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Research article

Estimating Socio-economic Value of Layawan River System in Northern Mindanao, Philippines

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ABSTRACT

Wastes from domestic activities, runoffs from agricultural systems, and minor industrial wastes are threatening the overall socio-economic values of a river system. As such, a study was conducted on estimating the socio-economic value of Layawan River system in Oroquieta City, Misamis Occidental as a consequence of prevailing threats on water pollution. In-person interviews using survey questionnaires and available secondary data were used. Results showed some water pollution sources such as food and utensil washings, bath soaps and detergents from bathing and laundry activities, agricultural drainage containing synthetic fertilizers and pesticides, wastes from poultry and swine production and eroded sediments from quarry activities. Subsistence fishing was done and it has an income of PhP 24,840.00 per year. Other incomes in Philippine Peso (PhP) per year included: quarry of gravels at PhP 86,400.00, recreation and ecotourism at PhP 96,000.00, and zipline adventure at PhP360,000.00 per year. Conserving and protecting the river system was perceived and the residents were willing to pay at PhP5,427,345.00. The perceived total socio-economic benefits of Layawan River system amounted to roughly around PhP 394,619,633,933.24 had prompted various stakeholders for its protection and conservation for the benefits of the present and future generations.

Keywords: Layawan Rivers, WTP, socio-economic value, livelihood

INTRODUCTION

The headwaters of Layawan River are located in Brgy. Sebucal in Oroquieta City. It is more or less a rolling plateau surrounded by steep mountains. At the base of these mountains are the gullies serving as headwater streams of Layawan River. It has three major headwater streams: Layawan, a stream traversing Lake Duminagat and Brgy. Sebucal, Panobigonon the eastern side of Brgy. Sebucal proper, and Manimatay, which joins the Layawan tributary to form a single Layawan River.

Water from Layawan watershed is mainly used for domestic and agricultural activities among the 33 barangays covered. Over the years, the watershed has been exposed to destructive activities such as illegal logging, encroachment, and timber poaching. The declaration of Mt. Malindang as a protected area (RA 9304) reduced destructive activities in the upland portion of the watershed, hence its eventual conservation. Water quality problems were observed in the low land portion of the city due to improper farming practices in the midland and lowland portions of the watershed. Anthropogenic wastes were also observed in certain parts of the river bank. This posed a huge threat to the residents of Oroquieta City as primary dependents of the water for various socio-economic uses (Bongcayao et al. 2015).

Layawan River was a recipient of cleanest and greenest river award in the Philippines. However, continuing threats of water quality deterioration was prevalent particularly the liquid wastes that were freely draining into the river system. Hence, this study was conducted to help the local government and other concerned stakeholders to do holistic and concerted efforts on conservation, protection and management of the river system. The economic estimates (in Philippine Peso) of the river system could be an added significant information needed to immediately address this issue.

Considering all the factors contributing to the contamination of Layawan River, the wastes drained into the river system coming from various household uses and residues from agricultural activities in the forms of chemical fertilizers and pesticides including the impacts brought about by the extraction of river resources, all these wouldeventually destroy the river if not during our generation, it would be during the future generations (Vedra et al. 2013). This could reduce the fishing value of the river system and its provision of important socio-economic and ecological services to the people and aquatic life (Vedra and Ocampo, 2014). Results of the study might help increase the appreciation of the benefits provided by the river system especially to the constituents who rely their main livelihood. The applicable valuation methods (Navrud and Pruckner 1997) showed the people benefiting from Layawan River resources to take care and observe proper use and consumption for a continued supply for the present and future generations.

METHODOLOGY

In-person interviews using survey questionnaires were used to obtain the direct economic value of the resources given their current market prices. Pre-testing of the survey questionnaire was done to assess its understanding when employed to the respondents. Random sampling of the respondents was conducted, wherein the respondents must be the head of the family or any family representative of age group 20 years old and above either male or female. Focused group discussion (FGD) was conducted mainly to cross check the ideas reflected in the questionnaires. This is also to validate the information generated in the survey questionnaires. Participants of FGD served as key informants that included members of the Barangay Council, some people's organizations and other stakeholders. The data were useful in estimating the non-use values of the resources. Secondary sources of data were also obtained from any relevant offices like MPDO, MAO and CENRO. This is important to estimate the indirect use values of the resources using benefit transfer and damage cost methods.

The general framework of total economic value (TEV) of the resources included their active use and passive non-use values. For active use values, these included the direct and indirect values based on the current market prices. Mean values obtained were expressed into Philippine peso per year. Active use values used valuation techniques like market price method, surrogate market price method, travel cost method, damaged cost method and benefit transfer method (Costanza et al., 1997). The economic estimates were done using the survey questionnaires and relevant

secondary data. Whereas, passive use values included the bequest and existence values of the resources. This is a more passive economic estimation since the resources described did not have direct economic utilization. The monetary values for the bequest and existence values where obtained using the willingness to pay (WTP) of the respondents. WTP is influenced by the understanding, knowledge, perception and attitude of the respondents, which is a more personalized monetary value placed for the resources or it could be based on their own pragmatic points of view.

RESULTS AND DISCUSSION

Socio-demographic and Biophysical Profiles

There were four (4) members per household (29%) and single in household structure (84%). Farming (45%) was their major livelihood, while others were engaged in fishing and quarry activities (9%) (Bongcayao et al. 2015).

The City of Oroquieta has a total land area of 26,393.46 hectares. It is composed of forty seven (47) barangays. Most of the barangays are traversed by Layawan Watershed. Barangay Sebucal has the biggest area of 6,640.91 hectares. This barangay also has the highest elevation of 1,106 masl. Other highly elevated barangays include Mialen and Toliyok having an elevation ranging between 500-900 masl. The lowest elevation is computed to be on the average of 10 masl that mostly constitute the urban district of the city like Barangays Poblacion II and Taboc Norte (Bongcayao et al. 2015).

Results showed that residents were mainly attached to the river for various socio-economic undertakings including its function as a waste sink. These barangays are densely populated and that the river might be threatened should river conservation and protection not be realized.

Socio-Economic Value

The methods used to determine the relative values of the different uses and resources of Layawan River resources were based on the benefits, its relative impacts on the community and its surroundings. For resources directly sold and available in the market, the market price method was used and for those that were not bought or sold like for some environmental goods or services (e.g. clean water, clean air), the people's willingness to pay for such resources was considered using CVM. Surrogate price method was used for services not directly consumed. The travel cost method was used to determine how much an activity or resource is valued by combining all travel expenses incurred to conduct the activity. Generally, the total economic value of direct and indirect use values and non-use values of the Layawan River resources was described below:

Fishes

Fishing in the rivers was done for food and some high value fishes were sold at relatively higher prices like freshwater eel. Some fishes were used as food items as substitute for marine fishes. Fishing and the fishes caught were affected by the turbidity of the water and its reduction in numbers. This is turn, reduced their added income and the benefit they derived from the fishes (Vedra and Ocampo, 2014).

Most of the residents along the river system were fishermen. They sustained their families with the fish catch they got from the river. Some of which were sold for basic household necessities. This now became their livelihood and for fish to be sustainable meant learning to sustain catch and its corresponding income from it. Habitat protection was also seen very important to consider.For the fishes alone, their value was around PhP 24,840.00 per year based on prevailing market price.

Sand and Gravel Deposit

Other extractive resources found in the river are sand and gravel. Quarry of these resources provide the residents an income of PhP 86,400.00 per year. Average selling price is at PhP300.00 per cubic meter.

Irrigation

Source of irrigation water for agricultural lands around the river system is from the river water. Average of 70% or thirty three (33) barangays are into agricultural activities and these barangays are into lowland farming. Irrigation system is valued at PhP27,797,370.00 per year.

Ecotourism and Recreation

Two major recreation and ecotourism activities were undertaken at Layawan River, swimming and zipline adventure. For ecotourism, it had an estimated value of PhP 96,000.00, while for zipline adventure it had an estimated value of PhP 360,000.00 per year. Visitors were coming from nearby places and some were around the country. When developed more, the value of the river would eventually increase.

Indirect Use Values

Monetary estimates for diversity of fauna and their conservation was based on the values derived from the studies conducted by the Secretariat to the Convention on Biological Diversity (2001) and Kling (1993). It was estimated to have a total monetary value of PhP 1,908,850.00 per hectare per year. The monetary values were based on the interconnected functions of the faunal species from material and energy transfer, pest control, balance of predator-prey relationships, and genetic information. This is a surrogate monetary estimate, however, only the direct market value of the faunal species could be estimated from their meat price values, thereby setting aside their various ecological functions across time and space.

Soil fertility and its production function was based on the study of Pimentel et al., (1995). It was used to account recovery of nutrients from soil erosion. It was estimated to have a total monetary value of PhP 393,876,000,000.00 per hectare per year. Loss of soil nutrients and fertility would adversely affect its productivity function in the whole terrestrial ecosystem. It would create cascades of effects to the inhabiting microorganisms, plants and animals, and their diversity and ecological functions over time and space. Likewise, the economic capital of the people relying on fertility and productivity of the soils were also altered.

Likewise, values derived for floral diversity and conservation were based on the study of Carandang (2008). It was estimated to have a total monetary value of 707,800,000 million pesos per hectare per year. Individual tree stands can be valued for its timber and priced per board foot, but indirectly, it could not be valued given the added functions each tree stand bears. For instance, each tree stand serves as the anchorage for epiphytes, vines and lianas, a habitat for litter arthropods, a habitat and home of birds, bats, rodents, reptiles, insects and anurans, an agent for sequestering atmospheric carbon, an agent for ameliorating microclimatic conditions in the area, an agent of protecting soil erosion and loss of water, and many more. As a whole, several stands of trees would create a synergy of various ecological functions that are difficult to be valued monetarily over certain periods of time and space.

Provision of clean water for domestic and agricultural purposes was derived from the study of Young et al., (1986). It was estimated to have a total monetary value of PhP 10,128.24 per hectare per year. This is an economic estimate that projects the economic value of water consumed in the households either as drinking water or any related purposes. Water that is also used in farms for watering crops or as drinking water for the livestock. This is apart from the ecological functions of water to the diversity, composition, abundance, distribution, and survival of the inhabiting flora and fauna in an aquatic ecosystem over time and space. And this, could not bear an immediate economic value. Therefore, once the quality of water is affected all other components of the aquatic ecosystems' structures and functions and the interconnected ecosystems are also at stake.

Research and education values were derived from the actual travel cost and other expenditures allocated for this study amounting to more or less PhP 126,000.00 pesos. This is a surrogate value derived for the educational and research value obtained for a certain place.

The socio-economic and ecological significance for these indirect use values of the resources might be impaired upon the continuing threats posed by water pollution. It necessitates to do conservation as a proactive means to sustain the economic and ecological services derived from the river. As a matter of fact, various policy measures were created and implemented to conserve the river and protect it from degradation.

Existence and Bequest Values

Existence and bequest values are an unusual and somewhat controversial class of economic value. It reflects the benefit people received and the values attached for the future generations. that reflect the benefit people received from a particular environmental resource. No direct utility of the residents was derived from the resource and values were based on their willingness to pay. Data gathered showed that the existence and bequest values of the Layawan River resources had amounted to PhP 5,427,345.00.

CONCLUSIONS AND RECOMMENDATIONS

The study conducted was to determine the socio-economic valuation of the Layawan River resources and to verify impacts of waste deposition on these resources. Based on the information gathered from the respondents, abundant freshwater fishes can still be caught from the river and it is still their primary source of livelihood. Quarrying of sand and gravel is also practiced all year round and it obviously generated additional income for the family. In terms of agriculture, irrigation water from the river is enough for the farmlands. Domestic needs of water were achieved and along with its ecotourism and recreation activities.

However, continuing threats of water pollution come in and the stakeholders involved tried to address the issue with regulatory and non-regulatory measures. To this, the economic estimates of PhP394,619,633,933.24 could be a source of information that might add to strengthen the implementation of the policies created to protect and conserve the Layawan River system.

Awareness of the stakeholders of Oroquieta City towards environmental and ecosystem services conservation and management could be enhanced through interventions to be undertaken namely: regular coastal clean-up, mangrove planting, tree planting and information campaign on coastal resources. Likewise, the study recommended immediate information dissemination to address the issues and concerns of water pollution that might affect the status of the river system including its ecological and economic values. Additional efforts on information, education and communication (IEC) must be conducted among the residents, which can be aided by the local government and other stakeholders, primarily for the benefits of the present and future generations.

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