

Estimating Household Benefits from the Cagayan de Oro River Basin Ecosystem

河川の下流域に暮らす住民は、そのエコシステムから多様な恩恵を受けている。その受益額を住民から徴収し、河川の管理費に充てる仕組みを考える。

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Abstract

Households, especially those in the downstream communities, benefit from the Cagayan de Oro River Basin (CDORB) ecosystem in terms of a stable supply of good quality water, flood control, food (fish) supply, recreational activities and biodiversity. These benefits encompass both use and non-use values which are integrated in a single estimate using the contingent valuation method (CVM). In the study, CDO households are asked for their willingness to pay (WTP) or contribute to watershed rehabilitation and preservation efforts in terms of a certain proportion of their water bill. Mean WTP per household range from 12.19% to 17.58% of the water bill. With a total household population of 137,465 in CDO (2010 Census) and a mean monthly water bill per household of PhP531.8, the total value of the perceived benefits that can be derived from the rehabilitation and preservation of the CDO River Basin is estimated to be about 9-13 million pesos (US\$198-285 thousand) per month or 107–154 million pesos (US\$2–3 million) per year. Further, results of the regression analysis imply willingness to pay or contribute for watershed rehabilitation is associated with the age of the respondent, the perceived condition of the watershed and its impact on the livelihood of the people. These findings can help focus and design public awareness and information campaign programs to promote widespread participation in a payment for environmental services scheme for the preservation of CDO River Basin.

Keywords river basin, ecosystem services, willingness to pay, payment for ecosystem services (PES), contingent valuation

Introduction

This research aims to measure the total economic value (TEV) of the flow of ecosystem services that accrue to households from the Cagayan de Oro River Basin (CDORB) in Mindanao, Philippines. The resulting estimates provide the rationale for the adaptation of the river basin-wide payment for environmental services (PES) scheme which Xavier University-McKleough Marine Center (XU-MMC) is currently undertaking in collaboration with the Cagayan de Oro River Basin Management Council

(CDORBMC). Through PES, financial resources can be generated and used to reward local initiatives that restore and preserve the ecosystem. This approach has been identified as one strategic way to safeguard and enhance the continuing flow of environmental services from the CDORB.

This paper focuses on the household sector as a potential group of buyers or sources of rewards/payments for the providers of services to rehabilitate and preserve the CDO River Basin. As a well-protected watershed can provide security of water supply, fish

supply, recreation, biodiversity, flood control and increased resilience to extreme weather events and power supply, the general public, especially those in the downstream communities, stand to benefit substantially. Estimates of the economic benefits that can be derived by households from the CDO River Basin ecosystem can provide the underlying basis for the contributions that may be potentially collected from this sector. The poblacion and 40 village settlements (17 urban and 23 rural barangays) in Cagayan de Oro city comprise the biggest group of communities located at the downstream of the CDO River Basin.

The identification of the beneficiaries of ecosystem services and the estimation of the values of the stream of benefits they derive from the CDO River Basin will significantly facilitate the up-scaling and acceleration of the implementation of the CDORBMC/XU-MMC PES program that aims to reward the following up-stream communities for their rehabilitation and preservation activi-

ties: (1) MILALITTRA (Miarayon Lapok Lirongan Tinaytayan Tribal Association), the resource managers working in the sub-watershed in Batang, Mt Kalatungan; and (2) the Kitanglad-wide Council of Elders with the Tribal Guards (Kitanglad Guard Volunteers) of Mt Kitanglad.

It is also hoped that this research project, with all the surveys, key informant interviews, focus group discussions, research findings dissemination seminar/workshop and other activities it entails, can assist and contribute to the CDORBMC-XU-MMC PES information campaign, policy lobbying of PES/EbA-related laws in the Local Government Units, and the development and integration of PES in the Cagayan de Oro River Basin Master Plan.

The Study Site

The Cagayan de Oro River Basin (CDORB) has a total area of approximately 137,000 ha, spreading over 3 provinces (Bukidnon, Misamis Oriental

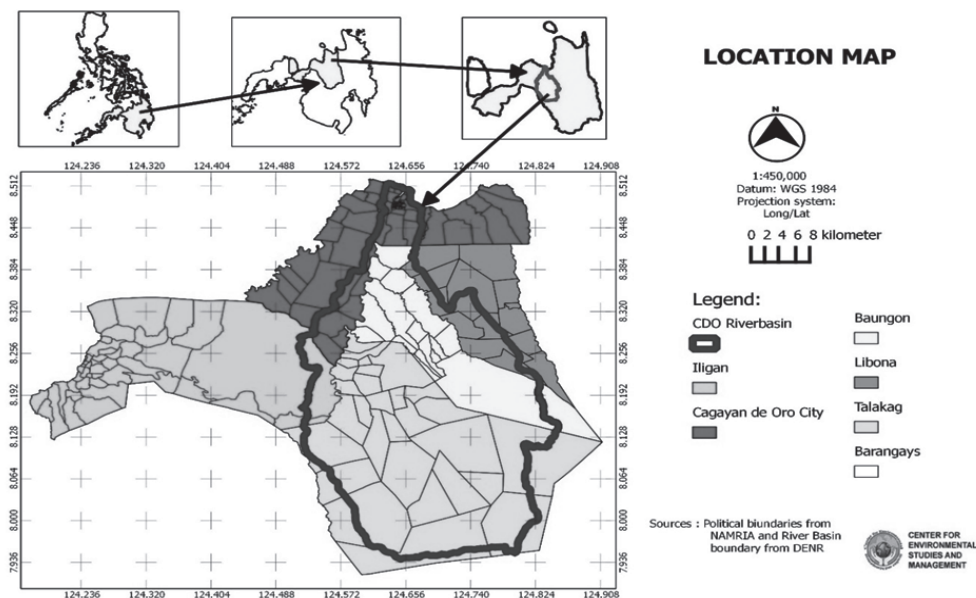


Figure 1. Cagayan de Oro River Basin Map
(Source: CDORB Management Council and Center for Environmental Studies and Management)

and Lanao del Norte), 3 municipalities (Baungon, Libona, and Talakag in Bukidnon), and 2 cities (Cagayan de Oro City in Misamis Oriental and a small portion of Iligan City in Lanao del Norte).

CDORB lies between 124°0'39" and 125°21'39" latitude and 7°32'20" and 8°57'39" longitude. It is bounded by Northern Cotabato in the south, by Lanao del Sur in the south west and by Bohol Sea in the north. The highest elevations within the CDORB can be found at the peaks of Mt. Kalatungan and Mt. Kitanglad at 2,824 masl and 2,899 masl, respectively. The steep slopes are predominant in the upland area in the south and southeastern portion of the basin where majority of the river's headwaters are located. They can also be found in the ridges of sub-basins where they serve as topographic divide between sub-catchments. Gentler slopes prevail along the coast and on the flat portions of several elevated terraces around the basin (CDO River Basin Management and Development).

Methodology

Households, especially those in the downstream communities, benefit from the Cagayan de Oro River Basin (CDORB) ecosystem in terms of a stable supply of good quality water, flood control, food (fish) supply, recreational activities and biodiversity. These benefits encompass both use and non-use values which are integrated in a single estimate using the contingent valuation method (CVM). CVM is a survey-based approach that is now used extensively in both developed and developing countries to incorporate values of non-marketed services and amenities in public policy/program assessment. Studies that employed CVM in estimating the total benefits from watershed rehabilitation and preservation programs include Alcon et al 2013, Almanza and Martinz-Paz 2011, Perni et al 2011 and Birol et al 2010.

In a CVM survey, respondents are asked to state their willingness to pay (WTP) for a good, service or public program. The stated WTP is the monetary estimate of the total benefits (tangible and intan-

gible, use and non-use values) that is derived from the good, service or public program. (Please refer to Mitchell and Carson 1989, Bateman et al 2002 and Boyle 2003 for a thorough discussion of CVM.)

CVM Scenario and Survey Instrument. The instrument used for our CVM survey was finalized after a series of key informant interviews, focus group discussions and pre-tests.

The CVM scenario adopted the set-up of the ongoing payment for environmental services (PES) scheme of Xavier University-McKeough Marine Center (XU-MMC) and Cagayan de Oro River Basin Management Council (CDORBMC). The watershed protection service providers and recipients of the rewards/payments are the upstream communities in Mt. Kitanglad and Mt. Kalatungan in Talakag, Bukidnon. The CDO Water District and other water utilities/providers (such as Rio Verde, subdivision management and maintenance groups, real estate developers, etc.) serve merely as a collection agent as each household's contribution/payment is computed as a certain proportion of the household's water bill and is included in the water bill. PES fund manager is Xavier Science Foundation and the monitoring authority is CDORBMC.

The WTP question followed the dichotomous choice format. As the common approach for public policy/program assessments, the CVM question was framed within the context of a referendum. Each respondent was asked if they would vote for the proposed CDORB rehabilitation and preservation program and be willing to pay an amount equivalent to a certain percentage of his/her household's current water bill. The respondents were told that if majority of the households would vote in favor of the program, then all, including those who did not vote for the program would be made to pay for the program.

In addition to the WTP valuation scenario, sections that elicit information on socio-economic profile, social capital, awareness and attitude on watershed and watershed protection, water supply, sanitation

and sewerage, water pollution¹, flood experience, fishing and tourism were included. Visual aids such as pictures of the CDORB, forest cover before and after proposed rehabilitation and preservation program were shown to the respondents as the CVM scenario was explained. Thus, the implementation of the survey itself, through the CVM scenario, served as an information campaign tool for the XU-MMC/CDORBMC PES program for the rehabilitation and preservation of the CDORB ecosystem. A number of respondents expressed appreciation for gaining relevant information on the state of the CDORB, its implications on their day-to-day living, and the rehabilitation and preservation plans. Focus group discussion and pre-tests were undertaken in setting the following six bid levels used in the final survey: 1%, 3%, 5%, 10%, 20% and 50% of the water bill.

Sampling and Survey Protocol. A total sample of 963 respondents was generated for the final survey through face-to-face interview with the household head or the member making expenditure decisions in the family. All barangays (40 Poblacion barangays and 41 other barangays; or a total of 81 barangays, only 17 of which are rural) of CDO City, the downstream portion of the CDORB, were included in the sampling frame. Systematic sampling procedure was employed in selecting the respondents in each barangay. The number of respondents in each barangay was set in proportion to the share of the barangay in the total CDO City population. The six bid levels were randomly assigned to respondents in all survey sites.

Data Analysis. The yes-no response to the dichotomous choice CVM question was analyzed using the framework developed by Hanemann (1984) based on the random utility model. A binary probit regression model was run to calculate parametric mean willingness to pay (WTP). For the non-parametric estimate, the Turnball formula was employed. Indi-

vidual household's WTP was aggregated to arrive at total WTP.

Results

Socio-economic Profile of Respondents. Majority of the responding household members are female (70%). This corresponds to the female spouse in the family. Our enumerators particularly asked for the household member who is responsible for budget allocation among household expense items. In the Philippine setting, this responsibility is usually assumed by the female spouse, whether or not she is earning income. On the average, the respondent is 48 years old, has 10 years of formal education (ie, a high school graduate), and a non-smoker.

74% of households own the house where they reside. The dwelling place of the average household has 2 bedrooms, 1 toilet, 1 television set, 1 radio, 1 electric fan, 3 phones (all kinds of phones, mobile and non-mobile), and no air-conditioning unit, washing machine, computer and automobile. On the average, each household has a total monthly income of PhP14,650/US\$324.84 and a monthly electricity bill of PhP1.003/US\$22.24.

Knowledge and Awareness about the CDO River Basin. Survey results reveal some degree of familiarity among CDO households with watershed and the CDO River Basin ecosystem, in particular. Majority has correctly identified as a watershed an illustration that consist of lands and water bodies through which rain water drains over two other illustrations depicting mainly bodies of water. Nearly half of the respondents claimed that they are familiar with the CDO River Basin, and majority claimed they are aware that the basin includes the forestlands in Bukidnon from which the CDO River water originates and that the destruction of these forestlands would affect the supply of water in CDO, the downstream portion of the watershed.

At present, two years since the creation of the CDORBMC, only 15% of the respondents have heard about the council and its activities. Informa-

¹ The questions on socio-economic profile, awareness and attitude on watershed and watershed protection, water supply, sanitation and sewerage, and water pollution are adapted from the survey instrument developed in Palanca-Tan 2015.

tion about the council was gained mainly through television and radio. No respondent was able to identify correctly the head of CDORBMC, implying the lack of solid knowledge/familiarity with the Council among survey respondents.

Survey respondents reveal a somewhat ambivalent attitude towards the degradation of CDORB and the need to address the problem. Although 75% of respondents think that the current condition of the CDO River Basin is already alarming, 50% believe that there are other more important environmental issues than this. Even if 63% agreed with the generic statement that “Filipinos must contribute to the rehabilitation and preservation of all forestlands in the Philippines”, only about half are willing to make a financial contribution for the restoration and preservation of forests in CDO and Bukidnon. It appears that not many are willing to support a watershed program despite recognition of the watershed’s role in their life, particularly with regard to water supply and flooding--two concerns closely identified with watershed degradation by the respondents.

The survey also reveals that households are more concerned about the impact of watershed degradation on water supply and flooding than on fishing, tourism, biodiversity and global warming.

CVM Scenario and WTP Question. In the CVM scenario, the plan to rehabilitate the CDO River Basin to restore and maintain forest cover to 40% of the watershed area was described. A map of the whole watershed area indicating forest cover before and after rehabilitation was shown to the respondent. A discussion of the Payment for Environmental Services (PES) scheme to finance rehabilitation and maintenance activities by upstream communities in Mt. Kalatungan and Mt Kitanglad under the supervision and monitoring of the CDORBMC then ensued. Before the WTP question, the respondent was asked if he/she had heard of this CDORB program before. About a tenth of the respondents answered in the affirmative and half of these respondents indicated televisions and radio as sources of the information. A few respondents indicated obtaining information

from priests (F. Nathan and Fr. Ledesma) during mass, conversations with officials from the city hall and barangays, Xavier University, non-government organizations, internet and neighbors.

The proportion of respondents who would vote for the CDO River Basin program and be willing to pay for the program monotonically decreases as the bid level (or program cost) increases from 1% of the water bill to 50% of the water bill. Almost 77% of respondents would vote for the program and be willing to pay if the program cost is only 1% of their current water bill. If program cost is 50% of the current water bill, only 11% of respondents would vote and be willing to pay.

Water supply stability and flood and soil erosion control are the predominant reasons for voting and willingness to pay for the planned CDORB rehabilitation and preservation program. Fishing, recreation/tourism and biodiversity, other benefits that can be derived from the program, are not the primary factors for the “Yes” response.

Mean and Aggregate Willingness to Pay for CDORB Rehabilitation and Preservation. To determine the factors that influence the likelihood that a household in CDO would vote and be willing to pay for the CDO River Basin rehabilitation and preservation program, a binary logit regression of the “yes-no” response to the WTP question is run with bid, household income and other characteristics, respondent characteristics, awareness and attitude variables as independent variables. The results of two regression runs are shown in Table 1. Regression 1 includes all variables that intuitively could affect household’s behavior. Regression 2 retains mainly the variables that turned out to be significant in regression 1.

Expectedly, the coefficient of Bid is significantly negative. This means that the household would be more likely to vote for the CDORB rehabilitation and preservation program if the cost of the program to the household is lower. This is consistent with the law of demand in economics. Household income did not turn out to be a significant factor. While gender of the respondent does not affect the likelihood of

voting and contributing for the program, age does. The younger the respondent, the higher the probability of voting for the program. Furthermore, respondents who think that the current state of the CDO River Basin is alarming and that their livelihood is affected by it are more likely to vote for the program. Respondents indicating that they would be willing to contribute money for the preservation of the forests in Bukidnon if these are part of the CDO River Basin are also more likely to vote for the program. Experience with flooding, water rafting; knowledge of rare fish species; and familiarity with the CDO River Basin, the Council and its plan are not significant.

The non-parametric estimate of the mean WTP for the CDO River Basin rehabilitation and preservation program is 12.19% of the water bill. A parametric estimate using the coefficients of regression 2 is 17.58%.

With mean WTP per household ranging from 12.19% to 17.58%, and with a total household population of 137,465 in CDO (2010 Census) and a mean monthly water bill per household of PhP531.8, the total value of the benefits (stable supply of good quality water, flood control, fishing and recreational value, biodiversity) that can be derived from the rehabilitation and preservation of the CDO River Basin would be PhP8.9-12.8 million (US\$197,591-284,959) per month or PhP106.9-154.2 million (US\$2.4-3.4 million) per year.

Conclusions

There is a substantial amount that can be potentially collected from households in Cagayan de Oro City on a regular basis. Collection of this amount in the form of an additional water charge shall ensure a sustainable flow of funds to reward the upland communities that will undertake watershed rehabilitation and preservation efforts. Thus, a more sustainable payment for environmental services (PES) scheme for the river basin may be realized. Currently, fund contributions in the PES scheme being implemented by the CDO River Basin Management Council

(CDORBMC) is on a voluntary basis. CDORBMC approaches potential donors (mostly non-government organizations and some private corporations and individuals) to make one-time donations. This approach entails substantial transaction costs and may not yield sufficient funds for continuing watershed preservation activities.

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References

- 1) Alcon, F., J. Martin-Ortega, F. Pedrero, J.J. Alarcon, M.D. de Miguel. 2013. Incorporating Non-market Benefits of Reclaimed Water into Cost-benefit Analysis: A Case Study of Irrigated Mandarin Crops in Southern Spain. *Water Resources Management*. 27:1809-1820.
- 2) Almanza C., J.M. Martinez-Paz. 2011. Intergenerational Equity and Dual Discounting. *Environmental Development Economics*. 16:685-707.
- 3) Bateman, I.J., R.T. Carson, B. Day, et al. 2002. *Economic Valuation with Stated Preference Techniques*. Edward Elgar Publishing, Cheltenham.
- 4) Birol, E., P. Koundouri, Y. Kountouris. 2012. Assessing the Economic Viability of Alternative Water Resources in Water-scarce Regions: Combining Economic Valuation, Cost-benefit Analysis and Discounting. *Ecological Economics*. 69(4):839-847.
- 5) Boyle, K.J. 2003. *Contingent Valuation in Practice*. In: *A Primer on Non-market Valuation* (eds. P.A. Champ, K.J. Boyle and T.C. Brown). Kluwer Academic Publishers, Dordrecht, pp 111-170.
- 6) Haab, T.C. and K.E. McConnell. 2002. *Valuing Environmental and Natural Resources: the Econometrics of Non-market Valuation*. Edward Elgar Publishing Ltd, Cheltenham.
- 7) Hanemann, M. 1984. Welfare Evaluations in Contingent Valuation Experiments with Discrete Responses. *American Journal of Agricultural Economics*. 66(3):332-341.
- 8) Mitchell, R.C. and R.T. Carson. 1989. *Using Surveys to Value Public Goods: the Contingent Valuation Method*. Resources for the Future, Washington DC.
- 9) Palanca-Tan, R. 2015. *Knowledge, Attitude and Willingness to Pay for Sanitation and Sewerage Services: A Contingent Valuation Survey in Metro Manila*. Unpublished paper.
- 10) Pemi, A., J.M. Martinez-Paz and F. Martinez-Carrasco. 2013. Assessment of the Programme of Measures for Coastal Lagoon Environmental Restoration using Cost-benefit Analysis. *Eur Plan Studies*. 21(2):131-148.

Table 1 Binary Logit Regression Results

Variable	Description	Coefficient	
		Run 1	Run 2
Constant		1.871**	1.476***
Bid	Program price to household as % of water bill	-0.082***	-0.081***
Household Income	monthly in PhP	0.000	0.000
Respondent Gender	1 if male, 0 if female	0.159	0.204
Respondent Age	in years	-0.025***	-0.023***
Respondent Education	In years	-0.005	-0.003
WaterConsumption	Household water consumption from main supplier	0.002	-
DrinkingWater	1 if respondent's household buys bottled water or from refilling stations for drinking water, 0 otherwise)	-0.114	-
EnvironGrpMember	1 if household is a membr in an environment-related group	-0.318	-
SeminarParticipate	1 if respondent has taken part in a seminar on watershed	-0.557*	-0.665**
FamiliarCDORB	1 if respondent is familiar with the CDORB	-0.240	-
HeardCDORBMC	1 if respondent has heard of the CDORBMC	-0.244	-
HeardCDORBPlan	1 if respondent has heard about the CDORB rehabilitation and preservation program	-0.033	-
ForestLossSendong	1 if respondent thinks loss of forest cover was a main cause of Sendong flooding	-0.012	-
LivelihoodEffect	1 if respondent thinks that the condition of the CDORB affects their livelihood	0.347**	0.351**
BukidnonForestPart	1 if respondent is willing to contribute if Bukidnon forest is part of the CDORB	1.197***	1.159***
CDORBStateAlarm	1 if respondent thinks that the current state of the CDORB is alarming	0.399**	0.459**
SendongFloodVictim	1 if household experienced flooding during Sendong and Pablo	-0.147	-
DumFloodRarely	1 if household rarely experiences flooding in current place of residence	-0.108	-
DumFloodAlways	1 if household always experiences flooding in current place of residence	0.293	-
WaterRafting	1 if household member/s has/have gone water rafting	0.332	-
KnowAhaan	1 if respondent knows ahaan	0.239	-
KnowPigok	1 if respondent knows pigok	0.149	-
Log-likelihood			
No. of observations			

Notes: * = significant at $\alpha=0.10$; ** = significant at $\alpha=0.05$; *** = significant at $\alpha=0.01$.