Households' Willingness to Pay for Improved Watershed Services of the Layawan Watershed in Oroquieta City, Philippines

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Abstract

Watersheds provide numerous ecosystem services to downstream communities often with no cost to them. Although these services are valuable to humans, they do not have monetary values attached to them, making their total economic value quite ambiguous. This ambiguity results in the non-optimal use of the natural resources that leads to the degradation of the watersheds. One approach that could address this issue is payments for ecological services (PES). The main objective of this study was to estimate the willingness-to-pay for improved watershed services by domestic water users within the Layawan Watershed in Oroquieta City. It employed the contingent valuation method to assess the willingness to pay of water users. More than 50% of the respondents voted positively to the referendum question which is whether they are willing to pay a certain amount for the conservation of the Layawan Watershed or not. The computed mean willingness to pay amounts were Php 57.48 and Php 53.89 per month per household for the parametric and non-parametric estimations, respectively. These amounts translate to 0.68% of the average monthly household income of the sample respondents, which is approximately Php 8 198.84. The amounts computed may serve as bases for a water user fee that may be collected from the domestic water users in the Layawan Watershed as buyers of the watershed services.

Keywords: payments for ecological services (PES), contingent valuation, domestic water users, watershed conservation

1. Introduction

Water covers nearly two-thirds of the earth's surface. However, about 96.5% of this is contained in the ocean and cannot be used for industrial, agricultural, and domestic purposes. Only 2.5% of the total volume of the earth's hydrosphere is fresh water and not all of it is accessible to humans (Shiklomanov & Rodda, 2003). Watersheds play an important role in providing fresh water to humankind as they collect and store water from rainfall and snow melts.

The Philippines has about 135 proclaimed watersheds corresponding to 1 561 128 hectares (DENR-FMB, 2011). These watersheds provide clean water for agricultural and domestic uses including drinking and other household activities. Water deficit is experienced in some parts of the country especially the highly urbanized areas as the supply of water is not evenly distributed among regions (World Bank, 2003). As a case in point, the National Capital Region (NCR) comes second to the highest in terms of population in 2010. However, only one watershed forest reserve is proclaimed in NCR, the La Mesa Watershed Forest Reserve. From 2000-2010, the country population increased at a rate of 1.9% annually (National Statistics Office). As the population increased, the demand for water also escalated, leaving some regions with limited water supply. According to the World Resources Institute, the Philippines ranks second to the lowest in terms of water availability with only 1 907 cubic meters per capita per year (World Bank, 2003).

Compounding the problem is the highly degraded state of most watersheds in the country. Of the 16 million hectares of upland areas, only about 7 million hectares are covered with forests (Forest Management Bureau, 2011). The rest are open lands covered with grasses or agricultural farms. This has resulted in significant impacts in downstream areas such as massive flooding, siltation of lakes and agricultural areas, and loss of lives. There are an estimated 24 million upland dwellers who are the *de facto* managers of these watersheds (Espiritu, Casin, & Camacho, 2010). A key challenge therefore is how to optimize the role of upland communities in rehabilitating and conserving watersheds.

One promising approach being tested in many developing countries including the Philippines is payments for ecological services (PES). PES is a direct conservation approach that seeks to support the positive environmental externalities through the transfer of payments from the beneficiaries of the environmental services to those providing these services that are usually the upland communities (Mayrand & Paquin, 2004). At present, a few PES schemes have been tried in some watersheds in the country with mixed results. In Balian Watershed, the downstream residents entered into an agreement with private landowners in the upland area in exchange for planting trees, forest protection and agroforestry practices. Non-cash payments included provision of free seedlings and forest guards. A voluntary PES scheme was also implemented in Mt. Kanlaon Natural Park where a local bottling company paid the local community for conservation activities such as reforestation and forest rehabilitation. Agroforestry training was also conducted for the upland farmers. In Bakun Watershed, two hydroelectric power plants paid the Bago-Kankanaey Tribe to undertake activities like agroforestry and reforestation projects. The indigenous tribe was also provided agricultural support and assistance in the formulation of their Ancestral Domain Sustainable Development and Protection Plan (Villamor & Lasco, 2009; Lasco & Villamor, 2010; Padilla, Tongson, & Lasco, 2005). Under these PES initiatives, the beneficiaries of the environmental services were directly involved in the transaction and the service providers were compensated for the provision of the service. Three different buyers of watershed services were showcased in these PES schemes, namely hydroelectric power plant, local bottling company, and downstream residents. PES schemes vary depending on the site where they were implemented and the institutions involved in the transaction.

Valuation of raw water is necessary in the implementation of a PES scheme. Placing a monetary value on and pricing raw water is an effective mechanism to manage its use. However, not all service beneficiaries, particularly domestic users, are capable of paying additional tariffs for their use of water. Padilla et al. (2005) highlighted PES as a mechanism for poverty alleviation not only for the upland communities but also for the poor service beneficiaries who were being made to pay for their use of water. The study stated that for the poor people to be better off with PES, proper evaluation of benefits and costs of PES mechanisms is necessary. Since the 1960s, several non-market valuation techniques have been employed (Carson, Flores, & Meade, 2001) in attempts to put values on environmental goods and services that are normally accessed for free. One of these is the stated preference technique frequently referred to as contingent valuation method (CVM). CVM is an economic tool used to elicit the maximum willingness-to-pay (WTP) of the potential service user for an environmental good or service (Wedgwood & Sansom, 2003). Although this technique has already been widely used, critics still question the capability of the method to accurately measure individuals' preferences. Whittington (2002) enumerated three reasons why is this so: (1) poorly executed contingent valuation (CV) survey, (2) weakly constructed CV scenario, and (3) poorly designed CV study resulting to failure in testing effects of variations in the design on the results of the survey. Gunatilake (2007) identified steps to come up with a successful CV study. These steps address the criticisms on the method.

Despite the criticisms, a number of contingent valuation (CV) studies have been carried out over the last ten years. Water supply and sanitation was one of the areas where CVM was first applied (Whittington, 1998) and it still remains as one of the most popular areas for CV studies. In the Philippines, CVM has been applied to a number of research studies assessing the WTP of domestic water users for improved water services. In 2007, Amponin et al. estimated the willingness to pay by domestic water users in Tuguegarao City for the protection of the Peñablanca Protected Landscape and Seascape (PPLS). A similar study was conducted by Calderon et al. in 2005 where a water user fee was estimated for households in Metro Manila. In some cases, results of this type of study have been used in the implementation of PES schemes wherein the beneficiaries of water resources themselves are made to pay for the conservation of the resource.

The paper discusses the willingness to pay of domestic water users in Oroquieta City, Misamis Occidental for the conservation of the Layawan Watershed. Specifically, the paper evaluates the level of awareness of the domestic water users on the importance of watersheds in the provision of sustainable water supply, identifies the factors that affect willingness to pay, and assesses how the mode of payment (mandatory and voluntary) and the information given on who will pay (all water users and domestic water users only) affect the respondents'

willingness to pay. The mean willingness-to-pay estimate derived from this study may serve as basis for the collection of a water user fee under a PES scheme in Layawan Watershed.

2. Methodology

The contingent valuation method (CVM), a stated preference technique, was used to estimate households' willingness-to-pay for the conservation of the Layawan Watershed, which is situated in the Mt. Malindang Range Natural Park (MMRNP), a protected area in Misamis Occidental, Philippines. The survey was conducted in 11 barangays, namely: Buntawan, Dolipos Bajo, Dolipos Alto, Talairon, Talic, Villaflor, Upper Langcangan, Lower Langcangan, Taboc Norte, Layawan, and Poblacion II. These barangays have the Layawan Watershed as their main source of water supply and thus considered as major stakeholders of the watershed.

Three focus group discussions (FGDs) participated by agencies involved in the management of MMRNP, irrigator-farmers and domestic water users were conducted to gain insights from the major stakeholders of Layawan Watershed on the current condition of the watershed, problems within the watershed, and awareness on the role of watersheds in providing sustainable supply of water resources. In addition, the results of the activity were used to fine-tune the survey questionnaire and generate bid amounts that were used in the survey.

2.1 Study Site

Layawan Watershed is one of the 15 major watersheds in the Mt. Malindang Range, a major rain-catchment area in the Zamboanga Peninsula that supplies water to the provinces of Misamis Occidental, Zamboanga del Sur, and Zamboanga del Norte (Baretto-Lagunzad & Ong, 2006). Its headwaters are located in Brgy. Sebucal and has a highest elevation at the North Peak reaching up to 2 183 meters above sea level. The watershed covers 33 barangays in six towns in Misamis Occidental and drains into the Layawan River to the coastal zone of Oroquieta City. It has a total area of 10 706 hectares, of which 6 198 hectares are classified as forest, 4 424 hectares as cropland, 57 hectares are planted with lowland rice paddy, and 27 hectares are classified as built-up area (2010).
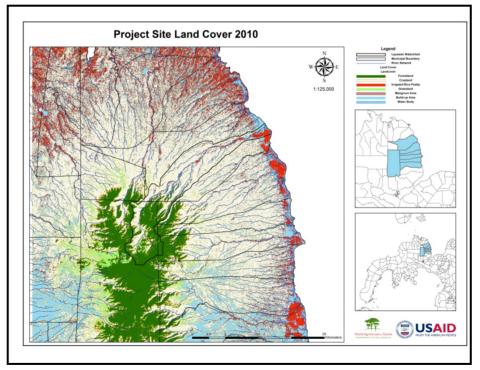

Figure 1. Layawan Watershed in Mt. Malindang, Misamis Occidental, Philippines

Water from the Layawan watershed is mainly used for domestic and agricultural activities. Over the years, the watershed has been exposed to destructive activities such as illegal logging, encroachment, and timber poaching. These resulted in an 18% decrease in forest cover from 1973 to 2010 (Figure 2). The declaration of Mt. Malindang as a protected area (Republic Act 9304) has helped reduce destructive activities in the upland portion of the watershed, thus conserving the water resources provided by the watershed. It has been observed that the

Layawan Watershed still produces an ample amount of freshwater. However, problems on water quality have been observed in the lowland portion of the city that can be attributed to improper farming practices in the midland and lowland portion of the watershed, and the anthropogenic waste observed in certain parts of the riverbank. This poses a huge threat to the residents of Oroquieta City as they primarily depend on the Layawan River as a source of water for domestic purposes.
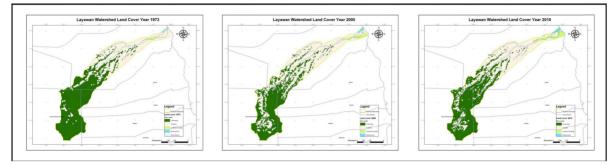

Figure 2. Time series map showing land cover change in Layawan Watershed

2.2 Sampling Procedure

Probability sampling was used in the study. The sample, determined using Slovin's formula, consisted of 369 households. In the actual survey, however, 400 households with and without water connections were included in the study to provide allowance. Systematic sampling technique was employed in selecting the households to be included in the survey.

To evaluate the effect of specific variables on the willingness to pay of the respondents, the sample was split into 4 subsamples based on the payment scheme – mandatory and voluntary – and the level of information given to the respondents on who will pay – domestic water users only and all water users, which include domestic water user, farmer-irrigators, industry sector, and the business sector.

2.3 Survey

The questionnaire used for the CV survey contained five (5) parts: (1) brief introduction of the study and what the survey was about, (2) a set of questions on the respondent's socio-demographic information, (3) current water supply situation, consumption behaviours, and respondent's level of awareness and attitude, (4) the CV market scenario, and (5) elicitation of willingness to pay of households.

The enumerators involved in the CV survey first underwent a training on the CV method and the purpose of the study. A pre-test was conducted to prepare the enumerators for the actual survey, evaluate the soundness and appropriateness of the questionnaire, and determine the final bid amounts to be used in the survey.

2.4 Bid Amounts

The study made use of the dichotomous choice format where respondents were asked if they would pay a given bid amount for the conservation of the Layawan Watershed. The bid amounts used in the survey were generated from the focus group discussion and from the pre-test. The final set of bid amounts used in the survey was P10, P20, P30, P50, P100 and P200 per month over and above the current water bill. The four lower amounts had the highest frequency of votes in the FGD and pre-test, while the P100- and P200- bid amounts were included to ensure that "yes" answers would be choked off.

2.5 Data Analysis

Tests on the differences in WTP under mandatory vs. voluntary payment schemes, and information as to whether all water users or only domestic water users would be made to pay the conservation fee at 5% level of significance were undertaken. Likewise, a test of correlation was performed to determine the association of selected variables to the respondents' WTP. Logit regression models were developed and the mean WTP were estimated using parametric and nonparametric approaches.

3. Results and Discussion

Two major water users were identified in the area: irrigator-farmers and domestic water users. The results of the FGDs reveal that farmers were willing to help in conserving the watershed, but they were unwilling to pay any

amount for the program because of their inability to pay. As a result, the study only focused on estimating the willingness to pay of domestic water users in Oroquieta City. The survey covered 11 lowland barangays in Oroquieta City. These barangays are located within the Layawan Watershed and are beneficiaries of the environmental services provided by the watershed, especially water.

3.1 Socioeconomic Profile of Respondents

The survey only involved household heads or household members who were at least 18 years of age at the time of interview. For this reason, a mean age of 48 years was obtained. Respondents' age ranged from 18 to 90 years. For the same reason, the survey revealed a higher percentage share for married people at 75%.

In terms of gender ratio, 70% of the respondents were female. Based on the census results of 2007, the number of males in Oroquieta City between ages 45-49 was almost half the total population (49%) within that age range (National Statistics Office). The higher number of female respondents in the survey can be attributed to the time the interview was conducted. The interview was done during daytime for seven days. It can be assumed that generally, women were the ones left in the house during the day while the men went to work. Furthermore, 31% of the respondents were unemployed/housewife while 21% were self-employed. Most of the self-employed respondents ran a small sari-sari store in front of their houses and these were generally women.

Data on educational attainment showed that 22% of the respondents finished high school, 21.30% reached high school level while 21.05% were college graduates. Only 0.50% had no formal schooling. Based on the Population Census of the Year 2000, only 4.8% of the total population of Oroquieta City was illiterate. Majority of the population reached at least elementary education. In terms of household data, on the average, there were three adults and one child per household, and two household earners per household. The average household income obtained was Php 8,198.84. A high percentage of the population (90%) had electricity connection. Only 5% of the respondents were members of an environmental organization; but most of the respondents were members of women's organizations and agricultural organizations.

3.2 Perception and Awareness about Watersheds and Mt. Malindang

The respondents' perception and awareness about watersheds and Mt. Malindang were assessed.

Table 1. Awareness and perception about watersheds and Mt. Malindang

Items	Response	Frequency	Percentage (%)
Protected Area	Aware	248	62.16
	Not aware	151	37.84
	Total	399	100
Watershed	Aware	221	55.39
	Not aware	178	44.61
	Total	399	100
Mt. Malindang Range Natural Park	Aware	287	71.93
	Not aware	112	28.07
	Total	399	100
Role of forests on watershed provision of various good and services	Aware	323	80.95
	Not aware	76	19.05
	Total	399	100
Importance of management and protection of watershed	Important	375	93.98
	Not important	24	6.02
	Total	399	100

As shown in Table 1, more than half of the respondents (55%) knew what a watershed is. A larger percentage (62%) was familiar with the protected area concept. The respondents were also asked if they were familiar with Mt. Malindang Range Natural Park (MMRNP), of which 72% answered in the affirmative. About 71% of those

familiar with MMRNP learned about the national park from relatives and friends. This shows that information about Mt. Malindang is being passed on to generations by word of mouth. Other sources of information were radio (30%), school (12%), television (8%), and others (7%).

The respondents were presented with statements about MMRNP and the Layawan Watershed. Results are summarized in Table 1. The positive response on the statements presented to the respondents can be attributed to the recent flash flood that hit Cagayan de Oro and Iligan City in Region 10. The people became more aware of the important role of the watersheds and were worried that if they do not protect Mt. Malindang, the same thing could happen to them as well.

3.3 Factors Associated with Willingness to Pay

Among other things, the study aimed to evaluate the effects of mode of payment, information as to who will pay the water user fee, and gender on willingness to pay.

Table 2. Test on the difference in the WTP between mandatory and voluntary payment schemes

Payment Scheme	Percent WTP	$/Z_c/$
Mandatory	50	1.10^{ns}
Voluntary	52.8	

Note: ns-not significant at 5% level of significance (with critical value of 1.96).

The result given in Table 2 indicates that there is no significant difference in the willingness to pay (WTP) of domestic users under a mandatory payment and domestic users under a voluntary payment scheme at 5% level of significance.

Table 3. Test on the difference in the WTP between those who were informed that all water users will pay and those who were informed that only domestic water users will pay

Information on who will pay	Percent WTP	$/Z_c/$
All water users	49	1.90^{ns}
Only domestic water users	53.8	

Note: ns-not significant at 5% level of significance (with critical value of 1.96).

Moreover, as shown in Table 3, there is no significant difference in the WTP of respondents who were informed that all water users will pay and respondents who were informed that only domestic water users will pay.

Thirteen variables were tested as to their association with the respondents' WTP (Table 4). Among the considered variables, only educational attainment of the respondents and the bid amount assigned to the respondent are associated with the respondents' WTP. Moderate association between these variables and the willingness to pay of the respondent was observed.

Table 4. Correlation coefficients for association with **WTP** and its test of significance

Variables	Coefficient	p-value	Degree of Association
Awareness on the roles of watershed	.053	0.292ns	
Perception on the importance of watershed management	.049	0.326ns	
Age	0.418	0.355ns	
Total number of household members employed	0.131	0.236ns	
Educational attainment	0.177	0.028*	moderate
Income	0.545	0.642ns	
House ownership	0.145	0.139ns	
Household size	0.200	0.195ns	
Water distributor	0.147	0.072ns	
Water expenditure	0.496	0.101ns	
Water quality	0.064	0.200ns	
Reliability of water supply	0.138	0.108ns	
Bid amount	0.576	0.000*	moderate

significant at 5% level of significant; ns-not significant at 5% level of significance

Note: Cramer's V and Eta coefficients are used for categorical and ratio variables, respectively. If the association is significant, the degree of association of these variables was further determined.

Table 5. Percentage distribution of respondents who are WTP based on their educational attainment

Educational Attainment	Percent WTP
No formal schooling	70.6
Elementary	52.8
High school	42.8
College	56.0
Vocational	63.6
Master's degree	20.0

Table 6. Percentage distribution of respondents who are WTP based on the bid amount assigned

Bid Amount	Percent WTP
10	93.9
20	74.2
30	64.7
50	40.3
100	22.7
200	12.1

The association can be further described in Tables 5 and 6. It can be seen that generally, as the educational attainment of the respondent gets higher, there is a tendency for the respondent to be not willing to pay. Also, as the bid assigned gets higher, the proportion of respondents who will be willing to pay decreases as well.

3.4 Logistic Regression and WTP Estimate

The estimated logit model for the households' WTP is given below.

$$\log it(Y) = 1.0163 - .0234 Bid\_amount + 0.00004 TotalHH\_inc + 0.0578 Vocational \qquad (1)$$

(if the educational attainment of the respondent is vocational)

$$\log it(Y) = 1.0163 - .0234 Bid\_amount + 0.00004 TotalHH\_inc \qquad (2)$$

(otherwise)

Table 7. Results of the logistic regression

Parameter	DF	Estimate	Standard Error	Wald Chi-square	PR > ChiSq	Exp (Est)
Intercept	1	1.0163	0.4400	5.3354	0.0209	2.763
EDUCLEV 2	1	0.2652	0.4279	0.3842	0.5354	1.304
EDUCLEV 3	1	-0.3248	0.4108	0.6251	0.4292	0.723
EDUCLEV 4	1	0.3854	0.4297	0.8044	0.3698	1.470
EDUCLEV 5	1	1.5157	0.7988	3.6005	0.0578	4.553
EDUCLEV 6	1	-2.6512	1.7254	2.3612	0.1244	0.071
TOTHHINC	1	0.000040	0.000016	6.2361	0.0125	1.0001
BID_AMOUNT	1	-0.0234	0.00282	68.5727	<0.0001	0.977

The results of the logistic regression are summarized in Table 7. The estimated coefficient of bid amount indicates that the log odds of being willing to pay decreases by 0.0234 for every peso increase in the bid amount, holding other factors constant. Furthermore, for every peso increase in the bid amount, the odds that the respondent is willing to pay over not willing to pay is 0.977.

On the other hand, the estimated coefficient of total household income indicates that the log odds of being willing to pay increases by 0.00004 for every peso increase in the total household income, holding other factors constant. For every peso increase in the total household income, the odds that the respondent is willing to pay over not willing to pay is 1.0001.

Table 8. Percentage distribution of respondents that are willing to pay given a bid amount

Bid Amount (in Php)	Percentage of YES Responses
10	93.94
20	74.24
30	64.71
50	40.30
100	22.73
200	12.12
Pooled	51.4

Table 8 shows the distribution of respondents across the six bid amounts used in the contingent valuation survey, which shows the expected negative relationship between bid amount and percentage of YES responses. At the lowest bid amount of Php 10.00, 94% of the respondents answered YES to the WTP question, while only 12% of respondents presented the highest bid amount of Php 200.00 answered YES. All in all, 51.4% of the respondents revealed that they were willing to pay the bid amount that was presented to them during the survey.

Table 9. Mean WTP using parametric and nonparametric approaches

	Parametric			Nonparametric
Min	Median	Mean	Max	Mean
43.43	51.98	57.48	197.28	53.89

The mean WTP estimated using parametric and nonparametric approaches are Php 57.48 and Php 53.89 per household per month (Table 9). These WTP estimates translate to 0.70% for the parametric estimate and 0.66% for the non-parametric estimate of the average monthly income household of the respondents, which is around Php 8,198.84.

3.5 Logistic Regressions and WTP Estimates of Subgroups

Logistic regressions were also performed on subgroups of the sample: a) payment scheme (mandatory vs. voluntary), b) information on which users will pay (all water users vs. domestic water users only), and c) interaction between payment scheme and information on which users will pay.

3.5.1 By Payment Scheme

Table 10 shows the distribution of YES responses by payment scheme and across bid amounts. The expected behaviour of decreasing YES responses with increasing bid amounts can be observed in both payment schemes. At the lowest bid amount of PhP10/household/month, about 97% and 91% of the respondents under the mandatory and voluntary schemes, respectively, expressed willingness to pay. At the highest amount of Php 200/household /month, these decreased to about 15% and 9%, respectively.

Table 10. Percentage distribution of respondents who are willing to pay given a bid amount according to payment scheme

Bid Amount (in Php)	Percentage of YES Responses	
	Mandatory	Voluntary
10	96.70	90.91
20	72.73	75.76
30	64.71	64.71
50	33.33	47.06
100	17.65	28.13
200	15.15	9.09
Pooled	50.00	52.76

Voluntary payment scheme

The estimated logit model for the voluntary payment scheme is:

$$\log it(Y = 1) = 1.4761 - .0225 Bid\_amount \qquad (3)$$

Table 11. Logistic output for voluntary payment scheme

Parameter	DF	Estimate	Standard Error	Wald Chi-square	PR > ChiSq	Exp (Est)
Intercept	1	1.4761	0.2540	33.7692	<.0001	4.376
BID_AMOUNT	1	-0.0225	0.00384	34.3824	<.0001	0.978

For this model, only bid amount was found to be a significant factor at 10% level of significance Table 11). The estimated coefficient of bid amount indicates that the log odds of willing to pay decreases by 0.0225. For every peso increase in the bid amount, the odds that the respondent is willing to pay over not willing to pay is 0.978.

Mandatory payment scheme

The estimated logit model for the mandatory payment scheme is:

$$\log it(Y = 1) = 1.2949 - 0.6941 Elementary + 1.5020 Vocational + 0.5093 Aware\_role\_forest - 0.0227 Bid\_amount$$

(4)

Table 12. Logistic output for mandatory payment scheme

Parameter	DF	Estimate	Standard Error	Wald Chi-square	PR > ChiSq	Exp (Est)
Intercept	1	1.2949	0.4311	9.0223	0.0027	3.651
EDUCLEV 2	1	-0.6941	0.4086	2.8853	0.0894	0.500
EDUCLEV 3	1	-0.6105	0.3997	2.3327	0.1267	0.543
EDUCLEV 4	1	0.4360	0.4653	0.8783	0.3487	1.547
EDUCLEV 5	1	1.5020	0.8844	2.8844	0.0894	4.491
EDUCLEV 6	1	-1.1245	1.2352	0.8288	0.3626	0.325
S6	1	0.5093	0.2452	4.3146	0.0378	1.664
BID_AMOUNT	1	-0.0227	0.00405	31.2255	<0.0001	0.978

The logistic output for the mandatory payment scheme (Table 12) shows that aside from bid amount, educational level and awareness on the role of forest were also found to be significant at 10% level of significance.

The estimated coefficient of bid amount indicates that the log odds of willing to pay decreases by 0.0227 for every peso increase in the bid amount, holding other factors constant. This means that for every peso increase in the bid amount, the odds that the respondent is willing to pay over not willing to pay is 0.978. Meanwhile, the estimated coefficient of "elementary" indicates that the log odds of willing to pay decreases by 0.6941 for those whose educational attainment is elementary compared to those who have no schooling at all. The odds that the respondent is willing to pay over not willing to pay for those whose educational attainment is elementary is 0.50 compared to those who have no schooling at all.

The estimated coefficient of "vocational" indicates that the log odds of willing to pay increases by 1.5020 for those whose educational attainment is vocational compared to those who have no schooling at all. The odds that the respondent is willing to pay over not willing to pay for those with vocational educational attainment is 4.49 compared to those who have no schooling at all.

The estimated coefficient of "awareness on the role of forest in the provision of watershed protection services" indicates that the log odds of willing to pay increases by 0.5093 for those who said yes compared to those who said no. The odds that the respondent is willing to pay is 1.664 or almost 2 times higher for those who are aware of the role of the forest relative to those who are not aware.

WTP estimates based on payment scheme

The mean WTP under the mandatory and voluntary payment schemes were estimated using the logit and nonparametric approaches.

Table 13. Percentage of willing to pay (WTP), mean WTP based on logit model and nonparametric approach

Payment Scheme	Percentage WTP	Mean WTP (logit)	Mean WTP (Nonparametric)	p-value
Mandatory	50.00	78.09	53.11	0.0001*
Voluntary	52.76	66.19	54.79	

significant at 5% level of significance; performed using the t-test on mean procedure.

As shown in Table 13, 50% and 53% of respondents under the mandatory and voluntary payment schemes, respectively, indicated willingness to pay. Furthermore, it can be seen that the mean WTP of the mandatory group of respondents (Php 78.09) is significantly higher compared to the voluntary group (Php 66.19) at 5%

level of significance using the estimated logit model. However, using the nonparametric approach yields a slightly higher mean WTP for the voluntary group (Php 54.79) compared to the mandatory group (Php 53.11).

Based on these results, the null hypothesis that there is no significant difference in the mean WTP under the mandatory and voluntary payment schemes is rejected.

3.5.2 By Information on Who Will Pay

Table 14. Percentage distribution of respondents who are willing to pay given a bid amount according to information on who will pay

Bid Amount (in Php)	Percentage of YES Responses	
	All Water Users	Only Domestic Water Users
10	93.94	93.94
20	75.76	72.73
30	52.94	76.47
50	42.42	38.24
100	17.65	28.13
200	12.12	12.12
Pooled	49.00	53.77

The distribution of respondents who answered YES to the WTP question by information group (i.e. all water users will pay vs. only domestic water users will pay) and across bid amounts is given in Table 14. As expected, a negative relationship between bid amount and YES responses could be observed.

Information that All Water Users Will Pay

The estimated logit model for the subgroup that was informed that all water users will pay is:

$$\log it(Y = 1) = -0.3585 + 0.000047 Tothhinc + 0.0233 Age - 0.330 Gender + 0.5884 KPA - 0.0252 Bid\_amount \quad (5)$$

Table 15. Logistic output for the subgroup all water users

Parameter	DF	Estimate	Standard Error	Wald Chi-square	PR > ChiSq	Exp (Est)
Intercept	1	-.03585	0.6326	0.3212	0.5709	0.699
TOTHHINC	1	0.000047	0.000026	3.2823	0.0700	1.000
AGE	1	0.0233	0.0116	4.0329	0.0446	1.024
GENDER	1	-0.3310	0.1914	2.9909	0.0837	0.718
KPA	1	0.5884	0.1855	10.0603	0.0015	1.801
BID_AMOUNT	1	-0.0252	0.00423	35.3851	<0.0001	0.975

For this group, the factors that were found significant at 10% level of significance are total household income, age, gender, whether the respondent knows what protected area is or not, and bid amount (Table 15). As expected, bid amount has a negative relationship with the log odds of a YES answer. That is, for every peso increase in the bid amount, the odds that the respondent is willing to pay over not willing to pay is 0.975.

On the other hand, total household income has a positive relationship, which means that the odds that a respondent who is informed that all water users will pay increases slightly as total household income increases. The log odds that a respondent is willing over not willing to pay increases as the respondent gets older, decreases if the respondent is male relative to female, and increases by almost 2 times if the respondent knows what a protected area is relative to if the respondent does not know.

Information that Only Domestic Water Users Will Pay

Table 16. Logistic output for the subgroup only domestic users

Parameter	DF	Estimate	Standard Error	Wald Chi-square	PR > ChiSq	Exp (Est)
Intercept	1	1.4854	0.2524	34.6266	<0.0001	4.417
BID_AMOUNT	1	-0.0216	0.00369	34.1331	<0.0001	0.979

For the sub-group informed that only domestic water users will pay, only bid amount turned out to be a significant variable at 10% level of significance (Table 16). The estimated logit model is:

$$\log it(Y=1) = 1.4854 - 0.0216 Bid\_amount \qquad (6)$$

Again, the model shows the expected negative relationship between the log odds of being willing to pay with the bid amount. For every peso increase in the bid amount, the odds that the respondent is willing to pay over not willing to pay is 0.979.

WTP Estimates by Information on Who Will Pay

Table 17. Percentage of willing to pay (WTP), mean WTP based on logit model and nonparametric approach

Information on Who Will Pay	Percentage WTP	Mean WTP (logit)	Mean WTP (Nonparametric)	p-value
All Water Users	49.00	58.54	50.75	0.0001*
Only Domestic Water Users	53.77	68.77	57.21	

significant at 5% level of significance; performed using the t-test on mean procedure.

Table 17 shows that more respondents (54%) who were informed that only domestic water users will be made to pay answered yes to the WTP question compared to those informed that all water users will be made to pay (49%). Furthermore, the mean WTP of those classified in the domestic water users group (Php 68.77) is significantly higher compared to the all water users group (Php 58.54) at 5% level of significance using the estimated logit model. A similar trend can be observed in the result using nonparametric approach, where the mean WTP of the domestic water users group (Php 57.21) is significantly higher than the all water users group (Php 50.75). One possible explanation for this is the difference in the average monthly water expenditure between the two groups. The average monthly water expenditure for those classified in the domestic water users group is lower by Php 35.00 compared to those in the all water users group. This gives them more money to spend for additional water fee. Moreover, about 30% of the respondents in the domestic water users group were not connected to any water distributor, compared to 24% for the other group. Those who were not connected to any water distributor may feel more obligated to pay for improved water services than those who were already paying.

Based on these results, the hypothesis that there is no significant difference in the mean WTP of respondents who are informed that all water users will be made to pay and respondents who are informed that only domestic water users will be made to pay is rejected.

3.5.3 By Pairwise Combination of Payment Scheme and Information on Who Will Pay

The mean WTP of respondents simultaneously considering the payment scheme and information on who will pay was also evaluated.

Table 18. Percentage distribution of respondents who are willing to pay given a bid amount according by subgroup

Bid Amount (Php)	Percentage of YES Responses			
	Voluntary-Domestic Water Users	Mandatory-Domestic Water Users	Voluntary-All Water Users	Mandatory-All Water Users
10	88.24	100.00	93.75	94.12
20	76.47	68.75	75.00	76.47
30	82.35	70.59	47.06	58.82
50	47.06	29.41	47.06	37.50
100	40.00	17.65	17.65	17.65
200	6.25	17.65	11.76	12.50
Pooled	57.58	50.00	48.00	50.00

Table 18 shows that in general, the expected negative relationship between the percentage of YES responses against bid amount can be observed for the four subgroup combinations.

Voluntary Payment-Domestic Water Users

The estimated logit model for the subgroup presented with the scenario of voluntary payment and only domestic water users will pay is:

$$\log it(Y = 1) = 1.3418 + 0.000077 Tothhinc - 0.0253 Bid\_amount \tag{7}$$

Table 19. Logistic output for voluntary-domestic water users

Parameter	DF	Estimate	Standard Error	Wald Chi-square	PR > ChiSq	Exp (Est)
Intercept	1	1.3418	0.4336	9.5779	0.0020	3.826
TOTHHINC	1	0.000077	0.000046	2.7774	0.0956	1.000
BID_AMOUNT	1	-0.0253	0.00587	18.5540	<0.0001	0.975

The factors that were found significant for this group of voluntary-domestic users at 10% level of significance are total household income and bid amount, and both exhibit the expected positive and negative signs, respectively. As shown in Table 19, for every peso increase in the bid amount, the odds that the respondent is willing to pay over not willing to pay is 0.975. On the other hand, the odd of willingness to pay of a respondent classified in the group of voluntary-domestic increases slightly as total household income increases.

Mandatory Payment – Domestic Water Users

The estimated logit model for the subgroup presented with the scenario that payment is mandatory and that only domestic water users will pay is:

$$\log it(Y = 1) = 0.3890 + 0.9043 familiarity\_mtmalindang + 0.6941 Aware\_role\_forest - 0.0195 Bid\_amount$$

$$\tag{8}$$

The factors that were found significant in this group at 10% level of significance are whether the respondents are familiar with Mt. Malindang or not, whether or not they are aware about the role of the forest, and bid amount.

Table 20. Logistic output for mandatory-domestic water users

Parameter	DF	Estimate	Standard Error	Wald Chi-square	PR > ChiSq	Exp (Est)
Intercept	1	0.3890	0.4678	0.6914	0.4057	1.476
FMM	1	0.9043	0.2818	10.2992	0.0013	2.470
S6	1	0.6941	0.3570	3.7807	0.0518	2.002
BID_AMOUNT	1	-0.0195	0.00502	15.1373	<0.0001	0.981

As expected, bid amount has a negative effect on the log odds of being willing to pay (Table 20). For every peso increase in the bid amount, the odds that the respondent is willing to pay over not willing to pay is 0.981. On the other hand, the odds of willingness to pay of a respondent classified in this group is around 2.50 times higher for those respondents who are familiar with Mt. Malindang compared to those who are not familiar. Finally, the odds of willingness to pay of a respondent is around 2 times higher for those respondents who are aware about the role of forest compared to those who are not aware.

Voluntary Payment – All Water Users

The estimated logit model for the subgroup presented with the scenario that payment is voluntary and all water users will be made to pay is:

$$\log it(Y = 1) = 1.2153 - 0.0217 Bid\_amount \tag{9}$$

Table 21. Logistic output for voluntary-all water users

Parameter	DF	Estimate	Standard Error	Wald Chi-square	PR > ChiSq	Exp (Est)
Intercept	1	1.2153	0.3494	12.0979	0.0005	3.371
BID_AMOUNT	1	-0.0217	0.00545	15.8234	<0.0001	0.979

For this model, only bid amount was found to be significant factor at 10% level of significance. In this case, the odds that the respondent is willing to pay over not willing to pay for every peso increase in the bid amount is 0.979 (Table 21).

Mandatory Payment – All Water Users

The estimated logit model for the group presented with the scenario that payment is mandatory and all water users will pay is:

$$\log it(Y = 1) = 0.8817 + 0.000074 Tothhinc - 0.0246 Bid\_amount \tag{10}$$

Table 22. Logistic output for mandatory payment-all water users

Parameter	DF	Estimate	Standard Error	Wald Chi-square	PR > ChiSq	Exp (Est)
Intercept	1	0.8817	0.4136	4.5454	0.0330	2.415
TOTHHINC	1	0.000074	0.000042	3.0955	0.0785	1.001
BID_AMOUNT	1	-0.0246	0.00600	16.8965	<0.0001	0.979

For this model, the factors that were found significant at 10% level of significance are total household income and bid amount, both of which exhibit the expected positive and negative signs, respectively (Table 22). For every peso increase in the bid amount, the odds that the respondent is willing to pay over not willing to pay is 0.976. On the other hand, the odds of willingness to pay of a respondent classified in this group of voluntary-all water users increases slightly as total household income increases.

Mean WTP Estimates by Payment Scheme and Water User Combination

Table 23. Percentage of willing to pay (WTP), mean WTP based on logit model and nonparametric approach

Subgroups	Percentage WTP	Mean WTP (logit)	Mean WTP (Nonparametric)	p-value
Voluntary-Only Domestic Water Users	57.58	74.79	59.50	0.0001*
Mandatory-Only Domestic WaterUsers	50.00	62.83	55.29	
Voluntary-All Water Users	48.00	56.00	50.64	
Mandatory-All Water Users	50.00	59.67	50.82	

*significant at 5% level of significance; performed using the t-test on mean procedure.

Table 23 shows that for the subgroup voluntary-all water users, only 48% of the respondents said YES to the WTP question, while the mandatory-only domestic water users and mandatory-all water users subgroups had 50% of respondents expressing willingness-to-pay to the bid amounts presented to them.

Among the four formed groups, the highest percentage of respondents who are willing to pay for a given bid amount are those whose payment scheme is voluntary and the information on who will pay is only domestic water users, while the lowest came from those with the same payment scheme but the information on who will pay is all water users (Table 29). In terms of the mean WTP, using both parametric and nonparametric approaches, the highest amount was generated from the group of those respondents classified as voluntary-only domestic water users. Based on the one-way ANOVA technique, it can be said that at least one of the subgroups mean WTP is significantly different from the other.

Table 24. Pairwise comparison of four subgroups

MIX Comparison**	Difference Between Means	Simultaneous 95% Confidence Limits	
Vol-dom vs man-dom	11.960	4.137	19.782 ***
Vol-dom vs man-all	15.110	7.288	22.932 ***
Vol-dom vs vol-all	18.780	10.958	26.603 ***
Man-dom vs man-all	3.151	-4.652	10.953
Man-dom vs vol-all	6.821	-0.982	14.624
Man-all vs vol-all	3.670	-4.132	11.473

* Significant at the 0.05 level indicated by ***, Critical Value of Studentized Range 3.64872.

**Vol – voluntary payment; Man – mandatory payment; Dom – domestic water users; All – all water users.

Table 24 gives the pairwise comparison of the four subgroups formed. Using the Tukey's studentized range (HSD) mean comparison, it can be concluded that only the subgroup voluntary-only domestic water users is significantly different from the other 3 subgroups, while these 3 subgroups are not significantly different from each other.

4. Conclusion

In general, the people of Oroquieta have a high level of environmental awareness. Majority of the respondents agreed that it is important to manage and protect the watershed in order to have a sustainable supply of water as well as lessen the effects of natural disasters as what happened in Iligan City and Cagayan de Oro in 2011.

Majority (51.4%) of the respondents are willing to pay for improved watershed services. The study also reveals that there is no significant difference among the willingness to pay estimates of the split samples. About thirteen variables were tested as to their association with respondent's willingness to pay. Only educational attainment and bid amount were found to have a moderate degree of association to the respondent's willingness to pay. The study shows that as the educational attainment of the respondent gets higher, the less likely the respondent is willing to pay. In the same manner, as the bid amount assigned increases, the proportion of respondents who will be willing to pay decreases.

The mean WTP estimated using parametric and nonparametric approaches are Php 57.48 and Php 53.89 per household per month, respectively. The mean WTP estimates based on payment schemes were also computed. It can be seen that the mean WTP of the mandatory group of respondents (Php 78.09) is significantly higher compared to the voluntary group (Php 66.19) at 5% level of significance using the estimated logit model. In terms of the information on who will pay, the mean WTP computed of those classified in the domestic water users group (Php 68.77) is significantly higher compared to the all water users group (Php 58.54) at 5% level of significance using the estimated logit model. It can therefore be concluded that the hypothesis that there is no significant difference in the mean WTP of respondents under the mandatory and voluntary payment schemes, and between those who are informed that all water users will be made to pay and respondents who are informed that only domestic water users will be made to pay, is rejected. Meanwhile, the mean WTP amount was also estimated for the subgroups. Using Tukey's studentized range (HSD) mean comparison, it can be concluded that only the subgroup voluntary-only domestic water users is significantly different from the other 3 subgroups, while these 3 subgroups are not significantly different from each other.

Oroquieta City residents are willing to pay because they want the watershed to continue producing environmental services such as flood control, biodiversity conservation, recreation, and carbon sequestration. Because of the unexpected disaster that happened in Cagayan de Oro and Iligan City in December 2011 which was said to be caused by illegal logging in the area, the people of Oroquieta became more concerned about the state of their forests and how their degradation could cause the death of thousands of people. On the other hand, respondents are not willing to pay mainly because they cannot afford the assigned bid amount. A relatively large percentage of the total households interviewed were from rural barangays and have relatively low income.

Using the parametric mean WTP estimate, a total of Php 3 292 224.48 can be collected annually from a population of 4 773 households living in the lowland barangays of Oroquieta that fall within the boundary of the watershed. This is more than the annual budget allotted by the government to Mt. Malindang which s around Php 2.4M.

In terms of fund management, the respondents were informed that the fund would be deposited to the Integrated Protected Area Fund (IPAF) managed by the Protected Area Management Bureau (PAMB), a multi-sectoral body comprised of representatives from government and non-government organizations, people's organizations, the indigenous peoples, academe, and the religious sector. Generally, the respondents do not have any issues on this because the PAMB is a multi-sectoral body. For the collection of the water user fee, majority of the respondents (83%) liked the proposal to collect the fee as a surcharge on their water bill. Those who did not like the proposal just do not want to have an increase in their water bill and thus prefer other ways of collecting the fund.

Acknowledgement

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