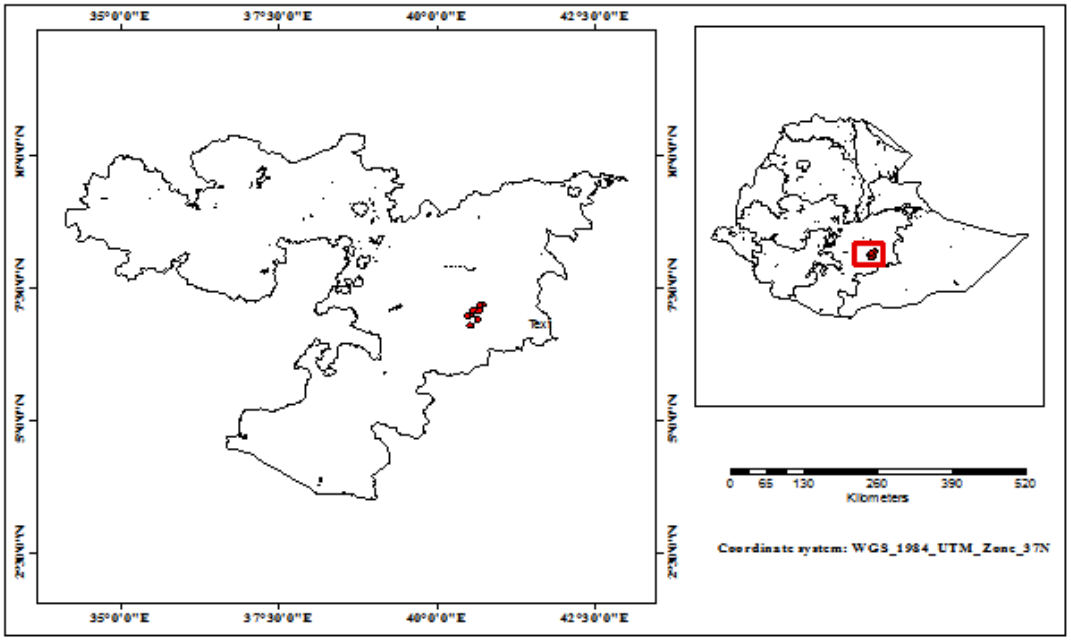

Figure 1 Map of the study area.

Households willingness to pay for different bid values

Households were asked to state whether they are willing to pay or not for conservation of bread wheat by providing on the hypothetical market scenario on the bread wheat production and conservation activities for the next coming five years. Commensurately, in this study there were three initial bid values (30, 60, and 90) among this values the respondents were asked to state their willingness to pay by giving the randomly offered initial bids in equal proportion. In this case, if the respondents accept the randomly offered initial bid, the follow up bid was doubled and if they were not accepting the initial bid the follow up bid became halved. As a result, most (95.63%) of the households accept the randomly offered initial bid and the remaining 4.37% were not willing to pay the initial bid closed ended questionnaire. In addition, 76.25% of the households willing to pay the follow up bid value, the remaining 25.75% were not willing to pay the follow up bid value for conservation of bread wheat (Table 1).

Table 1 Households willingness to pay for the first and follow up bid value

WTP	WTPBID1		WTPBID2	
	Number	Percentage	Number	Percentage
Yes	153	95.63	122	76.25
No	7	4.37	38	25.75
Total	160	100	160	100

Source: Own Survey, 2018

Economic value of bread wheat conservation

An important issue related to the measurement of economic value using WTP is aggregation of benefit.[14] There are four important issues to be considered regarding sample design and execution in order to have a valid aggregation of benefits: population choice biases, sampling frame bias, sample none response bias and sample selection bias.[15,16] Random sampling method was used in this study using a list of households. A face to face interview method was used and Protest zero responses were excluded from the analysis and possibility of Protest zeros was accounted in the estimation of the aggregate benefit. Hence, none of the above biases was expected in the analysis.

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Households were also asked to express their maximum willingness to pay for *Bread wheat* conservation in open-ended questions. Therefore, the mean maximum willingness to pay for bread wheat conservation was obtained:

$Mean\ WTP = \sum \frac{MxWTP}{N}$ and Mean MWTP= 14, 120. /153= 92.29 labour day per year.

Where, Mean MWTP is mean maximum willingness to pay, MWTP is summation of maximum willingness to pay of the sampled households and N is number of sampled households. The mean willingness to pay for the sampled respondents was 92.29 labour day per household per year, which ranges from a minimum of 72 to a maximum of 210 labour day per household per year from open-ended question. They provide the maximum about 210 in year, which is 17.5 days in month. The relational behind thin high figure is in the study area the crop is produced year twice and most of the study farmers were engaged the production of this two season production of bread wheat.

Mean was used as a measure of aggregate value of bread wheat conservation in this study. In Table 2 above, the aggregate WTP was calculated by multiplying the mean WTP by the total number of households who are expected to have a valid response in the selected CSBs. Following this, in this study the aggregate WTP for bread wheat conservation activities was computed 231,555.61 (926,222.44$) person days per year in the selected two CSBs from the open ended questions. This shows that there is high level of willingness to pay for bread wheat conservation in the study area.

Table 2 Economic value of the bread wheat conservation in the study CSBs

Sampled CSBs (2)	Total HHs in selected CSBs	Sampled HHs with valid response	Sampled HHs with invalid response	Expected total HHs with invalid response	Expected total HHs with valid response	Mean WTP	I Total WTP[1]
Total	2621	160	7	112	2509	92.29	231,555.61

Source: Own survey computation, 2018

[1]The figures are in person days per year at the time of survey and the minimum wage rate per day was 4 USA dollar in the study area Is the monetary value of the person day estimates which was multiplied by 4 US dollar Birr

Those are households "which are expected to protest against the proposed project in the entire study area, (Agarfa and Goro). It was calculated by the multiplication of the percentage of protest sampled households" (1.8%) by the total number of households in the study area. Hence, 4.37%*32,441 = 1417.67 this number was deducted from the total number of households in the study area for economic value analysis

There are 34,992 households in the study area (Agarfa and Goro Woredas). It is also possible to calculate the total economic value of bread wheat conservation for the whole Woredas. After deducting the protest zeros (*1417.67*) the expected total households with valid responses are 33,574 households. The total willingness to pay in the whole study area (Agarfa and Goro Woredas) is simply the multiplication of the respective means and the number of expected households to have valid responses. Hence, the aggregate economic value of bread wheat conservation in the study area from the open ended formats was 3,098,644.46 (12,394,177.17) person days per annum for five years.

Econometric model

Under this section, the Logistic regression model analysis result for determining factors of WTP for conservation and sustainable utilization of bread wheat in study area was interpreted and discussed. Logistic regression model result was indicated in Table 3. The maximum likelihood estimates of the logistic regression model show that, from twelve variables hypothesized as determinants of WTP participation in bread wheat conservation seven variables were found to be statistically significant, while the remaining were less significant in explaining the variations in the dependent variable. These significant variables include availability of labor for activities, distance from market and productivity of the land of at 5% significance level, and total farm income and perception about the importance of bread wheat conservation at 1% level.

Marginal effect (dy/dx) reveals that as the availability of labour for farm activity increases by one unit (number), the probability of participation in WTP for bread wheat conservation and production for next five years will increases by 18.05%. This is plausible since some households with high number family member within working age group may not face the problem of labour availability and engaged in agricultural activities than small size family member in working age group, and hence able to participate in WTP for bread wheat conservation and production.

Table 3 Logit model result for determinants of households WTP

Variables	Coeffients	Stan. D	Z –value	dy/dx
Constant	-4.5524	2.5761	-4.2	
Age	0.0126	0.0219	-0.58	0.0018
Education	0.0454	0.0697	0.65	0.0067
Household size	0.061	0.0773	0.79	0.009
Land	0.1741	0.2482	0.7	0.0256
Labour availability	1.1697	0.5322	2.20**	0.1725
Extension agents visit	0.1649	0.4274	0.39	0.0243
BIDI	-1.4059	0.8854	-2.46**	-0.0598

Table Continued...

Variables	Coeffients	Stan. D	Z –value	dy/dx
Market distance	0.6827	0.317	2.15**	0.1007
TLU	-0.1889	0.0919	-2.06**	-0.0278
Average farm income	0.00002	8.06	3.76***	4.47
Land productivity	-0.1883	798	-2.36**	-0.0277
Perception of Bread wheat	3354	0.1235	2.72 ***	0.0494
Log likelihood	-79.2585	LR chi2(11)	56.07	
Prob> chi2	0	Pseudo R2	0.2613	

Source: Model estimation result, 2018

Where ***, and ** means level of significance at 1% and 5% respectively

Similar with the earlier expectation, the initial bid offered (BID1) has a negative and significant effect on the WTP for bread wheat conservation practices. The marginal effect indicates that the probability of increasing one-person day for the contribution of the proposed improvement of conservation of bread wheat reduces the probability of willingness to pay by nearly 5.98%. The residence indicates that the households' residence and market distance has positive and significant relation for in this study for conservation of bread wheat. As the house residence near to market by one minute, the probability of WTP for bread wheat conservation increases by 10.07%, and this is due to fact that if the producer residence is near to the market they can access market information for the product easily, can get production input with low cost and transport their farm products to the market with low cost. The result also reveals that, as hypothesized level of livestock holding in TLU and WTP for the conservation of bread wheat has positive and significant ration in this study. This means that as households' livestock holding increases by one TLU, the probability of WTP for the bread wheat conservation increases by 2.78%. This might be those individuals who have high number of TLU might be willing to pay conservation and continuous production of bread wheat, since the byproduct of bread wheat used as forage for animals like *Teff* and barley. Therefore, households who have animals do give emphases for bread wheat production.

The average income from the total farm activity and participation for WTP bread wheat conservation has positive and significant relationship. The result indicates that as mean farm income increases by one birr, the probability of participation on WTP for bread wheat conservation and production will increases by 556.00 %.

The status of farm land productivity has negatively and significantly affects the WTP of bread wheat conservation and production, which was expected in the hypothesis. The marginal effect estimation reveals that as the productivity of farm land status decline though time, the probability of WTP for bread wheat conservation and production by allocating more labour time will decline by 1.07%.

Moreover, the model result reveals that the perception of the importance of bread wheat conservation has positive and significant relationship with conservation of bread wheat. The result indicates that if household perceived that bread wheat conservation is important, the probability of WTP for bread wheat conservation.

Conclusion and recommendations

The finding of this study from Logistic regression model result shows that households WTP for the participation in bread wheat conservation were found to be statistically and significant affected by availability of labor for farm activities, initial bid offered, residence distance of farm households from market, total farm income, perception about the importance of bread wheat conservation, livestock holding in TLU and farmland productivity through time. Moreover, the mean maximum WTP for bread wheat conservation on activities was computed at 3,098,644.46 (12,394,577.84) person days per year for five years in the selected two districts based on the open ended questions. Therefore, the mean maximum willingness to pay value indicated that the economic value of conserving bread wheat is high in the study. Hence, policy should give emphases at national, regional, and other operational levels, so as to bring an anticipated result on lives of producers from conservation and sustainable utilization of bread wheat farmers variety at study area. Besides, this study alone is not enough to generalize the value of bread wheat farmer's variety. Therefore, it's better to broaden the scope of study in year and areas to be studied.

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Conflicts of interest

All author listed here declare no conflict of interest exists.

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