An Economic Valuation of Freshwater Ecosystem Services in Lawis River Spring, Buruun Iligan City

RESA MAE LAYGAN
MARIA PIA M. SISON

Abstract

Balancing the allocation of freshwater ecosystem services to different users is one of the challenges of sustainable water resource management. By valuing resources and ecosystem services economically, it can provide useful support for water conservation policies by quantifying the economic value associated with the natural resource. Thus, economic valuation is an important tool for decision-making on sustainability of ecosystem services. One of the techniques in determining the economic value is the willingness-to-pay (WTP) method. This refers to the price that an individual is willing to pay for the consumption and/or conservation of the ecosystem services. This study aims to determine the economic valuation of Lawis River Spring located in Buruun, Iligan City Lanao del Norte through the use of the WTP method. In gathering this data, convenience sampling was done and accompanied by a modified survey-questionnaire. Also, the researcher obtained physico-parameters and conducted four-day solid waste characterization (Friday to Monday) in the research locale. Results revealed that an individual is willing to pay a total of PHP 42.20 for the freshwater ecosystem services, infrastructural development and maintenance of the spring. The physico-parameter results also revealed that the water is safe for humans, aquatic life and other living organisms. It also indicates an acceptable remark for domestic and agricultural use for households situated nearby the area and for recreational activities of potential tourists and/or

LAYGAN is currently completing her Master's Degree in Sustainable Development Studies focusing on Economic Development at Mindanao State University – Iligan Institute of Technology. SISON is currently Associate Professor II of the Department of Sociology at Mindanao State University – Iligan Institute of Technology

visitors. The result of Total Suspended Solids (TSS) and salinity may indicate the presence of solid contaminants and wastes in the water resource. The study concluded that the Lawis River Spring is still in a good condition and has potential for community-based tourism in Iligan City. However, due to the presence of water insoluble materials and wastes in the area, there is a need for appropriate conservation and water management strategies. The economic valuation undertaken here can be basis for sustainable water conservation policy-making.

Keywords: Ecosystem Services, Economic Valuation, Economic Value, Willingness-to-pay

INTRODUCTION

Background of the study

The world's ecosystems yield a flow of essential services that sustain and fulfill human life, from seafood and tim-ber production to soil renewal and personal inspiration.

Ecosystem services are the conditions and processes by which ecosystems sustain and fulfill human life and other living things (Brauman & Daily, 2014). People pursue many of these ecosystem services to satisfy their needs (Millennium Ecosystem Management Board, 2005). Water is one of the essential resources that provide ecosystem services that beneficial to all organisms in earth. It also plays a significant role in sustaining the human health and welfare (Rahmanian, et al., 2015). The rising demand of water due to population growth, agriculture and industrial development as well as urbanization has forced environmentalists to identify the chemical, physical and biological characteristics of water resources and determine the necessary conservation measures (Regina & Nabi, 2003).

Balancing the allocation of freshwater ecosystem services to different users is one of the challenges on sustainable water resource management. One of the promising ways to address this is through economic valuation of ecosystem services (Korsgaard & Schou, 2010). By valuing resources economically, it can provide useful support for

water conservation policies through quantifying the economic value associated with the particular resource. Thus, economic valuation is an important tool for decision-making on sustainability of natural resources including freshwater ecosystem services.

One of the techniques in providing economic value of ecosystem services is the willingness-to-pay (WTP) method. This refers to the price that an individual is willing to pay for the consumption and/or conservation of the services. The WTP concept is based on the welfare theory by Dupuit which deals on how to derive the measures of a change in individual satisfaction due to a change in price and quantity or quality of goods and services provided (Markandya, Harou, Bellu, & Cistulli, 2002; Kamri & Kasumka, 2017). Various studies have adopted this approach in valuing an ecosystem. A study of Garrod, et al. (1996) used WTP method to estimate the costs and benefits of enhancing flow in the River Darent in United Kingdom for recreational purposes. Results revealed that respondents were willing to pay £12.32 (residents) and £9.76 (visitors) to improve current flow levels in any of the 40 rivers presently subject to low water flows. Another study of Loomis, et al. (2000) also adopted WTP approach in estimating the willingness of households to improve and increase the ecosystem services in Platte River in Colorado. The study revealed that households were willing to pay $21 per month, or $5.60 per mile of river, for increased ecosystem services. Meanwhile, the study of Sylvie (2012) assessed the farmers' willingness to pay for the protection of Nyabarongo River System. The mean household's maximum WTP for the protection of Nyabarongo River system was 486.4 Rwandan francs (Rwf) per household per month or less than 1USD$. The study of Foster (2008) estimated the residents' willingness to pay for ecosystem services and water quality improvements in the Ichetucknee Springs and River. It was found out that average WTP was estimated to be $16.2 per household per month. Also, majority of the residents believe that protecting water quality in the River is an important concern. Similarly, Shah, et al. (2015) investigated the household preferences and willingness to pay (WTP) for water quality improvement of the Swat River in Pakistan. Results revealed that the estimated annual mean WTP per household for water quality improvement of the water resource is $2.40 and incorporating this value to the households in Swat Valley would generate up to $544,000 per year. The study concluded that this value will serve as basis for policy formulation towards water quality improvement of the Swat River. Studies pointed out the importance of

economic valuation on ecosystem services using WTP as the value serves as basis for policy-formulation and strategies on resource management. Valuing these ecosystem services and integrating those values into decision-making processes can help assess the impacts of development policies that modify the ecosystem's condition and in human welfare (Federal Ministry for Economic Cooperation and Development, 2012).

Thus, the main objective of this paper is to determine the economic valuation of Lawis River Spring located at Burrun, Iligan City Lanao del Norte by using WTP Approach. Specifically, the objectives of this study are the following: (1) to identify the water quality in terms of the following physico-parameters: (a)Water pH level (b) Temperature (c) Dissolved Oxygen (d) Salinity (e) total dissolved solids (TDS) and (f) total suspended solids (TSS); (2) to characterize the solid wastes generated from the cottages in terms of organic and inorganic; (3) to describe the socio-economic profile of the respondents in terms of: (a) Age (b) Sex (c) Residence (d) Civil Status (d) Religious Affiliation (e) Highest Educational Attainment (f) Employment Status (g) Monthly Income; (4) to identify the level of social perceptions of respondents on the ecosystem and services of Lawis River Spring in terms of: (a) satisfaction on ecosystem services (b) safety and access (c) cleanliness and maintenance (d) sustainability; and (5) to determine the per person's value on their willingness to pay for: (a) Ecosystem Services (b) Infrastructural Development (c) Maintenance value.

The conceptual framework of this study as shown in Figure 1 was derived from the ecosystem services framework conceptualized by Vectors (2015). The framework on this study shows the interdependence of ecological to social and socio-economic aspects that affect the economic value of the Lawis River Spring.

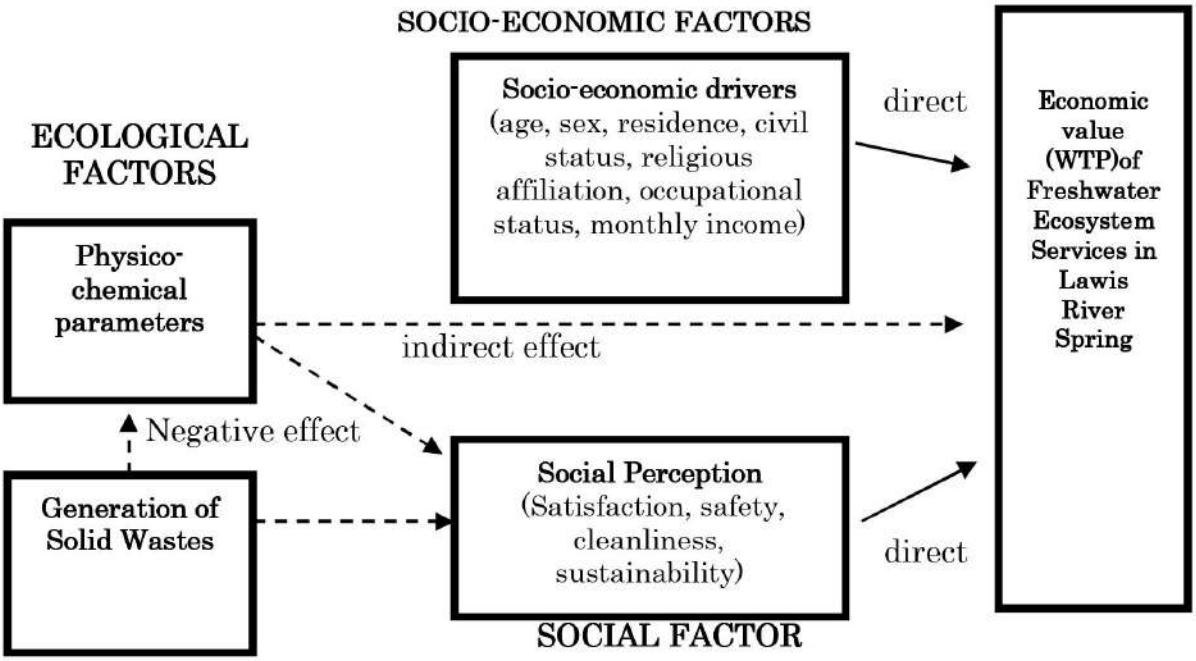

Figure 1. Conceptual Framework

The conceptual framework in Figure 1 illustrates the factors that can affect the economic value of freshwater ecosystem services in Lawis River Spring. First, what are the physical and chemical characteristics of the freshwater ecosystem? Physico-chemical parameters are one of the ecological indicators to determine the water quality of a water resource. These characteristics can influence how people perceive the quality of services provided by the ecosystem, which can also influence their satisfaction and willingness-to-pay. Thus, these parameters may indirectly affect the WTP of users or visitors on the ecosystem services. Another ecological factor is the generation of solid wastes in which it can also affect the perception of respondents in terms of cleanliness and how well the area is managed. Solid wastes may also have negative impact on the physico-chemical characteristics of the freshwater, and therefore, it can also affect the sustainability of the ecosystem services and its economic value. On the other hand, socio-economic factors of an individual such as age, sex, residence, civil status, religious affiliation, occupational status, and monthly income may influence their willingness-to-pay for the ecosystem services. For instance, if an individual has higher income, there is a high probability that he or she is

willing to pay for the ecosystem services. Or if an individual is employed, he or she has the ability to pay for the services.

METHODOLOGY

This study generally aims to determine the economic valuation of the freshwater ecosystem services Lawis River Spring, Buru-un Iligan City. This study employed a descriptive type of research design in order to attain its specific objectives particularly on the willingness-to-pay of the respondents.

a.) Physico-chemical parameters

Water temperature, water pH level, dissolved oxygen (DO), salinity, total dissolved solids (TDS), and total suspended solids (TSS) are the physico-chemical parameters that were assessed in the three sampling sites: Upper area (located at 8°11'18.3"N 124°10'41.2"E), recreational area (8°11'20.1"N 124°10'35.3"E) and the downstream (8°11'21.4"N124°10'31.6"E). The sHM Digital COM-100 waterproof combo meter was used in measuring the water temperature (°C) and total dissolved solids (TDS). The tip of the material was dipped into the water surface until the readings became stable. Meanwhile HM Digital pH-200 waterproof pH meter was used in measuring water pH. The electrode was dipped into the water surface until the readings became stable, and then was rinsed thoroughly with distilled water before taking another reading. In measuring Dissolved Oxygen (DO), PINPOINT II Dissolved Oxygen Monitor was used and calibrated before taking any readings. The probe of the material was submerged for about 1 inch into the surface of the water. The value was read directly from the meter and was expressed in mg/L. Salinity, expressed in parts per thousand (ppt), was measured using refractometer. Using a glass dropper, a small drop of water was placed on the testing prism, and the value was read through the calibrated eyepiece. The values obtained in each sampling were recorded accordingly.

b.) Solid Waste Characterization

In this study, solid wastes produced by visitors on every cottage in the area were collected. The four-day weekend (Friday to Monday) collection operation was done in the 2nd week of November, 2018. The waste collected were put in the garbage bags and separated into 2 classifications: organic and inorganic. The organic wastes are composed of food wastes, peelings (fruits and vegetables), and paper or board. On the other hand, the inorganic wastes

are composed of plastics, sachets, polyethylene terephthalate (PET) bottles, wrappers and plastic bags. The separation of wastes into classifications was done manually. During the weighing process, each group of waste was weighted using an electronic weighting portable scale. The values obtained from collection per day were recorded accordingly in kilogram (kg) basis.

c.) Social Perception

The social perception of the respondents in terms of their satisfaction on ecosystem services, cleanliness, safety and sustainability of Lawis River Spring were also assessed in order to support the economic valuation of the ecosystem services. A 5-point Likert Scale was used to measure the extent of their perception to which they agree or disagree to a particular statement. The scale was subdivided into: strongly disagree (lowest=1), Disagree, True to some extent, Agree and Strongly Disagree (highest=5). In gathering the data the researcher also conducted face-to-face survey interview to the respondents along with the letter of consent and the structured survey questionnaire.

d.) Willingness-to-pay survey

In determining the economic valuation of the ecosystem services in Lawis River Spring, the researcher conducted a face-to-face survey interview to the visitors in the research area accompanied by a structured survey questionnaire with a letter of consent. This study questionnaire is divided into three parts: socio-economic profile, willingness-to-pay (WTP) information and the social perception on Lawis River Spring. The respondents were selected using convenience sampling.

In this study, WTP refers to the value in pesos (PHP) that an individual is willing to pay to the ecosystem services, infrastructural development, and maintenance of Lawis River Spring.

RESULTS AND DISCUSSIONS

The site is surrounded with *colocasia esculenia* (Gabi), *adiantum aleuticum* (Maidenhair fern), and *bambusa vulgaris* (bamboo tree) as well as big rocks. There is also presence of some decayed plants and riparian vegetation including herbaceous perennials: *amaranthacea, poaceae, fabaceae, cyperaceae and araceae*. There are some cottages and "sari-sari" stores surrounded in the recreational area or Site B.

1.) Physico-chemical parameters

Table 2 summarizes the physicochemical parameters on three sampling sites in Lawis River Spring. Water pH, temperature (^{0}C), dissolve oxygen (DO), salinity (ppt), total dissolved solids (TDS), and total suspended solids (TSS) were obtained in the sampling sites.

Table 2. Physicochemical Parameters of each Sampling Site

Parameters	Site A	Site B	Site C	Mean	Variance	Std. Dev.
Water pH	7.88	7.458	7.484	7.61	0.0559	0.2365
Temperature (^{0}C)	25.76	25.76	25.98	25.83	0.0161	0.1270
Dissolve oxygen (mg/L)	7.72	8.58	7.76	8.02	0.1570	0.3963
TDS (mg/L)	127.8	128	127.6	127.8	0.0267	0.1632
TSS NaCl	92.14	92.34	91.96	91.15	0.0240	0.1552
TSS (mg/L)	340	520	560	473.3	13733.33	117.19
Salinity (ppt)	2.5	2.8	3.2	2.83	0.2467	0.0822

Water pH indicates the concentration of the acidic or basic character of a solution and it is also controlled by the dissolved chemical compounds and biochemical processes (Saksena & Kaushik, 1994). This parameter is positively correlated with electrical conductance and total alkalinity (Gupta, 2009). In the present study, Table 2 reveals that the three sampling sites of the study area have a mean pH level of 7.61. The pH level in each sampling site indicates a neutral water solution (Grand River Conservation Authority, 1995). The optimum pH for river water is around 7.4 and its acidity can be increased by an acid rain but it will be neutralized by the limestone (DeBrosse, 1997). Since the pH level of each sampling site is above the optimum pH, this implicates that the water is not acidic and can be closely considered as neutral solution, which is mostly true for freshwater resources. The higher pH value also suggests that carbon dioxide and carbonate-bicarbonate equilibrium are influenced possibly because of changes in physicochemical condition (Karanth, 1987). The water temperature controls the rate of all chemical reactions, and influence fish growth, reproduction and immunity (Walia, et al., 2016).

In this study, Site C obtained the highest water temperature which is 25.98^{0}C among the other sampling sites. This is possibly because Site C is not more shady unlike Site A and B. The cooling effect of shade trees and grasses may control the temperature (Armson, et al., 2012). Higher temperature of

the area may enhance the movement of ions due to electrostatic potential (Oguntona, et al., 2012). The mean value of temperature in the study area which is 25.83^{0}C is found within the acceptable limit of World Health Organization as freshwater and have a good quality for survival of aquatic life. Dissolved oxygen (DO) is one of the significant physico-parameters (Walia, et al., 2016) and for aquatic life and chemical characteristics of the environment (Premlata, 2009). Among the three sampling sites, Site B obtained the highest DO which is 8.58mg/L. This is possibly due to the duration of bright sunlight has influence on the % of soluble gases (O2 & CO2) in the area (Krishnamurthy R., 1990) compare in Site A and C. It also indicates an increased microbial activity (Moss, 1972; Morrissette, 1978; and Kataria, 1996). The mean value of DO which is 8.02 mg/L indicates that the water resource is in good quality. The minimum DO may not be less than 5.0 mg/L in order for the aquatic life to survive (Egemen, 2011) and a good condition for most aquatic organisms (Behar, 1996). Thus, the result implicates that Lawis River Spring is in a good condition for aquatic life.

Total dissolved solids (TDS) show the salinity behavior of water (Dahiya & Kaur, 1999). It also indicate the total amount of inorganic chemicals in solution (Colman et al., 1992; Furhan, et al., 2004), A water resource containing more than 500 mg/L od TDS is not desirable for drinking (Saksena, et al., 1994) and may pose harmful effect on humans and aquatic life (Mezgebe, et al., 2015). Table 2 reveals that the study area has a mean TDS value of 127.8 mg/L is within the permissible limit of World Health Organization. The result also indicates that each sampling sites is safe for humans and aquatic life and is suitable for recreational and domestic activities.

Total Suspended solids (TSS) include particles that are suspended in water (Mezgebe, et al., 2015). It is also an indicator that there is a presence of contaminants such as industrial wastes and metals in the area that can bind with sediments and influence aquatic life and water quality (Toronto and Region Conservation Authority, 2017). The present study shows the average value of TSS in the sampling sites ranged 340 mg/L– 560mg/L. Among the three sampling sites, Site B and Site C obtained large value of TSS compared to Site A. This is also probably because of the presence of human activities in which there is a possibility that the domestic and industrial wastes such as plastic bottles, sachets, and other water insoluble materials are thrown in the water.

Salinity refers to the concentration of salt in water (Dirican, 2015). This parameter has significant correlation to the number of aquatic species, water temperature, dissolved oxygen, and depth (Marshall & Elliot, 1998). For freshwaters, the average salinity is

commonly 0.5ppt or less (Environmental Protection Agency, 2001). In this study, it has shown that the salinity of the three sampling sites ranged 2.5ppt to 3.2ppt has a mean value of 2.83ppt. Results did not conform to the common average salinity for freshwaters. This is possibly due to the potential evaporation that tends to increase salinity concentrations (Dunlop et al., 2005). The salinity values are also probably due to poor water management in the area that may influence aquatic life, productivity, and water quality of the study area.

2.) Solid waste Characterization

In Table 3, it summarizes the weights of organic and inorganic solid wastes from the 4-days solid waste characterization.

Table 3. Solid Waste Characterization

Days	Inorganic Wastes (in kg)	Organic Wastes (in kg)	Total wastes per day
Friday (Day 1)	2.23	3.63	**5.86**
Saturday (Day 2)	4.41	6.43	**10.83**
Sunday (Day 3)	5.07	6.95	**12.02**
Monday (Day 4)	1.48	3.42	**4.90**
Total Waste Generated:	**12.79**	**20.03**	**32.82**
Percentage:	**39%**	**61%**	**100%**

As shown in Table 3, organic wastes obtained the highest amount of wastes in the area which is 61% from the total wastes generated. This is probably because people used to consume foods and paper plates or boards while visiting or having recreational activities in the area. Although organic wastes biodegrade easily, these can contribute negative impact to the environment. Organic wastes such as food wastes is an emerging environmental issue as it increase greenhouse gas (GHG) emissions (methane) and can be a source of nutrient and pathogens pollution in waterways (Kibria, 2017). On the other hand, inorganic wastes account 31% from the overall total waste generated in Lawis River Spring. Inorganic wastes such as plastics can cause detrimental effects to the environment including water pollution (Speight, 2017). These waste products can change the pH of water and can pose threat to the aquatic life (Gupta, 2016).

As revealed in Table 2, the result of TSS shows that there is a presence of contaminants such as organic and inorganic solid wastes that

were suspended in the freshwater particularly in Site B and C. The result of solid waste characterization in Table 3 supports the result of physico-chemical parameters that the increase of salinity, the presence of dissolved solids and suspended solids were possibly because of the various human activities in the area as well as the generation of wastes. Table 3 also reveals that the highest amount of wastes produced in the area happened during Saturdays and Sundays. This is possibly because most people visit the area during weekends. The concern on waste disposal is common to urban areas where population is rapidly growing and amount of waste generated is also increasing (Kathiravale & Mohd Yunus, 2008). Waste management become complex and the facilities provided cannot cope with the increasing demand and needs. Thus, there is a need of a real approach to be implemented considering environmental, social and economic aspects (Aye & Widjaya, 2006).

3.) Socio-economic Profile of Respondents

Table 4 shows the socio-economic profile of the visitors in Lawis River Spring in terms of age, sex, residence, civil status, religious affiliation, employment status and monthly income.

Table 4. Summary on the Socio-economic Profile of the respondents

Age	**Frequency**	**Percentage Distribution**
16-20	23	46%
21-25	13	26%
26-30	8	16%
31 and above	6	12%
Sex		
Female	20	40%
Male	30	60%
Residence		
Within Iligan	38	76%
Outside Iligan	12	24%
Civil Status		
Single	43	86%
Married	5	10%
Separated	1	2%
Widowed	1	2%
Religious Affiliation		
Roman Catholic	40	79%
Islam	4	8%
Others	7	13%
Educational		

Attainment		
Elementary	1	2%
High School Level	17	34%
High School Graduate	8	16%
College Level	11	22%
College Graduate	8	16%
Vocational	3	6%
Graduate Studies	1	2%
Employment Status		
Employed	18	36%
Self-employed	1	2%
Retired	1	2%
Unemployed	8	16%
Student	22	44%
Monthly Income		
No Income	31	62%
Less Than 10,000	9	18%
10,000 and above	10	20%
TOTAL SAMPLE:	**50 respondents**	

Based on the data as shown in Table 4, majority of the respondents were aged 16 to 20 years old comprising 46% of the sample. The result implicates that most of the respondents were youths and defined as young, independent and adventurous (Horak & Weber 2000; Moisă 2010). Most of them are willing to seek out personal indulgences and memorable experiences to different places and natures (Demeter, 2014). Meanwhile, in terms of sex, it shows that most of the respondents were male comprising 60% of the sample while female obtain 40%.

Also, most of the respondents were locals of Iligan City comprising 76% of the sample while 24% of them came from other places. The result indicates that the respondents who resides within Iligan City can easily access the destination with travel costs and time (Demeter, 2014). However, in terms of civil status, majority of the respondents were single which consist of 86% of the sample. This indicates most of them were young and do not have family obligations, thus, they have more time to visit the place (Horak & Weber 2000; Moisă 2010). In terms of religious status, most of the respondents were Roman Catholic comprising 86% of the sample. Based on the Philippine Statistics Authority, most people in Iligan City were affiliated to the Roman Catholic Religion.

In terms of the respondents' highest educational attainment, majority of them were High School Level comprising 34% of the sample followed by those who were college level (22%), High School Graduate (16%), College Graduate (16%), Graduate Studies (2%) and Elementary Graduate (2%). However, none of them were doctoral degree holder. This results shows that the respondents undergone with formal education.

On the other hand, it also reveals that majority of the respondents were students (44%) and employed (36%). Also, it shows that most of them have no income comprising 62% of the sample which this includes the number of students and unemployed individuals. However, some of them earned PHP 10,000 and above (20%). Since Lawis River Spring is a public area and no entrance fee, most of the low income earners were more likely to visit the area. Also, majority of the visitors in the area were young which implicates that young visitor's travel on a strict budget. They choose inexpensive accommodation, enabling them to have a relatively long duration journey and spend their money on a wide range of activities (Maoz, 2006).

4.) Social Perception on Lawis River Spring

Table 5 shows the social perception of respondents towards Lawis River Spring in terms of their satisfaction on the ecosystem services, cleanliness, safety and sustainability of the area. It also shows weighted mean on each statement along with the corresponding remarks.

Table 5. Social Perception on Lawis River Spring

INDICATORS	Weighted Mean	Remarks
Satisfaction on ecosystem services	3.51	Agree
Cleanliness and Maintenance	2.96	True to some extent
Safety and Access	3.10	True to some extent
Sustainability	3.65	Agree

Note: *1.00 – 1.80 =Strongly Disagree, 1.81 – 2.60 = Disagree, 2.61 – 3.40 = True to some extent, 3.41 – 4.20 = Agree, 4.21 – 5.00 = Strongly Agree*

In terms of the satisfaction on ecosystem services as shown in Table 5, the weighted mean of 3.51 shows that most of the respondents agreed that

they are satisfied with ecosystem services provided by Lawis River Spring particularly the provisioning and cultural services. These ecosystem services provide quality life and satisfaction to the well-being of individuals and communities (Summers et al., 2018). It shows the link between ecosystems to the human satisfaction (Vectors, 2015). Meanwhile, the weighted mean of cleanliness and maintenance which is 2.96 reveals that the respondents somehow agreed to some extent about the maintenance and cleanliness of the area. Solid waste management is one of the major concerns of the locals on the Lawis River Spring. The fast increasing of municipal solid waste quantity and the generation of wastes is one of the potential challenges to the management of solid waste in urban areas (Nguyen, 2011). On this concern, best approaches on waste management need to be implemented in consideration with the sustainability of the area (Aye & Widjaya, 2006). The weighted mean of safety and access which is 3.10 reveals that majority of the respondents agreed to some extent that the Lawis River Spring is safe and easy to access. Based on the ocular inspection, the locals or visitors would take time before they can access the place which is found to be far from the highway. There is no access road established and there is a need for investment on the infrastructural development of the place. Moreover, the weighted mean on sustainability which is 3.65 shows that most of the respondents agreed that the river spring will continue to exist in the future generation.

In the long run, healthy freshwater ecosystems are probably able to retain the adaptive capability on sustaining ecological services in the face of future environmental disruptions such as climate change (Baron & Poff, 2004). Ecological services are costly and irreplaceable when aquatic ecosystems are degraded (NRC 1992; Baron et al. 2002).Freshwater ecosystems are known to be a "biological assets (that are) both disproportionately rich and disproportionately imperiled" (Abramovitz 1996). There is a need to maintain or restore freshwater ecosystems to a sustainable state that will continue to provide services to the society (Baron & Poff, 2004).

5.) Willingness-to-pay

Table 5, shows the willingness-to-pay per person to the Lawis River Spring particularly its freshwater ecosystem services, infrastructural development and maintenance

Table 6. Economic value of the Lawis River Spring per person

Willingness-to-pay (WTP)	Mean value	Min	Max
Freshwater ecosystem services	PHP 10.79	0	50
Infrastructural development	PHP 12.94	0	100
Maintenance Value	PHP 18.31	1	200
TOTAL VALUE:	**PHP 42.20 per person**		

Table 6 revealed an estimated mean value of PHP 10.79 for the WTP of freshwater ecosystem services indicating that each visitor is willing to pay on this amount. This result is possibly because most of the respondents are not high-income earner and most of them are students. Socio-demographic factors such as age, gender, and income play a significant role in determining decisions in travelling, trip planning, and their purchase decisions (Sharma, 2019). Aside from these socio-demographic factors, service-related factors including quality of service can also be a factor that influences the WTP. Service quality defines as "what the customer gets out and is willing to pay for" (Drucker, 1991). Quality of services has also a positive influence on the customer satisfaction (Ozturkcan, et al., 2009). This claim supports result in Table 5 that most of the respondents are satisfied with the ecosystem services in Lawis River Spring but there is a need of improvement especially on the cleanliness and maintenance of the area. Aside from the satisfaction from the ecosystem services, cleanliness or the quality of the area can also influences the decision and the WTP of the visitors. Research shows that service-related factors especially the quality of services will influence the consumers' decision when it comes to choosing a recreation provider (Sava, 2014).

In terms of infrastructural development, result showed that visitors averagely willing to pay PHP 12.94 for the improvement of the area. This is possibly because visitors are willing to pay to develop and increase the ecosystem services that they will receive in the future (Foster, 2008; Shah, et al., 2015). Although development provides benefits on increasing an ecosystem services but if not implemented in a sustainable approach, the ecosystem will be deteriorated and can lead to degradation and loss of wildlife habitats and deterioration of scenery (UNEP, 2001).

Table 6 also illustrated that visitors are willing to pay an estimated of PHP 18.31 for the maintenance of Lawis River Spring. This result appeared to be the highest mean value among the different categories of WTP. The willingness of visitors to pay for the maintenance value is possibly because they want to preserve and maintain the cleanliness of the area which can increase its quality of ecosystem services. An individual who has a positive perception from a given service is likely to have higher satisfaction level (Lee

et al., 2007) and the more that he or she is willing to pay (Drucker, 1991). Increase quality services can also improve recreational benefits (Yeh, et al., 2016).). The result also conforms to the social perception of the visitors that most of them did not really agree that the place is clean and well-maintained. This is also possibly because of solid wastes that were not properly disposed and scattered along the area. Thus, this value implicates that visitors are willing to pay for the maintenance and preservation of the area. People are also motivated to preserve the resources for future generations ("Existence value," n.d.), so that they can also acquire benefits from the ecosystem services. The evidence for value of maintaining the existence can have significant policy implications that locals or visitors may have a positive WTP for protecting the biodiversity of the areas that they visit, despite not using this resource at all (Cerda & Losad, 2013).

Moreover, this study revealed that the estimated economic value of freshwater ecosystem in Lawis River Spring is PHP 42.20 per person. This estimated value can serve as basis for policy formulation especially on implementing strategies on solid waste management and conservation policies in the area. Assigning monetary values for an ecosystem services can help assess the impacts of development policies in consideration with the three pillars of sustainability: environment, economic and social (Federal Ministry for Economic Cooperation and Development, 2012).

CONCLUSION AND RECOMMENDATIONS

The study assessed the economic valuation of freshwater ecosystem services in Lawis River Spring. The physico-chemical parameters indicate that the study area is safe for humans, aquatic organisms, and other living organisms. It also indicates an acceptable remark for domestic and agricultural use for households and recreational activities of tourists and/or visitors. The result of TSS, salinity, and solid waste characterization indicate the presence of solid contaminants and wastes in the water resource that may pose negative risk on ecosystem services.

In terms of socio economic profile, majority of the locals and visitors who are the respondents of the study are young and resides within Iligan City. Mostly of them were male, high school level, students and employed individuals. Most of them perceived that they are satisfied with the ecosystem services provided by the freshwater and believed that the area will continue to exist in the future generation. Also, most of them agreed to some extent that the spring is clean, well-maintained, safe, and accessible.

The study also concluded that the estimated total economic value of freshwater ecosystem services in Lawis River Spring is PHP 42.20 per person. This indicates that an individual is willing to pay this amount for the ecosystem services, infrastructural development, improvement and maintenance of the area. This value is also reasonable for serving as basis for policy formulation towards development of Lawis River Spring. This can also help in implementing appropriate strategies particularly on solid waste management and water conservation of the area. Thus, the following recommendations are hereby made:

1. The research suggests that the local community should cooperate with the Local Government Unit (LGU) in implementing solid waste management strategies in the recreational area. Clear and visible signage must be posted along the area to inform the visitors on how to dispose their solid wastes. Also, they must put big trash bins for organic and inorganic wastes along the cottages or sari-sari stores in the area to cater huge amount of wastes. They must also set-up hygienic amenities and comfort rooms away from the waterways.
2. Given that most of the respondents are willing to pay more for the maintenance of the ecosystem services; this paper recommends that the LGU should support the direct local community in maintaining the cleanliness of the area and its quality of ecosystem services. If the area is properly maintained, many visitors will satisfy and advertise other people to visit the place. Therefore, this can promote additional livelihood in the community.
3. This paper also suggests to future researchers the conduct of further related studies addressing the limitations of this study. Since this study only conducted a 4-day solid waste characterization, future researchers can also conduct 1-week or 7-day waste characterization in the study area. They can also add other physico-chemical parameters in identifying the water quality of the study area. Also, in their future studies they can employ other economic valuation techniques such as Travel Cost Method Approach and Hedonic Pricing in valuing the ecosystem services.

REFERENCES

Armson, D. & Stringer, Pete & Ennos, Roland. (2012). The effect of tree shade and grass on surface and globe temperatures in an urban area. Urban Forestry & Urban Greening. 1, p.245–255. 10.1016/j.ufug.2012.05.002.

Baron, J. S., & Poff, N. L. (2004). Sustaining Healthy Freshwater Ecosystems. *Universities Council On Water Resources*, Issue 127, Pages 52-58.

Behar, S. (1996). *Testing the Waters*. Rival Watch Network, 208-211

Breffle, William & Eiswerth, Mark & Muralidharan, Daya & Thornton, Jeffrey. (2014). Understanding how income influences willingness to pay for joint programs: A more equitable value measure for the less wealthy. Ecological Economics. 109. 10.1016/j.ecolecon.2014.10.001.

Colman, J., Lardinois, P., Rabelahatra A., Rafaliarison, J., van den Berg, F. Randriamiarana, H., and Johannes, J. (1992). Manuel pour le Développement de la Pisciculture à Madagascar, FI: DP/MAG/88/005. Document Technique N°4. PNUD/FAO-MAG/88/005.

Dahiya, S.; Kaur, A.J. (1999). Assessment of physicochemical characteristics of underground water in rural areas of Tasham Subdivisions, Bhiwani District, Harayana. *Environment Poll.* 6, p. 281

DeBrosse, S. (1997). The Crooked River Project: Cuyahoga River. *Water Quality*. Retrieved last April 27, 2020 from https://www.grc.nasa.gov/www/k-12/fenlewis/Waterquality.html

Demeter And Br. (2014). Typologies Of Youth Tourism.Pdf. (N.D.). Retrieved From Http://Webbut.Unitbv.Ro/Bu2014/Series%20v/Buletin%20v%20pdf/16_Demeter_Bratucu.Pdf

Dirican, S. (2015). Assessment of Water Quality Using Physicochemical Parameters of Çamlıgöze Dam Lake in Sivas, Turkey. *Ecologia*, 5 (1), p. 1-7

Drucker, P. (1991). Innovation and entrepreneurship: Practice and Principles. Louisiana, Louisiana State University Press

Dunlop, J., McGregor, G., & Horrigan, N. (2005). Characterization of impacts and a discussion of regional target setting for riverine ecosystems in Queensland. *Potential impacts of salinity and turbidity in riverine ecosystems*. State of Queensland.

Egemen, O. (2011). Water Quality. *Ege University Fisheries Faculty Publication,* 14, p. 1-150.

Ejolt. (2012). Contingent Valuation. Retrieved December 2, 2018, From Http://Www.Ejolt.Org/2012/12/Contingent-Valuation/

Ejolt. (2013). Economic Valuation. Retrieved December 5, 2018, From Http://Www.Ejolt.Org/2013/05/Economic-Valuation/

Environmental Protection Agency (2001). Estuarine Science: Salinity. *Discovery of Estuarine Environments*. University of Rhode Island.

EPA. (2015). *Ground Water Contamination.* Retrieved last April 27, 2020 from Environmental Protection Agency: https://www.epa.gov/sites/production/files/2015-08/documents/mgwc-gwc1.pdf

Fao. (N.D.). Applications Of The Contingent Valuation Method In Developing Countries. Retrieved December 2, 2018, From Http://Www.Fao.Org/Docrep/003/X8955e/X8955e03.Htm

Federal Ministry For Economic Cooperation And Development. (2012). Economic Valuation Of Ecosystem Services. *Giz*, 2.

Fondriest Environmental, Inc., (2013). "Dissolved Oxygen." Fundamentals Of Environmental Measurements. Retrieved From Https://Www.Fondriest.Com/Environmental-Measurements/Parameters/Water-Quality/Dissolved-Oxygen/

Fripp E. 2014. *Payments For Ecosystem Services (Pes): A Practical Guide To Assessing The Feasibility Of Pes Projects*. Bogor, Indonesia: Cifor.

Furhan I., Ali, M., Salam, A., Khan, B.A., Ahmad, S., Qamar, M., and Umer, K. (2004). Seasonal Variations of Physicochemical Characteristics Of River Soan Water At Dhoak Pathan Bridge (Chakwal), Pakistan. *International Journal of Agriculture & Biology*. 1560– 8530/2004/06–1–89– 92

Grand River Conservation Authority (1995). River Data: Water Quality. Cambridge, Ontario

Gupta, D. P., Sunita and Saharan, J. P. (2009), Physiochemical Analysis of Ground Water of Selected Area of Kaithal City (Haryana) India, *Researcher,* 1(2), p. 1-5.

Gupta, Asha. (2016). WATER POLLUTION-SOURCES, EFFECTS AND CONTROL. Pointer Publishers Jaipur.

Hanley, N. (2001). A Benefit Analysis Of The Impacts Of The Water Framework Directive For Scotland. Report To The Scottish Executive.

Hjerpe, E., Hussain, A., & Phillips, S. (2015). Valuing Type And Scope Of Ecosystem Conservation: A Meta-Analysis. *Journal Of Forest Economics*, *21*(1), 32–50. Https://Doi.Org/10.1016/J.Jfe.2014.12.001

Horak, S., Weber, S. (2000). Youth Tourism In Europe: Problems And Prospects. I*n: Tourism Recreation Research*, Vol. 25, No.3, and P. 37-44.

James Kevin Summers, Lisa M. Smith, Richard S. Fulford And Rebeca De Jesus Crespo (November 5th 2018). The Role Of Ecosystem Services In Community Well-Being, Ecosystem Services And Global Ecology, Levente Hufnagel, Intechopen, Doi: 10.5772/Intechopen.74068. Available From: HYPERLINK "https://www.intechopen.com/books/ecosystem-services-and-global-ecology/the-role-of-ecosystem-services-in-community-well-being" Https://Www.Intechopen.Com/Books/Ecosystem-Services-And-Global-Ecology/The-Role-Of-Ecosystem-Services-In-Community-Well-Being

Karanth, K. R., (1987) Groundwater Assessment Development and Management, (Tata McGraw Hill publishing company Ltd., New Delhi, p. 725-726.