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Abstract

The purpose of this study was to examine the factors that influence local residents' Willingness to Pay (WTP) for enhanced mountain ecosystem services. Using the single bounded dichotomous choice value elicitation format, the Contingent Valuation Method (CVM) was applied. For the year 2024–2025, the majority of the data used in this study were primary and cross-sectional. The sampled residents were obtained using basic random sampling techniques of probability sampling. This study used a well-designed questionnaire to gather primary data. Cross-sectional data from 408 carefully chosen sampled households were used in the study. The responses to the CV survey were analyzed using the Probit empirical model. The test statistics for the Probit model revealed that respondent's gender, education family size, families' yearly income, respondents' perception on mountains degradation, as recreational facilities, as water source biodiversity degradation, as tourist destination, respondents' satisfaction level had a positive effect on the likelihood that families would be willing to pay more for better Choke Mountain ecological services. On the other hand, age of the respondent, and initial bid offered to respondents had a negative expected effect on the probability of saying 'Yes' for the initial bid offered to them for improved ecosystem services. Therefore, management plans should consider gender-sensitive and family-centered approaches to ensure equitable participation. Distance and initial bid size negatively influenced WTP, payment schemes should be designed to be fair, affordable, and sensitive to households' varying economic conditions and proximity to Choke Mountain.

Key Words: Choke, Ecosystem, Contingent Valuation Method, Willingness to Pay, Probit, Ethiopia

1. Introduction

Choke Mountain is the source of more than 59 rivers, and 273 small springs which are the main tributaries of Upper Blue and thus it is sometimes called the water tower of the upper Blue Nile River system in Ethiopia, (Shrestha, R. K., & Alavalapati, J. R. R. (2006). Among the principal rivers that flow from this mountain are Chemoga, Temecha, Gedeb, Tijan, Tefe, Teme, Azewari, Sede, Inat Muga, Gilgel Muga, Zimbl, Komed, Oromo Meshageriya, Tiliku Abeya, Tinishu Abeya, Ayabab, and Gudela. Additionally, Choke Mountain has a lot of potential resources that might be useful as tourism attractions, making it a popular destination for both domestic and foreign travelers. The existence of many unique and common biological diversity like Gibra (Giant Lobelia rhynchopetalum) and Key Kebero (Ethiopian Wolf), and the cool temperate agro-ecological (Wurch in Amharic) zone and the existence of marvelous landscape, the four stepped mountains (Arat Mekeraker in Amharic) are some of the potential resources captured by Choke Mountain. Therefore, like that of Semen and Bale Mountains, Mount Choke can support the nation's growth in ecotourism. The other most notable aspect of this mountain is the presence of wetland ecosystems, which encompassed more than 3386 km2 and varied from sedge to regularly wet prairies. Out of this figure, seasonal wetlands with high moisture, seasonal wetlands with low moisture, and open water constitutes 3000km^2, 340km^2 and 46km^2 respectively (Teferi et al., 2010).

These natural environments are essential for guaranteeing food security, reducing poverty, and ultimately attaining sustainable development for the nation, either directly or indirectly. The reason for this is that the Mount Choke range resource bases offer resources such as food, drinking water, small-scale irrigation, grazing, construction supplies, and tourism-related amenities. Additionally, it is utilized for scientific study and educational purposes, temperature stabilization, flood

management, home for a variety of plant and animal species, and ecological stability.

Choke Mountain currently is home to more than 132,069 families who are engaged in traditional farming. As a result, they are the first to gain advantages from the ecosystem's rejuvenation and, conversely, the first to suffer from the extreme deterioration of its natural assets (Ibid).

Besides Sudan and Egypt which are countries found in the downstream of Nile basin get water o from mount Choke ecosystem and they have used this water for drinking, transportation, tourism and recreation, irrigation,hydroelectric power generation, andhabitat for various fauna and flora.

In spite of these immense contributions to the national as well as the international community, 22.4 km2 of wide-open water and 607 km2 of low-moist seasonal swamp of the mountain were lost between 1986 to 2005 which clearly showing that the resources in the Mt. Choke range wetland ecosystem is currently facing serious problem of degradation and exploitation. The main reasons contributing to such degradation and exploitation of mount Choke range wetland ecosystems comprise growing population challenges, a lengthy history of human settlement, rise in poverty, biodiversity loss and even elimination, changing climates, erosion of soil and consequently decreased soil fertility, excessive livestock farming, deforestation and government inaction (Ibid).

Therefore, in order to sustain the above multiple wetland benefits, there is a need to develop conservation and management mechanisms, restorations, enhancement these ecosystems. And one best way of protecting this Mountain wetland resource from degradation and over exploitation is estimating its economic value. Measuring the economic value of this Mt. Choke Wetland ecosystem resource is needed and sometimes mandatory because of two reasons. First Ecosystem services have not market price, second lack of knowledge on the multidimensional values of wetlands for the society including the environmental policy makers and hence absences of strong national wetland policy or strategy.

2. Literature review

Using choice experiment (CE) approach, which presents respondents with hypothetical scenarios of ecosystem improvements and associated costs to estimate their willingness to pay (WTP) with quantitative, cross-sectional survey design and multinomial logit model showed that Households with higher literacy levels tended to exhibit a greater willingness to pay for the conservation and improvement of the Choke Mountain ecosystem compared to illiterate households, with this relationship being statistically significant at 10% level. This indicates that education has a positive effect on the valuation of the environment and the willingness to financially support ecosystem services (Getnet Berhanu,2012).

Abafita et al., (2017) examined the willingness to pay (WTP) of households for improved ecosystem services in the Choke Mountain watershed, Ethiopia using a double bounded dichotomous choice contingent valuation (CVM) method. Data from a representative sample of households were analyzed using binary logit and probit regression models to identify socio-economic factors influencing bid acceptance. The study found that female respondents were more likely to express higher willingness to pay for ecosystem conservation than males in addition to income of the respondents. These results highlight the importance of socio-demographic features, especially gender and education, in preferences and financial support for improvement of ecosystem services, with important implications for environmental valuation and policy planning. However, the study by [10] explored the willingness to pay (WTP) of households to regulate ecosystem services in Taiwan through a contingent valuation approach, and found that female respondents were more prone to state a higher WTP for ecosystem conservation than male respondents, suggesting stronger pro-environmental attitudes among women in the Taiwanese context, which clearly demonstrated inconsistency concerning the gender effect on ecosystem conservation.

Another study by Ureta et al,. (2014) studied the willingness to pay (WTP) of households for improved watershed services in Oroquieta City, Philippines using a contingent valuation method (CVM). Data were collected from household surveys and analyzed using binary logit regression models to identify the socio-economic factors affecting the acceptance of bids. The study showed that family size positively influenced WTP; larger households were more likely to accept the bid

for improved watershed services and also higher household income, education levels, awareness were significantly associated with greater WTP. This finding confirmed that household socio-economic characteristics, particularly family size, income, education, and environmental awareness, are significant determinants of WTP for watershed improvements.

In another study in Nepal, Shrestha and Alavalapati (2006) showed that households who perceived watershed degradation more seriously were more willing to support and pay for watershed restoration programs. Similarly, in the Philippines [14] found that awareness of watershed degradation significantly increased willingness to finance conservation efforts of household. [17] also found in China that people who perceived more environmental degradation also had higher willingness to donate money to ecological conservation. Taken together, these results suggest that perceived environmental degradation translates into increased public support and willingness to pay for ecosystem restoration in different socio-economic and geographical settings.

Using a contingent valuation method (CVM), Ayele and Mekonnen (2020) explored the determinants of households' willingness to pay (WTP) for recreational ecosystem services in the Choke Mountain Watershed, Ethiopia. The study applied econometric models (binary logit and marginal effects analysis) to identify key socio-economic and perception-related factors influencing WTP and found that income and education was positively and significantly influenced WTP; higher-income households were more willing to pay for recreational ecosystem services. Furthermore, perception of environmental quality: Households who perceived environmental degradation or recognized the value of the ecosystem were more likely to pay for its improvement confirming that environmental awareness and socio-economic characteristics significantly shape households' willingness to pay for ecosystem recreational services, highlighting the importance of income, education, and perception in environmental valuation.

Whitehead, J. C. (2000) in the United States and Lee and Han (2002) in South Korea found confirmed that positive attitudes toward recreational ecosystem services significantly increase willingness to pay showing that respondents with favorable attitudes toward recreation and environmental quality were more likely to accept payment bids in contingent valuation studies, consistent with higher "Yes" responses for ecosystem improvement.

Aryal et al., (2014) found that rural households in Nepal exhibit a higher willingness to pay for forest ecosystem services when they perceive declining ecosystem quality. Overall, these studies indicated that environmental awareness and perceived ecosystem deterioration are key behavioral drivers of conservation support in mountain regions, as households tend to place higher economic value on ecosystem restoration when they recognize environmental decline. These findings are consistent with broader evidence from global mountain and watershed ecosystems, where perceived environmental degradation is commonly associated with increased willingness to pay for conservation and ecological rehabilitation initiatives.

Wang and Zhang (2009) evaluated household willingness to pay (WTP) for ecosystem restoration under the Loess Plateau ecological rehabilitation program in China using a contingent valuation approach. The results indicate that households derive substantial value from watershed ecosystem services, particularly those related to water supply reliability and hydrological regulation**.** Econometric analysis shows that household dependence on watershed services significantly influences willingness to pay. Specifically, households who benefit more from reliable water supply and improved watershed functions exhibit a higher probability of expressing positive WTP and a higher level of payment for ecosystem restoration programs**.** This suggests that perceived importance and direct reliance on ecosystem services strongly increase public support for environmental rehabilitation initiatives. Besides initial bid offered to households has a negative and statistically significant effect on acceptance of payment for ecosystem restoration. Overall, the study concluded that watershed dependency and initial bid were a key determinant of conservation financing behavior, highlighting the importance of ecosystem service reliance in shaping household valuation of ecological restoration programs.

3. Methodology

a. Study Approach and Design

To calculate the monetary value of improved Choke Mountain ecosystem services, this study used a cross-sectional research approach, gathering data at the household level. Both explanatory and descriptive design research were applied. Descriptive analysis helped in summarizing and presenting the data, while explanatory design was used to examine the relationships between household preference to pay for better Choke Mountain ecosystem and various determinants

influencing their preference to pay in order to estimate the ecosystem economic value. Both quantitative and qualitative research approaches were combined to guarantee a thorough grasp of the research subject.

b. Data Source and Type

Primary and cross-sectional data for the year 2025 obtained through a contingent valuation survey were used to collect from three purposively selected Woredas (Bibugn, Sinan and Debey Tilat Gin Woredas). Out of 450 in-person interviewees using simple random sampling, 408 were selected as usable.

c. Model Specification

The replies to the closed-ended binary format, in which participants are provided the first "bid" with "yes" or "no" answers, were analyzed using the probit model. The basic model for analyzing such dichotomous contingent valuation responses is Random Utility Model (RUM). This unpredictable utility model begins with a utility formula that includes both unpredictable and predictable components in an individual's indirect utility (Haneman and Kanninen, 1998).

This is due to the fact that, even when a person feels certain of his or her utility, the researcher may only make likelihood judgments regarding respondents' "yes" or "no" answers to the suggested scenario because some of its components are not visible from the researcher's point of view.

The indirect utility function for respondent 'j' can be written as follows, **Vij =Vi (Yj, Xj, εij) ---1**, where **Yj =jth** respondent's income, **[i]=** 1 denotes the final state (after improvement) and **i**=0 denotes the status quo (initial state), **Xj=** is vector of household characteristics and attributes of a given choice, **εij=** is the random component of a given indirect utility that is the stochastic disturbance term assumed to be independently and identically distributed with mean 'zero and a constant variance of σ2. Based on this model respondent 'j' answers 'yes' or 'no' to a required payment of initial 'bid' price βi* for a proposed Choke Mountain ecosystem improvement. Households are faced with two choices: either to maintain the status quo or to accept the improvement. Therefore, the household will choose the improved ecosystem service, if the utility

with the contingent valuation program, net of the required payment, that is the initial 'bid', exceeds utility of the status quo (Haab and McConnell, 2003).

$V1j\ (Yj-\beta i^*, Xj, \varepsilon 1j) > V0j\ (Yj, Xj, \varepsilon 0j)$ ----------2

By specifying the utility function as additively separable in deterministic and stochastic preferences, and by assuming linear functional forms (which is the simplest and most commonly used), it can be rewritten as:

$V1j\ (Yj-\beta i^*, Xj) +\varepsilon 1j > V0j\ (Yj, Xj) +\varepsilon 0j$----------3

$=\alpha jXj +\beta 1\ (Yj-\beta i^*) +\varepsilon 1j>\alpha jXj+\beta oYj+\varepsilon 0j$----------4

Where αj is a vector of parameters and Xj is different explanatory variables excluding income. The fundamental problem that the researcher may encounter here is that the random component of preferences cannot be known; therefore he/she can only make probability statement about 'yes' or 'no' responses for the given bid which provides an intuitive basis to analyze binary responses. Thus, the probability that the respondent says 'yes' is the probability that he/she thinks he/she is better-off from the improved ecosystem service program.

$Pr.\ (Yes) =Pr.\ [V1j\ (Yj-\beta i^*, Xj) +\varepsilon 1j > Voj\ (Yj, Xj) +\varepsilon 0j]$ ----------5

$Pr.\ (V1j>V0j) =Pr.\ [V1j\ (Yj-\beta i^*, Xj) +\varepsilon 1j > V0j\ (Yj, Xj) +\varepsilon 0j]$ ----------6

$=Pr.\ [V1j\ (Yj-\beta i^*, Xj) - V0j\ (Yj, Xj)] > \varepsilon 0j-\varepsilon 1j$----------7

$=Pr\ [V1j\ (.)-Voj\ (.)+\varepsilon 1j-\varepsilon 0j>0]$ ----------8

$=Pr\ [\Delta V+\eta>0]$ ----------9

And $Pr.\ (Noj) =1-Pr.\ (Yes)$ ----------10

$Pr.\ (V1j \leqslant V0j) =1-Pr.\ (V1j>V0j)$ ----------11

$=1-Pr\ [\Delta V+\eta>0]$ ----------12

Where η=ε1j-ε0j and letting Fη (.) be a cumulative distribution function, and in the probit model it follows the normal cumulative distribution function and in the logit model Fη(.) follows the logistic cumulative distribution function. The choice between the two models is a matter of mathematical convenience, since both the logit and probit models give similar parameter estimates [Haab 2003]. Assuming the normal cumulative distribution the probit model can be given by: Tj*= β'Xj+εj ----------13

Where Ti*= is unobservable latent variable, that is unobservable households' readiness to pay for enhanced ecological benefits. WTPi, which is dummy variable we observe with the following definition:

WTPj = 1 if Tj* ⩾ βi*(Tj* = 1, if the answer is "yes"). If Tj* <βi*, WTPj = 0 (Tj* = 0 if the answer is "No"), Xj represents a number of independent variables, Bi* is the starting bid amount given to respondents, and εj is the random error term, which is assumed to have a random normal distribution with a mean of "zero" and a constant variance of σ2.

From the perspective of the researcher, it is evident from the random utility framework that people's readiness to pay is an unknown variable. Therefore, even though a person is aware of his or her maximum readiness to pay, Ti*, it is a variable that is unknown to the observer with a given cumulative distributed function (cdf) denoted F(Ti*/Xi,θ), where θ is the coefficient of this distribution, which has been calculated according to the responses to the contingent valuation interview; Ti* is the individual's answer, and hence Ti* = 1 for "yes" response, Ti* = 0 for "no," responses and Xi is an independent variable. To put it briefly, in this elicitation format, the respondents are asked if they would be willing to pay the initial "bid" (βi*) to obtain the better ecosystem advantages. They responded with "Yes" or "No," but their actual readiness to pay for the enhanced mountain ecosystem services is not visible. Thus this 'Yes' or 'No' responses obtained from the closed ended survey is estimated by Maximum Likelihood procedures and thus the Likelihood function can be expressed as a series of Bernoulli trials

L=∑ Tj* ln Fj+ (1-Tj*) ln (1-Fj) ----------14, where Fj =F (Tj*/Xj, θ), ith individual's response probability and Tj* is the dummy variable indicating an individual choice 1 for 'Yes' and 0 for 'No' .

We define the probit model for residential choice for the enhanced Choke Mountain Ecosystem as follows in light of the aforementioned rationale:

$$WTPi = \beta O + \beta 1RGND + \beta 2REDU + \beta 3RAGE + \beta 4LSATIFA + \beta 5RFMS + \beta 6YFINC + \beta 7RPDEG + \beta 8RAPRECF + \beta 9RBIODP + \beta 10RWATS + \beta 11RTOURC + \beta 12IB + \beta 13HHHEAD + \beta 14ECOIMPRACTIV + \beta 15RLOCACM + 16MASR + \varepsilon i \quad ---------- 15$$

The explanatory variables are defined in table 1, βi is the regression parameter's value, εi is the value of the error term, and WTPi is the reply to the "bid," which is 1 if the answer is "yes" and 0 if it is "no." STATA 17 econometric software was used to estimate the regression parameters using the Maximum Likelihood approach.

Determining the median (or mean) of the WTP distribution is one of the primary goals of constructing an empirical WTP model based on a CV survey reply. The mean and the median measures are the most widely used measures of welfare change, where the mean measure is more sensitive to skewness or kurtosis, and the median measure has statistically a smaller sampling error than the mean estimate. The mean is an appropriate welfare measure in the cost benefit analysis as it reflects the Kaldor-Hick's compensation criterion, but not the median [6]. As a result, the mean measure is used in this study to determine the overall benefit of the enhanced Mountain eco system services. As the mean WTP for closed-ended single bounded questions is determined using the probit model, it may be described as follows: **Mean (Average) WTP =γ= -σ/β----------16,** where β is the coefficient of the "bid" given to the participant, while σ= is the value of the constant or intercept term.

Table 1: Description of Variables and Expected sign

Variables	Description	Expected Sign
Explained Variable		
WTP	Willingness to pay, dummy, 1 for yes, otherwise,0	
Explanatory variables		

RGND	The respondents 'gender, dummy, 1 for male and 0 for female	+-
REDU	Respondents' educational status, dummy, 1 if literate, 0, otherwise	+
RAGE	Respondent's years of age in years	-
LSATIFA	Respondent's satisfaction level, dummy, 1 if unsatisfied, 0 otherwise	+
RFMS	Respondents' family size in numbers	+-
IB	Initial bid offered to respondents	-
YFINC	Households' average yearly income	+
HHHEAD	Head of family, dummy, 1 for head and 0 for non-head	+
MASR	Respondents' marital status, dummy, 1 if married, 0 otherwise	+
RPDEG	Respondents' perception on mountain degradation, dummy, 1 if degraded, 0 otherwise	+
RLOCACM	Distance from Choke Mountain	+
ECOIMPRACTIV:	Respondents' perception about practices performed for mountain's ecosystem services	+
RAPRECF	Respondents' perception on recreational facilities, dummy 1 if not efficiently providing recreation, 0 otherwise	+
RBIODP	Respondents' perception on biodiversity degradation, dummy, 1 if degraded, 0 otherwise	+
RWATS	Respondents' perception on Choke Mountain as source of water, dummy,1 if they believe that choke is source of water, 0 otherwise	+
RTOURC	Respondents' perception on Choke Mountain as tourist destination, dummy, 1 if they believe as tourist destination, 0 otherwise	+

4. Results

4.1.Probit Model Findings and Analysis

The estimated probit model estimation results using STATA version 17.0 were shown in Table 2. The significance and the direction of the effects of each explanatory variable on WTP was given by the coefficients of the probit model, while the probability that respondents accept or reject the offered bid due to a change of dummy variables from 0 to1 for discrete variables and a unit change in continuous explanatory variables were indicated by the marginal effects coefficients.

Table 2: -Probit Model Maximum Likelihood Estimates

				Total Number of obs.=408
				Wald chi^2 (16) =109.68
				Pseudo R^2= 0.9067
Variable	Estimated Coefficients	Std.Err.(Robust)	P>|z|	(dy/dx)
RGND	.9128073	.4395985	0.038**	.254743
HHHEAD	.2372592	.5509252	0.667	.0547574
RAGE	-.1573045	.0486147	0.001***	-.0339866
MASR	.9422226	.6548705	0.150	.2728837
REDU	.7602975	.4567394	0.096*	.1722472
RFMS	.7011415	.2392479	0.003***	.1514857
YFINC	.0000359	$6.99e^{-06}$	0.000 ***	7.76e-06
RLOCACM	.1195362	.2548953	0.639	.0258265
RPDEG	1.135153	.4419035	0.010**	.2962646
RAPRECF	3.518779	.5660783	0.000***	.8423812
ECOIMPRACTIV	.2010919	.5208212	0.699	.0470547
RBIODP	1.771398	.5016685	0.000***	.4962198
RWATS	1.629878	.4025056	0.000***	.4327043

RTOURC	3.73725	.7261751	0.000***	.9120266
LSATIFA	1.61617	.4953173	0.001***	.4632751
IB	-.0484322	.0102855	0.000***	-.0104641
_-cons	5.94637	1.600258	0.000***	
Log pseudolikelihood = -25.800649 Restricted Log likelihood = -276.41772				

5. Discussions

Male respondents are willing to pay more than female respondents and statistically significant at the 5% significance level and were 25.5% more likely accepting the initial offered bid comparing to their counterpart for the recommended increased mountain ecosystem service, assuming all other factors remain the same. The finding was in opposite to study conducted in Taiwan by Lin et al., (2009), showing that women were more willing to pay for regulating ecosystem services

At the 1% level of significance, the likelihood of a "Yes" response (accepting the suggested bid) is statistically significant and declines with age. The marginal effects show that, ceteris paribus, the likelihood of responding "yes" to a particular bid decrease by 3.3% for every year that the respondent's age increases. This implies that younger respondents may be more concerned than older respondents with improving environmental quality. This finding was consistent with the findings of (Aryal et al., 2014).

Literate groups representing different education levels compared with the illiterate group, were generally preferred to pay more for better Choke Mountain ecosystem at 10% level of significance. This result suggests that more educated households are more aware about the value of improved mountain ecosystem services and hence willing to pay more, and it was similar to the finding of (Abafita et al., 2019).

From table 2, the outcome demonstrated that family size had a positive effect on the likelihood of accepting the bid and was significant at the 1% significance level, despite the fact that no a priori

expectations about family size and preference to pay were made. According to the marginal impact, respondents were 15.1% more likely to pay for better Choke Mountain services when their family size increased by one member, ceteris paribus. This outcome was consistent with the findings of a study carried out in Oroquieta City by (Ureta et al. 2014).

As expected, prior, annual income of the household, had positive effect on households' willingness to pay for improving Choke Mountain ecosystem and significant at 1% level, suggests that a one birr increase in the annual income of the household increases the probability of accepting an offered bid by 7.76e-06%, other things being equal and this result was similar to the finding of (Aryal et al.,2014).

As expected, the dummy variable representing perception about Choke Mountain degradation had a positive sign and is significant at 5% significance level, which was consistent with the findings of (Shrestha and Alavalapati, 2006, Ureta et al.,2014 and Zhang et al.,2013).The marginal effect clearly indicated that if households thought that the mountain is degraded, their willing ness to pay for improved mountain's ecosystem services were increased by 29.6%, ceteris paribus.

Households' attitudes about Choke Mountain provision of recreation facilities also increase the likelihood of a "Yes" response (accepting the suggested bid) as expected and significant at 1% level. This result was similar to the finding of (Ayele and Mekonnen,2020). Assuming all other factors were held constant, the likelihood that a household would accept a bid rose by 84.2%.

Households' willingness to pay for enhanced mountain ecosystem services showed a positive predicted sign for the dummy variable mountain biodiversity deterioration, which was statistically significant at the 1% level. According to the marginal effect, households that believed that biodiversity was declining were more likely to pay for better ecosystem services. When compared to their counterpart, their likelihood of accepting the provided bid was 49.6%, ceteris paribus. This is consistent with the findings of (Teferi et al.,2010).

As expected, the dummy variable Choke Mountain serving as water source had a positive effect on households' willingness to pay for improved mountain ecosystem services at 1% significance level which was consistent with the findings of (Wang and Zhang, 2009). The marginal effect

indicated that comparing to their counterpart, the likelihood of adopting the first bid was higher by 43.3% for those households who didn't think that the mountain provides water source efficiently.

As anticipated, there was a positive correlation between the respondents' readiness to pay for better services provided by ecosystems and mountain tourism destination service. The likelihood of adopting the provided bid to pay for the suggested improved mountain ecosystem service is therefore 91.2% higher for individuals who believed that Choke Mountain could function as a tourist destination, all other variables being equal.

The coefficient of the dummy variable representing the level of satisfaction with the existing mountain ecosystem service and residents' satisfaction had the expected positive sign and statistically significant at 1% significance level which was similar to the findings of (Aryalet al.,2014). This finding implied that households were more likely to pay for enhancing mountain ecosystem services if they were dissatisfied with the current offerings.

The initial bid made to the responders has a negative impact on the likelihood of accepting the bid, as was predicted a priori, and is significant at the 1% significance level. This implies that, ceteris paribus, a one percent increase in the initial offer will result in a 1.04% decrease in the probability of paying for enhanced ecosystem services. This result was consistent with the finds of [(Wang and Zhang,2009).

Determining the central value (mean) of WTP distribution is one of the main objectives of estimating empirical WTP based on the CV survey response [7]. The mean WTP for discrete choice contingent valuation questionnaire responses can be computed from the Probit model by dividing the negative of the regression constants by the bid coefficient. That is Mean WTP = μ=-σ/β=-5.94637/-.0484322=122.777. For the suggested enhanced Choke Mountain ecosystem services, we therefore determine that the mean WTP derived from the closed-ended format is 122.8 birr per month.

6. Conclusions

This study evaluated the WTP of the local Choke Mountain communities in an effort to investigate the possibilities of cost sharing for the enhanced ecological services. In addition to secondary data from various sources, the study primarily used cross-sectional primary data. The Contingent

Valuation Method (CVM) was applied through in-person interviews with 408 randomly chosen sampling families. An open-ended follow-up elicitation structure was employed with a single-bounded dichotomous choice. In addition, questions about demographic and socioeconomic attributes, issues with the current basic degradation of the Choke Mountain ecosystem, and other general inquiries were posed to the sampled households.

The survey data from this contingent valuation survey were examined using both descriptive and econometric analysis utilizing STATA version 17.0. The Probit model was used for single bounded format closed-ended surveys in order to examine the factors influencing households' WTP and determine the average WTP of these sampled households for enhanced mountain ecosystem services.

The Probit model is used to get the mean WTP from the closed-ended contingent valuation survey responses. It also made it evident that a number of factors influence households' WTP for enhanced environmental services. Household gender (1 if male, 0 otherwise), educational background dummies, yearly income of the family, environmental degradation, destinations for tourism, water source, and satisfaction level were all important variables that positively influencing households' likelihood of accepting the first bid that was put forward to them. The probability of respondents answering "yes" to the suggested initial bid was significantly affected by the age of the respondents and the initial bid given to household, which had a negative predicted sign. This study revealed that majority of households (80.9%) were preferred to pay 122.8 birr per household per month for better Choke Mountain ecosystem services. This indicates strong community support and recognition of the value of ecosystem improvements. Based on the econometric results, the following recommendations were suggested:

6.1.Practical Implications

Since education positively influences WTP, awareness campaigns and environmental education should be strengthened to further enhance community participation in conservation initiatives. As household income significantly affects WTP, interventions that improve local livelihoods (e.g., sustainable agriculture, eco-tourism jobs) should be promoted to increase household capacity to contribute. Gender and family size were also found to be significant determinants of WTP. Therefore, management plans should consider gender-sensitive and family-centered approaches to

ensure equitable participation. Distance and initial bid size were also negatively influenced WTP, payment schemes should be designed to be fair, affordable, and sensitive to households' varying economic conditions and proximity to Choke Mountain. Furthermore, respondents valued recreational and water source facilities. Thus, investments should focus not only on biodiversity restoration but also on eco-friendly infrastructure that directly benefits households.

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Author Contributions

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Yibeltal Bantie Kebie, Getinet Assabu, Megbar Wondie, Sintayehu Adefires, Mulu Sewunet, Worknesh Tiruneh and Getaneh Belachew. The first draft of the manuscript was written by Yibeltal Bantie Kebie and all authors read, commented and approved the final manuscript. In short: -Conceptualization: Yibeltal Bantie Kebie, Getinet Assabu Ewunetu; Methodology: Yibeltal Bantie Kebie, Megibar Wondie and Getinet Assabu Ewunetu; Formal analysis and investigation: Yibeltal Bantie, Mulu Sewunet, Worknesh Tiruneh, Getaneh Belachew; Writing - original draft preparation: Yibeltal Bantie Kebie, Getinet Assabu, Megbar Wondie;

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Data Availability Statement:

The datasets generated during and/or analyzed during the current study are available from the corresponding author upon reasonable request.