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Determinants of Households Willingness to Pay for Conservation of Natural Kool Water (Burie Kool Wuha, W/Gojjam, Ethiopia)

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Abstract**—** *Most natural resources or environmental goods and services are exposed to degradation, society over utilize them for only their current benefits without thinking the future life span of these resources. The study analyzed determinants of households' willingness to pay for conservation of natural Kool water (Burie Kool Wuha, W/Gojjam, Ethiopia). The contingent valuation method and Heckman two step model was employed. The results indicates that sex of the household head, education of the household, value attached to the resource by households as source of income, value attached to the resource by households reserving for future generation and wealth of the households has a significant and positive correlation with households WTP, and family size of households, education of the household and wealth of the households has a significant and positive correlation with the households payment levels. On the other hand, initial bid value has a negative correlation with the level of payments. Therefore, by taking the importance of the resource for the society and the households WTP, the policy makers need to focus on identified factors in designing strategies for the conservation of the resource.*

Keywords**— Burie Kool Wuha; Conservation; CVM; Heckman two step model; Ethiopia.**

I. INTRODUCTION

Concern with the supposed increasing scarcity of natural resources, and the possibility of running out of strategically important raw materials or energy sources, is by no means new. Worries about resource scarcity can be traced back to medieval times in Britain, and have surfaced periodically ever since. The scarcity of land was central to the theories of Malthus and the other classical economists. In the 20thcentury, fears about timber shortages in several countries led to the establishment of national forestry authorities, charged with rebuilding timber stocks. Pessimistic views about impending resource scarcity have been most forcibly expressed in the Limits to Growth' literature which was widely understood to claim that environmental limits would cause the collapse of the world economic system in the middle of the twenty-first century, during the 1970s, the so-called oil crises further focused attention on mineral scarcities [37]. In 1986, the U.S. Department of the Interior (DOI) promulgated regulations for conducting natural resource damage assessments (NRDAs) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980. These regulations provide protocols for conducting assessments, as well as delineating appropriate measures of compensation for injuries to natural resources. The regulations focus on the residual injury that may remain after clean-up or remediation activities are completed. Originally, the regulations prescribed that Trustees use the lesser of restoration costs or foregone use values as the basis of measuring damages. They allowed for non-use values only when no use values could be measured [24].

Having a way to measure the magnitude of external cost on use of resources helps environmental protection advocators and policy makers greatly in their effort to create mitigation measures and conservation mechanisms. One of the most widely used approaches for decision of public policy instruments to mitigate environmental impacts has been the contingent valuation method (CVM). CVM has been widely accepted by academics and policy makers for valuation of resources, environmental goods, and services [47].

The CVM was first proposed by [6] who recognized that, some aspects of soil erosion (e.g., clogging of shared

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irrigation channels) have the attributes of a negative externality that is not borne as a cost by the individual farmer. Wantrup did not actually conduct a CVM. Rob Davis did the first actual CVM study in his dissertation, where he attempted to value non marketed aspects of the Maine woods (hunting and recreation values). The CVM became popular following the publication of a highly influential paper by [28] that endorsed the "real" nature of existence and other non-use values [20].

Local actors are the key to achieving real impact on the ground. While international donors, agencies and national governments play important roles in establishing effective enabling environments and channeling resources and technical support, ultimately effective adaptation takes place through the dynamics of local governance, civil society engagement, and economic development building from the actions of local authorities, civil society organizations, and private sector businesses. Recognized by international law and national laws as auxiliaries to the public authorities in the humanitarian field, national Red Cross and Red Crescent societies are also a critical resource at local level, drawing on an extensive volunteer base and long presence in communities [23].

Burie Kool Wuha is located in West Gojjam, Burie town, 411 km from Addis Ababa. It is natural cool water which can be used for production of standardized cool water without much processing. The resource is used by private organizations around the society for production without any care for the existing damage; even the society does not give any care for the resource. As a result of the combination of factors, the resource does not get the necessary conservation measure to be protected from damage. The immediate effect of this inefficient utilization is that it will lead to non-sustainability to the use of the limited scarce resource at the curse of future generations. In the long run this may even result in complete extinction of the resource if appropriate measures are not taken.

Currently, the local community uses the resource in a traditional way. They simply drink the natural cool water by believing on it as a medicine for heart disease but the use of the resource is more than that since it is used by private producers for the production of standardized cool water. However, if the local community conserves this resource properly by taking full sense of ownership and responsibility they can get a lot of benefits like, job opportunity for their children (since the resource can be used for production of standardized cool water), even they think this water as a medicine for heart disease and also it could be best income source for the society which may enable them for construction of basic infrastructures.

Therefore, this study aims at investigating the determinants of household's willingness to pay for conservation of natural cool water (Burie Kool Wuha) and tries to find ways for adaptation and mitigation.

1.1 Statement of the Problem

Natural resources provide a range of goods and services, food, fuel, medicines, fresh water, fisheries, and air and water regulation that support life on Earth. The people in developing countries remain the most directly dependent on natural resources for their food and livelihood security. Subsistence farmers, fishers, hunters and gatherers, and agricultural wage workers depend on the availability of usable land, water, and plant and animal species for their livelihoods [18]. Thus, the livelihoods of poor rural people depend on the condition of natural resources, particularly livelihoods of people living on fragile lands [49].

However, in the future the natural resources needed to sustain the human population will exceed available resources at current consumption levels. Unsustainable and uneven consumption levels have resulted in an increasingly stressed environment, where natural disasters, desertification, and biodiversity loss endanger humans as well as plant and animal species. The challenge of reversing the degradation of natural resources while meeting increasing demands for them involves significant changes in policies, institutions, and practices [18].

Markets are not well developed for many environmental goods and services especially for those with long-term or diffuse impacts. One thinks of avoided climate change, coral bleaching, or chronic pollution of air or water [15]. Because of the public-good nature of these goods and services, there are tendencies both to underestimate their importance (lack of knowledge) and understate one's willing-to-pay to address them (free-rider problems). In these cases, however, increased public awareness and knowledge about them can increase the economic values assigned to these problems, but ultimately an appropriate response will require some policy response by governments since private markets cannot handle these issue well or at all.

A spring may be the result of karst topography where surface water has infiltrated the Earth's surface (recharge area), becoming part of the area groundwater. The groundwater then travels through a network of cracks and fissure openings ranging from inter-granular spaces to large caves. The water eventually emerges from below the surface, in the form of a karst spring.

Physical factors determine how springs come into existence, where and when they occur, and how they

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behave under different natural settings. However, the social dimensions are equally important as they determine the management and use and affect their functioning and sustainability. A human activity like infrastructure development and industry directly affect the performance and in many cases the existence of springs [22.] Basically, humans' interaction with the uncertain natural environment is complex, with many paradigms competing to explain observed phenomena. It is suggested that the aspects of individual and collective vulnerability are distinct. They encompass relative poverty and deprivation as well as informal social security at the individual level; and infrastructure, the role of the state and policy intervention at the collective level. Alternative conceptions of the causes of vulnerability include the reinforcement of marginalization and vulnerability of poverty stricken groups; institutional and economic factors influencing greater economic activity in hazardous areas; and the co evolution of climate and the natural environment with social phenomena[2]

Therefore, institutional capacity development, focused on local institutions tasked with managing natural resources, has led to increasingly decentralized natural resource management and development of a range of participatory management systems[18].

However, many people in vulnerable areas continue to face complex challenges in adoption and adaptation of resource management and conservation strategies. Although much has been learned from diverse experiences in sustainable resource management, there is still inadequate understanding of the market, policy and institutional failures that shape and structure farmer incentives and investment decisions. Addressing the externalities and institutional failures that prevent private and joint investments for management of a resource will require new kinds of institutional mechanisms for empowering communities through local collective action that would ensure broad participation and equitable distributions of the gains from joint conservation investments [7]. A study by [40] tries to investigate the main determinants of household energy conservation patterns in Greece. The results show that socioeconomic variables such as consumers' income and family size are suitable to explain differences towards energy conservation preferences. In addition, the results suggest that electricity expenditures and age of the respondent are negatively associated with the number of energy conserving actions that a consumer is willing to adopt. Finally, other variables such as environmental information feedback and consciousness of energy problems are characteristics of the energy saver consumer.

A study by [39] determined visitors' willingness to pay for conservation of the resources at Gunung Gede Pangrango National Park (TNGP). The results indicate that income, gender (male) and residential (urban) were the significant factors that influencing the visitors' WTP for the entrance fee to TNGP.

A study by [31] assessed the factors influencing rural households' willingness to pay (WTP) and willingness to contribute labor (WTCL) for Boswellia papyri fera forest conservation in Ethiopia. The study found that household income as the most important factor affecting WTP whereas number of household labor is the most important factor affecting WTCL.

A study by [5] examines the determinants of farmers' willingness to pay for soil conservation practices in the highlands of Bale, southeast Ethiopia. The study found that education level of the household head, perception of soil erosion problems, Size of rented-in farmland; conservation undertaking in the past, parcel prone to erosion and farm area under crop are factors that affect farmers WTP for soil conservation practices.

A study by [41] assessed local communities' willingness to pay for river network protection in shanghai, china and also they evaluate the public's awareness of and attitude toward the river network and its protection. The results suggested that residents in Shanghai had a high degree of recognition of river network value but a low degree of satisfaction with the government's actions and the current situation. The number of years lived in Shanghai, the distance from the home to the nearest river, and the amount of the bid were important factors that influenced the respondents' WTP.

Burie Kool Wuha is natural cool water which can be used for production of standardized cool water without much processing. Simply the community uses the resource in a traditional way by believing the natural cool water as a medicine for heart disease. The basic problem here is the society never understands the value of the resource so that no one cares for their ownership. As a result of the combination of factors the resource does not get the necessary conservation measure to be protected from damage. What makes this study significant is; first, these types of resources are very rare (does not exist everywhere) in nature having such resource needs or calls for proper management for their utilization. Second, for such a resource there must be a great sense of ownership, so that everyone could be responsible for the costs and benefits of the resource. Lastly, Burie Kool Wuha is exposed to unnecessary damage, which is a cost to the society.

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There are various studies conducted on the determinants of households' willingness to pay for conservation of natural resources. But as far as the knowledge of this researcher is concerned, there are no previous studies conducted on the conservation of natural cool water basically attributed to the rare nature in the existence of the resource, particularly Burie Kool Wuha, may be lack of proper understanding about the value of the resource. Therefore, this study tries to fill this gap by answering the following basic research questions:-

1. How does the community's perceive the importance/existence of this natural cool water?
2. What are the determinants of households' willingness to pay for conservation of Burie Kool Wuha?
3. What are the determinants of households' maximum willingness to pay for conservation of Burie Kool Wuha?
4. How much is the amount that households are willingness to pay/contribute for conservation of Burie Kool Wuha?

1.2 Objectives of the Study

1.2.1 General Objective

The main objective of the study was to investigate households' willingness to pay for conservation of natural cool water (Burie Kool Wuha).

Specific Objectives

- To assess community's perception of the importance of the resource to their livelihood;
- To identify the determinants of households' willingness to pay for conservation of Burie Kool Wuha;
- To investigate the determinants of households' maximum willingness to pay for conservation of Burie Kool Wuha; and
- To estimate the amount that households are willing to pay/contribute for conservation of Burie Kool Wuha.

II. METHODOLOGY

2.1 Description of the Study Area

This study is conducted on BURIE KUL WUHA which is found in Burie town, W/Gojjam, Amhara National Regional State (Northwest Ethiopia) 411 km from the capital city, Addis Ababa. The major problem in this area is that the local community uses the resource in a traditional way simply they drink the natural cool water by believing it as a medicine for heart disease but they did not know the other values attached to the resource. It can be used to produce standardized cool water with-out much processing. This natural cool water is currently exposed to unnecessary damage since any drop of it has a cost.

Fig.1: Map of Study Area

Source: Taken from Office of Burie City Administration, 2018

Burie town is located in an altitude over 2300 meters above sea level. The general wellbeing of the society depends on natural resources simply the accumulation or ownership of natural resources like land and forest basically determine the wealth of households in the area. Burie town has eight kebeles of which four of them namely kebele 01, kebele 02, kebele 03 and kebele 04 has been in existence before and four other kebeles namely Wangedam, Tengeha, Kebesa and Wendegi are incorporated recently. There are a total of 9449 households in the town within eight kebeles.

2.2 Data Sources and Types

In order to get all the necessary information on the area where the research is conducted, the study employed primary data obtained from contingent valuation survey. The main source of data was primarily gathered through structured questionnaire and face to face interview with a cross sectional sample survey for the year 2017/18.

2.3 Sampling Design and Procedures

A two-stage sampling technique was used to select the sample of households of Burie town. In the first stage, four newly incorporated kebeles i.e. Wangedam, Tengeha,

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Kebesa and Wendegi are located in a very distance from Burie Kool Wuha. Having this in mind, the rest four old kebeles which are located closer to Burie Kool Wuha i.e. kebele 01, kebele 02, kebele 03 and kebele 04purposely selected.

In the second stage, households in the four selected kebeles were listed and sample households were randomly selected from those kebeles using probability proportion population to the sample size. According to Yamane formula for calculation of sample size from a population

$$n = \frac{N}{1 + N(e)^2}$$

Where, n is the sample size$e = 0.1$ is the desired level of precision and N is total population. Accordingly, as there is no generally agreed formula about the sample size, 100 sample households was selected by adopting Yamane formula. This total sample can distributed to each Kebeles according to probability proportion population to the sample size.

Table 1: Number of households and sample size

Kebeles	Total number of households	Sampled households
Kebele 01	1222	$\frac{1222}{4805} * 100 = 25$
Kebeles 02	1122	$\frac{1122}{4805} * 100 = 23$
Kebeles 03	1095	$\frac{1095}{4805} * 100 = 23$
Kebeles 04	1366	$\frac{1366}{4805} * 100 = 29$
Total	4805	100

Source: Own Computation

2.4 Method of Data Analysis

For the sake of data analysis, both descriptive and econometric techniques were used. In order to achieve the first objective (i.e. in order to analyze the perception of households about the importance of Burie Kool Wuha for their livelihood) descriptive analysis like Pearson's$\chi 2$ and one way ANOVA were used. In the econometric part Heckman's two-step model were adopted to investigate the determinants of household's willingness to pay for conservation of the resource and their payment levels simultaneously. Variables, which determine household's willingness to pay for conservation of Burie Kool Wuha, was analyzed through this model. In this part STATA 14 software were employed to determine the coefficients of the variables which are significant to the model under consideration and to test the statistical significance relationships between the determinants and the dependent variable.

2.5 Model Specification

The Heckman's two-step model was used to analyze the obtained household survey data. Heckman's two-step method is a statistical method that allows for accurate sample selection bias, for which Heckman accepted the Economic Nobel Prize in 2000. There are two reasons to use Heckman's two-step model in this study. First, it allowed us to examine the two steps leading to households' decisions in a single model while distinguishing the influence of different factors between these two steps. In other words, this enables to investigate the influence factors of willingness to pay along with payment level in a single model. The model is used to analyze the factors influencing households' payment levels simultaneously, and prevent the disturbance of households' who's WTP will be zero. Secondly, the model could explicitly resolve potential sample selection bias. It is, therefore, possible to insert irrelevant variables, or to choose not to include associated variables in the sample, which may cause sample selection bias. Therefore, this researcher used Heckman's two-step model to prevent these problems.

[21] examined the determinants of farmers' willingness to pay (WTP) and their payment levels for ecological compensation of Lake Wetland, by using CVM. Heckman's two-step model were employed for the empirical study and found sound results. [30] Also determined households' willingness to pay to finance conservation projects in Layawan Watershed. The Heckman's two-stage analysis was employed for estimation of mean willingness to pay.

In this study Heckman's two-step model was used, first, the probit model is used to test the factors influencing WTP. Second, multiple linear regression models was used to further investigate the factors influencing payment levels.

Specifically, the models are expressed as follows:

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Z=α_0+α_1FMSZ+α_2HHSEX+α_3Age+α_4EDUC+α5USERE+α_6INC+α_7WLTH+α_8OCCR+α_9NUFM+α1BV+u_i……., (1)

In the first-stage Heckman model, *Z* is the dependent variable, which represents the probability of households WTP

$\alpha_0, \alpha_1, \alpha_2, \ldots, \alpha_{10}$ are coefficients that are estimated to examine the determinants affecting farmers' WTP. **FMSZ**,**HHSEX**, **Age**, **EDUC**, **USERE**, **INC**, **WLTH** ,**OCCR**, **NUFM** and **BV** are the explanatory variables, and u_i is the residual term.

Y=β_0+β_1FMSZ+β_2HHSEX+β_3Age+β_4EDUC+β5USERE+β_6INC+β_7WLTH+β_8OCCR+β_9UFM+β_1BV+σ_λ+u_i…….,(2)

In the second stage multiple linear regression model is used. *Y* is the dependent variable, which examines determinants affecting the households' payment levels. In this stage Mills ratio, λ, is added to overcome the sample selection bias. $\beta_0, \beta_1, \beta_2, \ldots, \beta_{10}$ and σ are the coefficients to be estimated. **FMSZ**, **HHSEX**, **Age**, **EDUC**, **USERE**, **INC** ,**WLTH** ,**OCCR**, **UFM** and **BV** are the explanatory variables, and μ is the residual term.

2.6 Explanations of Variables and Expected Signs

Dependent Variable

Willingness- to- Pay (WTP): The first dependent variable in the model is the households' WTP, which will be expressed as 0 and 1, dummy or artificial value. It takes the value 1 if the household are willing to contribute either money or labor and 0 otherwise.

Maximum Willingness- to- Pay (WTP): The second dependent variable in the model is the households' maximum WTP is a continuous variable which is the maximum amount that household are willing to pay for conservation of the resource.

Explanatory Variables:

Family size of respondent (FMSZ): This variable, which is continuous, refers to number of family in the household. According to [44] there is negative relationship between household size and willingness to pay. At the level of expectation, households' who live with more number of families will pay less based on the fact that income distribution of these households 'is low.

Gender (HHSEX): Is dummy variable which shows whether the household head is male or female. It takes the value 1 if the household head is male and 0 otherwise. [3] investigated that male respondents are more willing to pay than female respondents for women do not have equal control over resources. But it is impossible to expect the sign of this variable before the analysis of the data.

Age: this variable, which is continuous, refers to the age of the respondent. According to [4], [3] and Kaliba [25], age is negatively related to WTP. Household with older ages are expected to pay less for protection of natural resources as they have no awareness of the environment compared to new generations even though they understand the use of those resources through experience. On the other hand, households with lower age are expected to pay more based on the fact that current generation is more educated and understood the importance of the resources through education and real case. The sign of age of household is expected to be negative, as age of households' increases the willingness to pay will decrease.

Education of the household (EDUC): this variable is a dummy variable and takes value 1 if the respondent attended any formal education and 0 otherwise. According to [4]and[3], the respondent's educational level is positively related to WTP. It is expected that people with formal education give more priority to resource than those without. Therefore, we can hypothesize the effect of education level of the respondent on WTP for resource conservation to be positive.

Value attached to the resource by households (USERE): this variable is once again categorical variable which shows whether the respondents value or use the resource, i.e., Burie Kul Wuha for the purpose of current consumption, for future generation, or simply for existence value. We can say nothing about the sign or effect of this variable before data analysis. But, not sure, individuals those use BURIE KUL WUHA for current consumption and for future generation have high willingness to pay.

Income of households (INC): this variable is pre-tax income of households per year. Income is continuous variable and was expected to have positive effect on dependent variable, WTP which shows individuals with higher income pay more for conservation of the resource.

Wealth of the households (WLTH): ownership of land/residential house is used as a proxy for wealth. It is a dummy variable takes value 1 if the respondent has land/residential house and 0 otherwise. According [8] keeping all other things the same, for those living in their own house, the probability of accepting the offered bid to

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pay is higher compared with those who do not live in their own house. Since richer individuals have more ability to pay for conservation of resources, the expected sign of this variable is positive.

Occupation of households (OCCR): this variable is the job in which the respondent involved as income generation. This is a dummy variable taking value 1 if the respondent is employed in formal sector salary employment such as government, private organization and NGOs; and 0 otherwise. According to [33] individuals with formal job (government work) are willing to pay more than those who have informal (non-government work). It is believed that households with government work aware about natural resources than that of non-government works. So they are going to pay more for the conservation of the resource.

Unemployed family members in the household (UFM): dummy variable taking value 1 if one or more family members are unemployed and 0 otherwise. If households think conserving the resource create job opportunity for them, they will contribute for conservation. This variable is expected to have a positive impact on WTP.

Initial bid value (BV)*:* As the level of initial bid increases, the probability of saying "yes" for that bid will be decreases. So the expected relation between the WTP and BV is inversely related.

III. INTRODUCTION

In this chapter, we analyze and discuss the data from the contingent valuation survey in two ways: descriptive and econometric analysis. In the descriptive analysis households perception about the importance of Burie Kul Wuha for their livelihood were analyzed from open ended questions, besides that the general characteristics of sample households including socio-economic and demographic characteristics that are expected to affect households' willingness to pay for conservation of the resource were analyzed. In econometric analysis, the main focus is investigating determinants that affect households' willingness to pay for conservation of Burie Kul Wuha and to analyze the determinants that affect the maximum amount of money that households are willing to pay for conservation of the resource. Heckman two step model did those simultaneously.

3.1 Descriptive Results

3.1.1 *Descriptive summary of households` characteristics*

In the study, a total of 100 sampled households were interviewed. The summary of surveyed households' data is given in table 2 below. From the total of 100 sampled households, 36% are female headed households whereas 64% are male headed households. The average family size in the households is 3.46 with a minimum of 2 household members to a maximum of 5 household members. The data about the respondents' age showed that the average is 51.49 years which ranges from 24 to 80 years of old. Regarding the occupation of the households 70% are employed in formal sectors for salary whereas 30% are not formal sector salaried employees. The survey result also shows that 70% sampled households are owners of house/land whereas 30% are not owners of house/land which expresses the wealth status of households in this study.

The surveyed households earn an average income before tax of Birr 31289.68 per year ranging from a minimum of Birr 1000 to maximum of Birr 92400 per year. The data on educational status of sampled households revel that 67% attended formal education whereas 33% did not attend formal education. From the total sampled households 42% have unemployed family members whereas 58% do not have unemployed family member.

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Table 2: Description and summary of household's characteristics

Variable	Description	Mean	Std. dev	Min	Max
Wtp	*Willingness To Pay*: dummy variable 1 if households are willing to pay/contribute for conservation of the resource, 0 otherwise	0.7	0.4605662	0	1
Fmsz	*Family size*: number of family members in the household	3.46	0.9683893	2	5
Hhsex	*Sex of household head*:, dummy variable 1 if the households head is male, 0 otherwise	0.64	0 .4824182	0	1
Age	*Age* : Age of the respondent in years	51.49	12.65509	24	80
Educ	*Education*:, dummy variable 1 if the respondent attend formal education, 0 otherwise	0.67	0.4725816	0	1
Wlth	*Wealth*: has proxy of ownership of House/land, dummy variable 1 if the respondents have their own house/land, 0 otherwise	0.7	0.4605662	0	1
Occhh	*Occupation of household head:* dummy variable 1 if he/she is formal sector salaried employee, 0 otherwise	0.7	0.4605662	0	1
Ufm	*Unemployed family member*: dummy variable 1 if there is one or more unemployed family member/s in the household, 0 otherwise	0.42	0.496045	0	1
Inc	*Income:* Annual income of the household in Birr	31289. 68	22583.75	1000	92400
userer1	*Current Consumption value attached to the resource by households*: dummy variable 1 if for current consumption, 0 otherwise	0.27	0.446196	0	1
userer2	*Source of income value attached to the resource by households*: dummy variable 1 if for source of income, 0 otherwise	0.28	0.4512609	0	1
userer3	*Reserve value attached to the resource by households*: dummy variable 1 if reserving for future generations , 0 otherwise	0.05	0.2190429	0	1
userer4	*Existence Value attached to the resource by households*: dummy variable 1 if for existence value, 0 otherwise	0.4	0.492366	0	1
Bv	*Initial bid value* offered to the respondent in birr	0.68	0.4688262	0	1
Mwtp	Households' *maximum willingness to pay* in Birr	27.45	24.0737	0	90

Source: Own computations from households CVM survey data, 2018

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3.1.1 Comparison between willing and non-willing households

The cross tabulation analysis is used to assess the association between households willingness to pay in binary terms (i.e. willing or unwilling) and dichotomous independent variables.

As we see in table 3 below, even though, the majority of male and female are willing to pay for conservation of Burie Kul Wuha males willingness to pay (49%) is higher than that of females (21%), despite the fact that the difference is statistically insignificant.

Education of households has also a difference in willingness to pay for conservation of the resource i.e. Educated households are 59% willing to pay for conservation of the resource which is by far greater than not educated (11%) . The probability of Pearson's χ^2 also shows there is really a statistically significant difference in willingness to pay between educated and not educated households.

Moreover, the variable wealth which is expressed by ownership of house/land has also a statistically significant difference on willingness to pay for conservation of the resource based on the probability of Pearson's χ^2. The result indicated that owners of house/land are more willing to pay (54%) than not owners (14%).

Households having unemployed family members are more willing to pay for conservation of the resource than those without unemployed family member which is 36% and 34% respectively. The probability of Pearson's χ^2 also shows there is really a statistically significant difference in willingness to pay between households with unemployed family members and without unemployed family member.

Finally, occupation of households indicates that even if there is a difference in willingness to pay between those working in formal sector salary employment and not working in formal sector salary employment, the difference is not statistically significant.

Table 3: Comparison of willing and non-willing households

Variables		Willingness to pay			Pearson χ^2 Pr
		Willing	Unwilling	Total	
House Hold	Female	21%	15%	36%	3.6458
Head Sex	Male	49%	15%	64%	0.056
	Total	70%	30%	100 %	
Education Level	None-Educated	11%	22%	33%	31.5328 0.000
	Educated	59%	8%	67%	
	Total	70%	30%	100 %	
Wealth Ownership	None-owner	14%	16%	30%	11.1111 0.001
	Owner	54%	14%	70%	
	Total	70%	30%	100 %	
Unemployed Family Member	Don't have	34%	24%	58%	8.5151 0.004
	Have	36%	6%	42%	
	Total	70%	30%	100 %	
House Hold head Occupation	Informal	23%	7%	30%	0.9070 0.341
	Formal	47%	23%	70%	
	Total	70%	30%	100 %	

Source: Own computations from households CVM survey data, 2018

3.1.2 Perception, use pattern and problems of Burie Kool Wuha

There are some importance's of Burie Kool Wuha that initiate households to give value for the resource. Not only Burie Kool Wuha but also all other natural resources are attached different value by different people such as current consumption, jobs provision which is source of income, existence value, and reserving for future generation. From these current consumption and source of income are use-value and the remaining; existence value and use of future generation are non-use-value.

The results from an open ended question about the importance of the resource for their livelihood revealed that households value the resource for various functions like: current consumption, source of income, reserving for future generations and simply for existence value. In the meanwhile, they indicated that even if they value the resource for multi-purposes they are not capable of

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undertaking community owned production due to, lack of previous trend about community owned production in this area, lack of technological knowhow, lack of proposed projects about the community owned production and also the nature of community production demands strong commitment which they thinks as a challenge.

The households were asked to indicate the value they attach to the resource and why they value the resource. Summary of the responses are indicated in table 4

Table 4: Summary of values attached to Burie Kool Wuha

Value of the resource	***Households***	***Percentage***	***Share of willingness to pay (%)***		
			Unwilling	***Willing***	***Total***
Current consumption	40	40	22	18	40
Source of income	27	27	4	23	27
Reserving for future generation	28	28	3	25	28
For existence of the resource	5	5	1	4	5%
Total	***100***	***100***	***30***	***70***	***100***

Source: Own computations from households CVM survey data, 2018

The most important value that households attach for the resource was for current consumption and reserving it for future generation. From total 100 sampled households, 40 attached current consumption value to the resource, from these 18 were willing to contribute/pay for conservation of the resource whereas 22 were unwilling to pay. From all the sample households, 28 of them attached value to the resource for reserving it for future generation of which 25 were willing to contribute/pay for conservation of the resource whereas 3 were unwilling to pay. Furthermore, 27 of them attached value to the resource to be used as source of income from which 23 were willing to contribute/pay for conservation of the resource whereas 4 were unwilling to pay. The rest 5 households attached simply existence value to the resource from which 4 were willing to contribute/pay for conservation of the resource whereas 1 was unwilling to pay.

Still we can identify in which category of households does the maximum willingness to pay is significant using the ANOVA test below.

Table 5: ANOVA test between maximum WTP and value attached to Burie Kool Wuha

Source	**SS**	**df**	**MS**	**F**	**Prob > F**
Between groups	5971.30093	3	1990.43364	3.72	0.0141
Within groups	51403.4491	96	535.452595		
Total	57374.75	99	579.542929		
Bartlett's test for equal variances: χ^2 (3) = 3.5675 Prob>χ^2 = 0.312					

Source: Stata output result computed from households CVM survey data, 2018

As the variance analysis in table 5 showed the probability of "F" statistics is equal to 0.014 which implies there is a statistical difference between the mean maximum willingness to pay for each value attached to the resource by households and also in Bartlett's test for equal variances the probability of "χ^2" is equal to 0.312 which is statistically insignificant showing that the variances in the group are not unequal.

Furthermore, table 6 illustrates that whether there exists a statistically significance difference in terms of the mean maximum willingness to pay among the various categories of values attached to the resource by using pair wise comparisons of means with equal variances.

Table 6: Pair wise comparison of means with equal variances

Maximum Willingness to Pay	*Contrast*	*Std. Err.*	*Tukey*	
			t	*P>|t|*
Use Value of Resource				
Source of income vs. Current consumption	16.56019	5.763497	2.87	0.025
Reserving for future generation	11.375	5.701721	2.00	0.197

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vs. Current consumption				
Simply for existence of the resource vs. Current consumption	23.375	10.97619	2.13	0.151
Reserving for future generation vs. Source of income	-5.185185	6.241385	-0.83	0.840
For existence of the resource vs. Source of income	6.814815	11.26597	0.60	0.930
For existence of the resource vs. Reserving for future generation	12	11.23449	1.07	0.710

Source: Stata output result computed from households CVM survey data, 2018

As we see in table 6 above statistically significant difference prevailed only between those households that attached value for the resource as source of income vs. Current consumption which is equal to 0.025. This implies that the basic mean difference in households' maximum willingness to pay for conservation of the resource exists between households those attached value for the resource as source of income vs. Current consumption.

3.2 Households` Willingness to Pay for Conservation of Burie Kool Wuha

In this section the econometric analysis results are presented. Using Heckman's two-step model regression results, determinants of households' willingness to pay and their payment levels for conservation of Burie Kool Wuha are simultaneously discussed. However, before estimating the determinants of willingness to pay and payment levels, what is collectively called problems of regression analysis has to be checked first. One of those problems is multi-co-linearity or high inter-correlation among the explanatory variables. According [29], if there is Multicollineality or high inter-correlation among the explanatory variables, it becomes difficult to know the separate effects of each explanatory variable on the explained variable. In order to know how high these inter-correlations have to be to cause problems in our inference, rule of thumb was established by Gujarati which says that Multicollineality is a serious problem when a pair wise correlation coefficient between two repressors is greater than or equal to 0.8 [19], for continues variables Multicollineality is not a problem if vif between variables is less than 10. However, Multicollineality is not a problem for the data in this study. The other problem of regression analysis is Heteroscedasticity which is the case where the errors do have common variance. To correct these Heteroscedasticity problem robust standard errors are estimated. Furthermore, Ramsey test for omitted variables shows that the model has no omitted variables, since, the probability of "F" statistics is greater than 5 %. The overall significance, Wald chi2 test, established shows that the explanatory variables in the Heckman two step model are jointly significant which is different from zero at 1% significant level since there are some explanatory variables which significantly explain households' willingness to pay and payment levels.

3.2.1 Heckman Model Estimation Results

Heckman's two-step model is applied using Stata14.0. The households' WTP and their payment levels are used as the dependent variables, while household characteristics are used as the independent variables.

Table 7: First-Stage Heckman's regression analysis, WTP as a dependent variable

Variable	***Coefficient***	***P>|z|***
Family Size	.0343133	0.438
Household Sex	.1269152 *	0.079
Age of Household Head	-.0025365	0.423
Education Level of Household Head	.3434124***	0.000
Resource Source of Income Value	.2346479**	0.029
Resource Reserve Value	.2890475***	0.009
Resource Existence value	.1364059	0.334
Wealth of Household Head	.1752146*	0.052
Occupation of Household Head	-.1506171**	0.050
Log of household annual Income	-.022677	0.651
Unemployed	-.0857868	0.334

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Family Members		
Constant	.5437792	0.369
Number of obs =100 Censored obs = 24 0.0000 Uncensored obs =76 Wald chi2(11) = 61.92 Prob > chi2 =0 0000		

*Note: ***, **, and * represent significance at 1%, 5%, and 10%, significance level respectively.*

Table 8: Second-stage Heckman's regression analysis, MWTP as a dependent variable

Variable	**Coefficient**	**P>|z|**
Constant	-6.860289**	0.011
Family Size	.6391167**	0.013
Household Sex	.6022841	0.155
Age of Household Head	-.0204568	0.294
Education Level of Household Head	1.044255**	0.017
Resource Source of Income Value	-.155032	0.787
Resource Reserve Value	.0483189	0.922
Occupation of Household Head	-.6694517	0.158
Wealth of Household Head	.9814731**	0.022
Bid Value	-1.791288***	0.000
Log of household annual Income	.4469388**	0.040
mills lambda	.1020197	0.503
Rho	0.36600	
Sigma	0.27874563	
Number of obs =100 Censored obs = 24 Uncensored obs =76 Wald chi2(11) = 61.92 Prob > chi2 = 0.0000		

*Note: ***, **, and * represent significance at 1%, 5%, and 10%, significance level respectively.*

It should be noted that eleven explanatory variables are incorporated in the first stage, and ten explanatory variables are introduced in the second stage. This is because Heckman's model should include at least one variable in the first stage that is different from the variables included in the second stage.

3.2.1.1 Determinants of WTP

The first-stage Heckman's model regression analysis result indicated in table 7 shows that Gender (*hhsex*), Education of the household (*educ*), value of the resource as source of income (*userer2*), value of the resource reserving for future generation (*userer3*), Wealth of the households (*Wlth*), Occupation of households (*Occhh*) are significantly related to WTP, while family size of the households (*fmsz*), age (age), log of pre-tax level of income per year (*lninc*), unemployed family members (*ufm*), and value of the resource as existence value (userer4) are not statistical significance variables to determine willingness to pay.

Variables *educ*&*userer3* are statistically significant at 1% level of significance. *Occhh*&*userer2* are statistically significant at 5% level of freedom. Other variables, *hhsex* and *Wlth*, are significant at 10% level of significance.

As expected initially, dummy variable education of the households has a positive and highly significant relationship with households' WTP for conservation of the resource. This is due to the fact that households are more concerned about the environment as they become educated. Higher his/her awareness about environmental goods and services depends on education level perhaps results in high amount of information about environmental tasks. It indicates that households with any kind of formal education are willing to pay more than those without formal education or illiterate groups. This finding is consistent with the findings of [14] ; [8]; [34]; [33] and [10] they found a positive relationship between education and willingness to pay.

In the case of the categorical variable value attached to the resource by households (*usere*), households who value the resource reserving for future generation has a positive and highly statistically significance relationship with WTP this may be due to the fact that households those thinks about future generations are aware of sustainable use of resources and also households who value the resource as Source of income has a positive and statistically significance relationship with WTP this may be due to the fact households who value the resource as a source of income understand that conservation enhance benefits.

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The variable Occupation of households has a significant but negative relationship with WTP this implies that households that are not employed in formal sector salary employment are willing to pay more than those who are employed in formal sector salary employee. This is due to, may be, the fact that households without formal sector salary employee in that area may have great sense of ownership and they may started thinking about community owed production and may have long and sufficient closeness to the resource. So the variable occupation of households has a negative effect on WTP and statistically significant.

The variable sex of household head is statistically significant with WTP, and the coefficient is positive, the positive sign implies that male household heads are more willing to pay for the conservation practice than female household heads. This may be male household heads has better control over resources. This finding is consistent with [14]; [9]; [8]; and [39] their finding indicated that male household heads are more willing to pay.

Ownership of house/land, which is a proxy for wealth in the model, is the other most important factor which determines households' WTP for conservation of the resource. As expected initially, it has a positive relationship with WTP for the conservation practice and is statistically significant at 10% level of significant. It indicates that households living in their own houses/owners of land are willing to pay for conservation of the resource more than those living in rented or other houses/not owners of land. Therefore, ownership of a house/land should be taken seriously in the conservation practice of Burie Kool Wuha. This is consistent with the finding of [44] who indicated a positive relationship between wealth and willingness to pay.

3.2.1.2 Determinants of maximum willingness to pay

The Second-stage of Hackman's model regression analysis result shown in Table 8 indicates that Family size of households (*fmsz*), Education of the household (*educ*), Wealth of the households (*wlth*), Initial bid value (*bv*) and log of income of households (lninc) are significantly related to payment levels. The variable *bv* is statistically significant at 1% level of freedom whereas *fmsz*, *educ*, *wlth*, and *lninc* are statistically significant at 5% level of freedom.

The coefficient estimate of initial bid price has negative sign and highly significant at 1% level of significance. This implies that as the initial bid value increases households maximum willingness to pay will decline.

Economic theory predicts a positive association between willingness to pay and household's income [6]. The coefficient of log of income is statistically significant and positive as can be expected. It indicates that the higher the income of the households the higher there payment level will be. This finding is consistent with [14]; [8]; [34]; [33]; [10]; [31] and [39] they found a positive relationship between income and payment levels.

Ownership of house/land, which is a proxy for wealth in the model, is the other most important factor which determines households' maximum WTP. The coefficient of wealth is statistically significant and positive as can be expected. It indicates that households who owns house/land are stable groups in the society and the more they cares about the conservation practice and the more there payment level will be. This is consistent with the finding of [44] who indicated a positive relationship between wealth and payment levels.

Education of the households has a positive and highly significant relationship with households' maximum WTP for conservation of the resource. This is due to the fact that households are more concerned about the environment as they become educated. Higher his/her awareness about environmental goods and services depends on education level perhaps results in high amount of information about environmental tasks. This implies educated groups are more willing to pay for the conservation practice than illiterate groups. This finding is consistent with [14] ; [8]; [33]; and [10] they found a positive relationship between education and payment levels.

The variable Family size of the households which was expected as negative relation, that is, as the number of family increases, the individuals' WTP will decrease. But the result demonstrate the inverse of this, i.e., increase in family size increases the significance of the variable. Justification of this result was given by respondents as individual with more number of children thinks and reserves the resources for future generation. This variable has a positive and significant relationship with households' maximum WTP. Still we may infer that as the family size of households increases productivity of the households' increases and at the same time demand for productive natural resources also increases, thus, the more they are willing to pay for the conservation of the resource. This is consistent with the finding of [33] who found a positive relationship between family size and payment levels.

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The mean willingness to pay for contingent valuation questions is computed by taking the average of the households' maximum willingness to pay amount.

$$i.e. Mean\ WTP = \mu = \Sigma Mi/n$$

Where, Mi = the reported maximum willingness to pay amount by surveyed households

n = the sample size

$$Mean\ WTP = \mu = 27.45$$

Therefore, it can be concluded that the mean willingness to pay is 27.45 birr for conservation of Burie Kool Wuha.

To calculate the total WTP, multiplying the total population by mean WTP is total WTP for the resource conservation.

$$Total\ WTP = \mu N = 27.45 * 4805 = 131897.25$$

Where, N=is the total number of population in the four purposively selected kebeles of Burie town

Therefore, the total willingness to pay for conservation of Burie Kool Wuha is estimated to be birr 131897.25.

IV. CONCLUSION AND POLICY RECOMMENDATION

4.1. Conclusion

The survey results obtained from this CV survey was analyzed by using Econometric software STATA version 14.0 using both descriptive and econometric analysis. Heckman two step model was used to analyze the determinants of households WTP and their payment levels for conservation of Burie Kool Wuha.

In order investigate the perception of households towards the importance of Burie Kool Wuha for their livelihood the descriptive analysis was employed, the results of the analysis showed that around 40% of the households attached value for the resource for current consumption but their rate of willingness to pay for conservation of the resource is lower as compared to the others, this may be due to the fact that households thinking about current consumption may not worry about future generations. The second category of households attached value for the resource as a source of income which is 27%. The other value attached to the resource by households is reserving for future generation which is 28% and these households has higher rate of willingness to pay for conservation of the resource as compared to the others, this indicates that those households really understand the fact that conservation will enhance future benefits. The rest 5% attached value simply for the existence of the resource.

The major objectives of the study are to analyze the determinants of households' willingness to pay for conservation of Burie Kool Wuha and factors determining their payment level. In order to achieve those objectives Heckman two step model was employed, results show that sex of the household head, education of the household, value attached to the resource by households as source of income, value attached to the resource by households reserving for future generation and wealth of the households has a significant and positive correlation with households WTP, and family size of households, education of the household and wealth of the households has a significant and positive correlation with the households payment levels. On the other hand, initial bid value has a negative correlation with the level of payments. The mean willingness to pay for conservation of Burie Kool Wuha is found to be birr 27.45 and the total willingness to pay for conservation of the resource is estimated to be birr 131897.25.

4.2. Policy Recommendations

Taking in to account the existing population growth and increase in scarcity of natural resources, the economic value of the resource may be higher in the future than that of the present year. Households also understand it and they are mostly willing to pay for conservation of Burie Kool Wuha. By considering this fact, the following policy implications are suggested:

- The study focused on identifying the determinants of households' willingness to pay for conservation of the resource as it is difficult to conserve the resource without participation of the society. For instance, teaching households those are valuing the resource only for current consumption is very important because awareness about the value of the resource rather than current consumption increases households' willingness to pay for conservation of the resource and improves the existing situation of the resource.
- The result provides support for the establishment of community owned production of the standardized cool water because significant portion of the households perceived that the resource will serve as a source of income and they are willing to take part in the conservation program.
- The strong positive relationship between education and willingness to pay indicates that there is a need to

educate households about the benefits associated with conservation of the resource.

- The existing positive relation between wealth of the households and their willingness to pay imply that there is a need to consider household's wealth status in designing policies related to conservation of the resource.
- There is a positive relationship between households' annual income and their maximum willingness to pay for conservation of the resource. Hence, much emphasis should be given to households' income structure at the time of the conservation activity; households with higher level of income should pay more for the conservation of the resource.
- As an observation, the environmental protection authority is not well organized in the society in which the study is undertaken so that there is a need to strengthen them because they can play the major role in conservation of such natural resources.
- Finally, this study calls for further chemical and geological studies in this area.

Generally, creating awareness in the society about the importance of the resource and the impacts of their activities on the resource must be the role and major task of policy makers.

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