jehrd

Journal of Educational and Human Research Development 8:45-58 (2020)
Southern Leyte State University, Sogod, Southern Leyte, Philippines

Economic Valuation of Protected Area's Ecosystem Services: The Case of Mahagnao Volcano Natural Park (MVNP) in Burauen and La Paz, Leyte Philippines

[1]*Lemuel Preciados, [1]Rhena Jane Soria, [2]Fernando Polenio[†]

[1]Department of Economics
Visayas State University
Baybay City, Philippines
[2]Department of Environment and Natural Resources
Tacloban City, Philippines.

Abstract

Mahagnao Volcano Natural Park (MVNP) provides critically important ecosystem services. The natural ecosystem services of MVNP play an important role in maintaining the well-being of the families in the protected area through the provision of a wide array of services ranging from income support to food and recreation. This resource valuation has helped to put a price tag on the provisioning ecosystem service of MVNP using the standard approaches of the market-based method (MBM) and Contingent Valuation Method (CVM). Results reveal that the annual value of Mahagnao Volcano Natural Park's (MVNP) provisioning resource for Mahagnao is about PhP2,779,963 per year while for Bocawon is PhP645,745 per year, which translated to a total provisioning value for both communities amounting to PhP3,425,708 per year. On average, each household has benefited PhP90,174 per year. Moreover, survey results reveal that on average, each household's willingness to pay is PhP486 and PhP178.50 per year from Mahagnao, and Bocawo, respectively. The net benefit that goes to every household from protecting MVNP is PhP82.49 per day. Incorporating the benefit-cost principle provides an alternative practical tool and most relevant approach for measuring both the benefits gained and the willingness to pay for providing improved protection of livelihood and the environment for protected areas in the Philippines rural communities.

Keywords: *Market-Based; Contingent Valuation; Protected Area*

Introduction

Ecosystem services are recognized as the benefits received by people from environments (Millenium Ecosystem Assessment [MEA], 2005). These benefits can be direct and/or indirect provisions to human well-being (The Economics of Ecosystems and Biodiversity [TEEB], 2010). Functioning ecosystem services can provide a range of services essential for human survival like food, while others are more desirable services for human enjoyment such as recreation (Small et al., 2017). One accurate representation of an ecosystem is a protected area. A protected area is a recognized piece of land and water with ecological significance as it helps preserve and protect biodiversity (Republic Act 7586, 1992). There is a general agreement in the literature that protected areas (PA) in most countries are critical for biodiversity-preservation initiatives. However, some international scientific studies contend that there are also

Correspondence: lemuel.preciados@vsu.edu.ph; https://orcid.org/0000-0001-5558-606X *ISSN 2545-9759*

PA protection measures that became less successful because the economic importance for local people was not clearly understood and realized (Berghöfer, 2010; Gbadegesin & Ayileka 2000; Hoole & Berkes 2010). Oftentimes, the participation of the local communities is neglected (Hirschnitz-Garbers & Stoll-Kleeman, 2011). A critical step to address this issue on little knowledge of the benefits of a protected area to local people is a resource valuation study for ecosystem services. Ecosystem valuation is an idea of putting a monetary value on ecosystem goods and services that is often used to advocate the economic importance of the environment including non-marketable benefits with the ultimate purpose of encouraging sustainable development of ecosystems (van Beukering et al., 2015). These concepts and principles were also the basis for the conduct of this new research study.

This current study is done to identify and measure the quantifiable ecosystem services derived by people from the Mahagnao Volcano Natural Park, which is one of the protected areas in Leyte, Philippines. The park was declared as a National Park by Proclamation No. 184 on August 27, 1937, to preserve its scenic grandeur and natural features. Certainly, MVNP provides critically important ecosystem services. Some of these are captured by markets, but many are not. There are positive externalities that are regarded by the beneficiaries as free. However, many of these ecosystem services including those from MVNP are likely seen to be both under-conserved and undervalued. The natural ecosystem services of Mahagnao Volcano Natural Park play an important role in maintaining the well-being of the families in the protected area through the provision of a wide array of services ranging from income support to food and recreation. Ecosystem services valuation therefore shall help put a price tag on these natural resources.

The main objective of this study is to measure the economic value of identified ecosystem services provided by Mahagnao Volcano Natural Park protected area both in Burauen and La Paz, Leyte. Specifically, this current study aimed to; (1) Profile the demographic and socio-economic characteristics of the communities within the protected area; (2) Determine the benefits derived and the willingness to pay by households for the ecosystem services provided by MVNP, and (3) Estimate the resource value (net benefits) derived by households from the provisioning services of MVNP.

The natural environment has undoubtingly provided benefits to human beings. It offers food, different types of crops, water, and shelter – to name a few. It also features beautiful landscapes such as rain forests, crystal-clear waters, and unique features of the environment. This entices a mutual relationship between humans and the environment to achieve a sustainable and balanced environment. This issue is substantial since humans need nature to survive and its influence on human life (Jeong, 1997). Because of the continuous disruption and exploitation of the environment, there is a need to assess the economic value of these natural resources to provide a clear mechanism for its conservation. However, the benefits of the natural park as a protected area are considered intangible, hence economic valuation is difficult (Predo, 1995).

Over time, resource valuation has been an effective tool in appraising these natural resources. Direct and indirect use of these resources is valued in resource valuation since it is recognized that the core reasons for establishing protected areas are not always based on economics, but also includes maintaining of biological diversity and integrity for the preservation of various species and their habitats (Thompson & Peepre, 2000).

A Contingent Valuation Method (CVM), is a non-market valuation technique where respondents are asked on their 'willingness to pay' to maintain or improve the quality of the services provided by a certain site/protected area (Brander et al., 2010).

An ecological feature becomes an ecosystem service only if there is some persons somewhere who benefit from a given ecological process (Olander, 2018). The incorporation of benefit-cost analysis (BCA) in ecosystem valuation is gaining attention in the literature. It is being used as a guide for evaluating policies and programs that affect environmental services (Wegner & Pascual, 2011). They can be used as an effective tool to choose among policies that involve trade-offs between ecosystem services, among beneficiaries, and between periods (Pearce et al., 2006; Daily et al.,2009). They can also be used as a guide on the evaluation of proposed projects that aim to provide optimum economic net benefits from the flow of the ecosystem services to society (Carpenter et al., 2009; Daily et al., 2009). Hence, the benefit-cost analysis is considered as one of the analytical tools in this economic valuation study for the Mahagnao Volcano Natural Park's ecosystem services. This research has used resource valuation methods already commonly used in the subject of environmental economics which include a market-based method, and contingent valuation method. These methods were incorporated into a benefit-cost analysis framework that able to calculate the economic value of the ecosystem services in a protected area or landscape.

Protected areas are considered to provide huge revenue-earning units and can make a significant help to local economies. Moreover, investment in protected areas can provide a significant benefit to national and local communities (Phillips, 2002). The estimated consumer surplus and the recreational value of Mount Pulag Natural Park in the Philippines for instance were valued at PHP47,062,560 and PHP56,335,590 respectively (Navarro et.al, 2008). These values can determine the importance of resource valuation to the potential contribution of natural resources to the community and stakeholders.

Methodology

Sampling Procedure

The two barangays Mahagnao and Bocawon are situated within the MVNP area. As of November 2017, Barangay Mahagnao and Barangay Bocawon had 165 and 56 registered households, respectively. Before the official conduct of the study in the selected sites, courtesy calls with the LGU officials in the municipality of Burauen and La Paz were done to get permission and assistance from the local government for data collection and security. A complete enumeration sampling technique was employed in the conduct of the survey using a structured questionnaire. This implies the collection of data from every unit of the population and is usually more preferred for some cases because it can provide complete statistical coverage (FAO, 1999). While complete enumeration is usually preferable, they can be a more expensive method than the sampling surveys depending on the local circumstances. However, in this study, given the small number of population size, it is more appropriate to use the complete enumeration procedure to have greater accuracy of observations. Hence, all the households in Burauen and La Paz are included in the survey. The conduct of the surveys was done by well-trained enumerators who were graduates from the Department of Economics at the Visayas State University. The total number of respondents interviewed during the conduct of the actual survey for Burauen and La Paz were 119 and 45, respectively.

Market-Based Method

In this study, various resource valuation techniques are explored depending on their relevance. Through the surveys with the households and focus group discussions with key barangay officials in the protected area it was found that the most relevant and easily quantifiable ecosystem service was

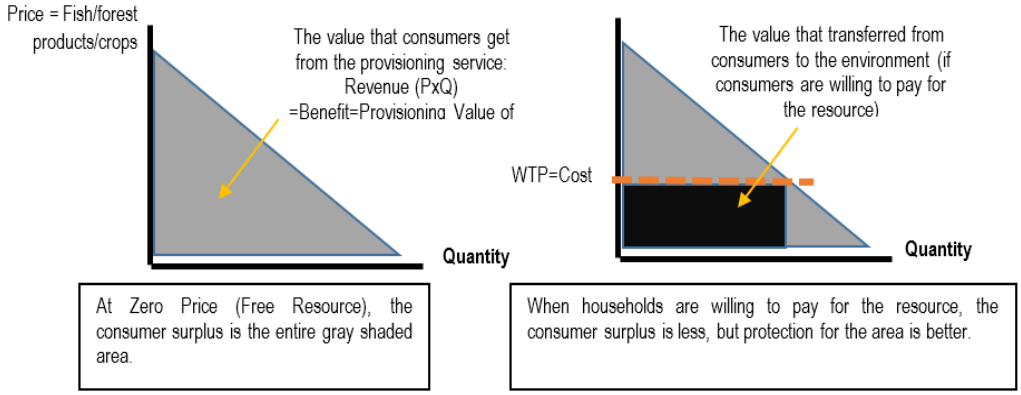

Figure 1. *Conceptual framework for measuring provisioning value of MVNP*

the provisioning service which is the income earned by households from fishing, coconut farming, and selling of fuel woods. Hence, this study has focused only on the benefit-relevant and quantifiable market-based consumptive values of ecosystem services for MVNP (Olander, 2018).

The market-based approach is typically used to approximate the value of environmental goods that are bought and sold in the market. In this study, we have tried to estimate the consumptive values of MVNP's ecosystem through its provisioning services as a source of income by households through fishing from the lake and through selling timber and forest products from the protected forest areas. In this study, it is assumed that when the MVNP's provisioning resource is free (zero price), the households in MVNP were able to enjoy huge consumer surplus. However, through this valuation study, households' willingness to pay is determined, and that is used as a proxy as their contribution (as a cost for them) for the improved maintenance and protection of the environment (Fig. 1). In MVNP, some households get income from fishing and others are through farming. Without the protection of the resource, the current income derived from the protected area would be limited. Therefore, this study quantifies the benefits and the costs associated with MVNP's identified ecosystem resource and determines the willingness to pay households to continue getting the income they currently derived from the protected area. The real value of the provisioning service of MVNP was measured by calculating the net consumer surplus (benefit per household less WTP per household).

Data Analysis and Interpretation. Given the depth and breadth of this resource valuation study, this research employed various analysis which includes descriptive statistical analysis and market-based valuation. The order of analyses employed in this evaluation process is the following:

Descriptive Statistics - to analyze the characteristics of households involved in the project. Frequencies, totals, percentages, and averages shall be computed to generally describe the households' socio-demographic and economic profile. Market-Based Calculation – to estimate the provisioning value of MVNP, this study uses the market-based method which could be calculated as:

Total Provision Value = *(Average Income Earned by Fishermen x Number of fishermen) + (Average Income by farmers x Number of farmers) + (Average Income by selling wood products x Number of sellers)*

Benefit-Cost Analysis – to compare and

quantify the monetary impact of the positive contribution of the ecosystem services to households such as the income derived from the livelihood within the protected area and the monetary values of household's willingness to pay which is considered as an outflow from them to the ecosystem services. The obtained monetary values for the benefits and costs and then aggregated to calculate the benefit-cost ratio (BCR) that represents an important decision-making criterion whether the willingness to improve the protection of MVNP delivers higher benefits relative to its costs. The benefit-cost ratio is calculated by dividing the value of benefits by that of costs or investments as shown below:

$$BCR = \frac{Summation of Benefits}{(Summation of Costs)}$$

If BCR $<$ 1: Investment option generates losses

If BCR = 1: Investment option is neither profitable nor loss

If BCR $>$ 1: Investment option is profitable

The Study Site.Mahagnao Volcano Natural Park (MVNP) is under the jurisdiction of the municipalities of La Paz and Burauen of Leyte, Eastern Visayas. Its location is at 124 51' 30" E longitude and 10 52' 30"N latitude. As of 2012, it was being validated by the National Mapping and Resources Information Authority (NAMRIA) in which the park has only 341 hectares, not 635 hectares. The greater portion of the MVNP belongs to the territorial jurisdiction of Burauen with an area of 239.315 hectares, while La Paz has only 101.91 hectares. MVNP has an elevation of approximately 417 to 620 meters above sea level. The area is characterized by mountainous to rolling terrain. About 50% moderately sloping and 15% is steep. The classification of soil within the MVNP is roughly mountainous rock. The soil type at the lower elevation is sandy loam while at the higher elevation is clay loam topped with thick humus layer derived from decomposed forest litter. The park contains different ecosystem types: forest ecosystem, lake ecosystems, volcanic ecosystem, hot spring, grassland ecosystem, and agricultural ecosystems. It can be generally described as adequately covered with forest vegetation composed mainly of primary and secondary growth forest. It exhibits unique bio-physical features which include a scenic combination of andesitic volcano peaks and the adjoining three (3) lakes, an old dipterocarp forest, an extinct volcano with sulfuric fumaroles, hot springs and riverine system which need to be conserved and protected in their natural state. MVNP is likewise endowed with a rich floral and faunal composition which includes rare and endangered species needing protection. The park possesses features of significance for scientific, educational, and recreational values. Lake Mahagnao also provides a sustained supply of freshwater fish and other aquatic resources to nearby communities (Fig. 2).

Results and Discussions

Demographic Profile in Mahagnao in Burauen and Bocawon in La Paz, Leyte

The study considered complete enumeration for the households in Mahagnao, Burauen, Leyte. Of the 165 households, only 72.12% (119) were able to participate in the survey since some of the respondents were not present in their house. The descriptive statistics below were based on an analysis of the 119 observations. The majority (56.3%) of the respondents or household heads are between ages 36-65. In the survey, there were more females (59.7%) than males (40.3%). Married individuals accounted for about 65.5% of the percentile of total observations. Residents are typically composed of 4 to 6 members (42.9%). Most of the respondents are residents of the area for approximately 24 years now (Table 1).

Figure 2. *MVNP site map (NAMRIA Topomap, 2012)*

Table 1. Demographic profiles of Mahagnao and Bocawon in MVNP

PROFILE	Mahagnao		Bocawon	
	Count	Percent	Count	Percent
Age				
Under 18	1	0.8		
18 to 35	39	32	23	51.11
36 to 65	67	56.3	21	46.67
66 and above	12	10.1	1	2.22
Mean	**44**		**37**	
Gender				
Male	48	40.3	3	6.67
Female	71	59.7	42	93.33
Civil Status				
Single	7	5.9		
Married	78	65.5	29	64.44
Live-in	28	23.5	14	31.11
Separated	0	0	1	2.22
Widowed	6	5	1	2.22
Household Size				
1 to 3	34	28.6	11	24.44
4 to 6	51	42.9	28	62.22
7 to 9	26	21.8	5	11.11
10 and above	8	6.7	1	2.22
Mean	**5**		**5**	
Years Residing in the Barangay				
1 to 10	26	21.8	12	26.67
11 to 20	30	25.2	17	37.78
21 to 30	29	24.4	6	13.33
31 to 40	18	15.1	7	15.56
41 and above	16	13.4	3	6.67
Mean	**24**		**20.24**	

Source: Actual Household Surveys in MVNP

Baranggay Bocawon in La Paz, Leyte is a smaller barangay in comparison with Baranggay Mahagnao in Burauen. The team was able to interview forty-five (45) respondents out of the 56 households residing in the area. Table 1 also shows that majority of the respondents or household heads are between ages 36-65 which is 37 years old on average. There were also more females (93%) than males (7%). Married individuals accounted for about 64.44% of the percentile of the observations, and the family sizes in the area are typically composed of 4 to 6 members. Most of the respondents are already residing in the area for approximately 20 years now, on average (see also Table 1).

Economic Profile of the Respondents in Mahagnao and Bocawon

Table 2 shows that most of the respondents attained at least Elementary Level (49.6%) and only one had a Bachelor's degree. Average monthly income registered at income bracket less than PHP5,000 or around PHP4,365.64. Of the 3 major sources of income of the respondents, 61.34% of the respondents have salaries/wages as their source of income, 31.09% of them get their income from farming, and 19.33% of the respondents have government assistance or 4Ps' beneficiaries. Surprisingly, fishing as a

Table 2. Demographic profiles of Mahagnao and Bocawon in MVNP

PROFILE	Mahagnao		Bocawon	
	Count	Percent	Count	Percent
Educational Attainment				
Elementary Level	59	49.6	17	37.78
Elementary Graduate	26	21.8	13	28.89
High School Level	25	21	6	13.33
High School Graduate	2	1.7	5	11.11
College Level	3	2.5	3	6.67
Bachelor's Degree	1	0.8	0	0
Master's or Doctoral Degree	0	0	0	0
Others or No education	3	2.5	1	2.22
Estimated Monthly Income				
Less than 5,000	77	64.71	34	75.56
5,000 - 9,999	33	27.73	11	24.44
10,000 – 14,999	7	5.88	0	0
15,000 – 19,999	1	0.84	0	0
20,000 and above	1	0.84	0	0
Mean	**4,365.64**		**3,505.63**	
****Current Sources of Income**				
Salaries/Wages	73	61.34	30	66.67
Sales from Homemade Products	4	3.36	2	4.44
Government Assistance	23	19.33	17	37.78
Remittances	8	6.72	3	6.67
Selling Forest Products	6	5.04	1	2.22
Farming	37	31.09	20	44.44
Fishing	7	5.88	0	0
Others	12	10.08	5	11.11

***multiple responses*
Source: Actual Household Surveys in MVNP

Table 3. Demographic profiles of Mahagnao and Bocawon in MVNP

*PROFILE	Mahagnao		Bocawon	
	Count	Percent	Count	Percent
Fishes	79	66.39	10	22.22
Fuel Wood	36	30.25	24	53.33
Swimming	63	52.94	7	15.56
Research/Education	28	23.53	2	4.44
Enjoyment from the scenery	40	33.61	5	11.11
Income from fishery	36	30.25	0	0
Tourist related income	28	23.53	1	2.22
Good crop harvest	44	36.97	6	13.33
No Benefit	15	12.61	12	26.67
Others; Domestic uses e.g. water	18	15.13	2	4.44

**multiple responses*
Source: Actual Household Surveys in MVNP

source of income is only recorded at 5.88% which contradicts our assumptions since the area has a vast Lake.

Table 2 also shows that most of the Bocawon respondents on average are elementary graduates. The average monthly income of all the respondents is registered at an income bracket less than PHP5,000 or around PHP3,505.63. Of the 3 major sources of income of the respondents, 66.67% of the respondents have salaries/wages as their source of income, 44.44% of them get their income from farming, and 37.78% of the respondents have government assistance or 4Ps' beneficiaries. Fishing as a source of income was not asked since the Bocawon

Table 4. Demographic profiles of Mahagnao and Bocawon in MVNP

Willingness To Pay (WTP)		Mahagnao		Bocawon	
		Frequency	Percent	Frequency	Percent
For an Improved Protection and Conservation for MVNP (per month)	0 or Not willing to pay	38	31.93	5	11.11
	5	14	11.76	11	24.44
	10	20	16.81	23	51.11
	20	13	10.92	3	6.67
	25	4	3.36	0	0
	50	10	8.4	2	4.44
	100	18	15.13	0	0
	Above 100	2	1.68	1	2.22
	Average (PHP)	**40.49**		**14.88**	
	Average ($, PPP)	**2.22**		**0.82**	

Source: Actual Household Surveys in MVNP
Note: Purchasing Power Parity (PPP) conversion factor in 2018 for the Philippines per international $ is 18.25 based from IndexMundi.com

Table 5. Demographic profiles of Mahagnao and Bocawon in MVNP

Provisioning Services	Mahagnao PHP	Bocawon PHP	TOTAL Value of Resource PHP
Economic benefits derived by households from the protected area			
A. Current Benefits derived from fishing			
Monthly Income earned (in PHP, average)	1,733.33	0.00	1,733.33
Income (Annual, in PHP)	20,800.00	0.00	20,800.00
Number of Families Served	10	0	10
Value of Resource	*201,801.60*	*0.00*	201,801.60
B. Current Benefits derived from selling forest products			
Monthly Income earned (in PHP)	1,450.00	0.00	1,450.00
Income (Annual, in PHP)	17,400.00	0.00	17,400.00
Number of Families Served	8	1	9
Value of Resource	*144,698.40*	*0.00*	144,698.40
C. Current Benefits derived from Farming (Coconut+Banana)			
Monthly Income (in PHP)	3,953.11	2,162.31	6,115.42
Income (Annual, in PHP)	47,437.31	25,947.71	73,385.02
Number of Families Served	51	25	76.18
Value of Resource	*2,433,463*	*645,745*	3,079,208
Resource Value (Benefits) - Cash Income, (*Annual, PHP*)	**2,779,963**	**645,745**	**3,425,708**
(*Annual, $, PPP*)	**152,327**	**35,383**	**187,710**
Average Resource Value (*per Household, Annual, PHP*)	**16,848**	**11,531**	**28,379**
(*per Household, Annual. $, PPP*)	**923**	**632**	**1,555**

Source: Actual Household Surveys in MVNP
Note: Purchasing Power Parity (PPP) conversion factor in 2018 for the Philippines per international $ is 18.25 based from IndexMundi.com

part is just far from the lake site.

Benefits Derived from MVNP in Mahagnao and Bocawon

Table 3 shows that residents of Mahagnao also get benefits from the protected area which includes fishes (66.39%), access to swimming (52.94%), good crop harvest (36.97%), enjoyment from the scenery (33.61%), fuelwood and income from the fishery (30.25%). Table 3 also shows that residents of Bocawon also get benefits from the protected area which includes fuelwood (53.33%), fishes (22.22%), access to swimming (15.56%), and good crop harvest (13.33%). Even if residents get benefits from the area, still 26.67% of the responses said that they get no benefits from the area.

Willingness to Pay for Improved Protection of MVNP by Mahagnao and Bocawon Respondents

Respondents were asked how much they are willing to pay per month for improved protection and conservation of MVNP. Table 4 shows that on average, the Mahagnao respondents are willing to pay by 40.49 PHP/month for the improved protection and conservation of MVNP. The Bocawon respondents indicated they are willing to pay 14.88 PHP/month, on average per household. The majority (16.81%) of the respondents in Mahagnao are willing to pay for 10PhP per month and only very of them (1.68%) are willing to pay above 100PhP per month. Similarly, the majority (51.11%) of the Bocawon respondents are willing to pay 10PhP per month and only very few (2.22%) are willing to pay above 100PhP per month.

The Market-Based Valuation Results from Households

The economic benefits provided by the MVNP protected area to households could be estimated through its impact on a household's economic activities such as fishing, selling of forest products, and coconut farming. Table 5 shows that the protected resource of MVNP is able to provide consumptive provisioning value for households as income from fishing of about 1,733 PHP per month or 20,800 PHP a year on average, which translated to a total value from fishing of 201,802 PHP per year with 10 families (5.88% of 165 households) benefiting the provisioned resource in Mahagnao. In contrast to the other barangay, there was no income earned from fishing for Bocawon households since the lake is less accessible to them because of the distance. Moreover, the protected area provides the farmer's income from selling forest products (i.e fuel woods). Table 5 shows that some households in Mahagnao were also benefiting for selling fuel woods in the area where they could get an income of about 1,450 PHP per month or 17,400 PHP per year on average. With 8 families (5.04% of 165 households) who were identified as to have benefited the forest products from selling fuelwood, this has translated to a total resource value of 144,698 PHP a year. For Bocawon, only 1 household (2% of 56 households) has reported to also getting fuel woods but this was for home consumption only. Furthermore, survey results have also shown that both barangays (Mahagnao and Bocawon) are benefiting from farming coconut and banana in the protected area. The survey results revealed that the Mahagnao respondents, on average, have gained a monthly income of 3,953 PHP. With 51 families (31% of 165) who have benefited the resource, the amount has translated to a total of 2,433,463 PHP as value for farming the coconut and banana in MVNP. Similarly, the Bocawon community has also benefited from the coconut and banana resources in MVNP. About 25 families (44.44% of 56) were the actual beneficiaries who have earned an income of about 2,162 PHP per month. In total, the annual provisioning value from farming in Bocawon was 645,745 PHP. Summing up the

two barangays, the market-based valuation has able to determine that the total economic value of the provisioning services of MVNP is about 3,425,708 PHP per year. This valued resource is expected to last for several years and may even increase its value if there is improved maintenance and protection in the area. On average, we have found that each household within the protected area has been provided by MVNP a provision resource in a form of income through fishing, selling forest products, and farming that was amounting to 16,848 PHP per year per household in Mahagnao, and 11,531 PHP per year per family in Bocawon.

Assessing the Total Net Benefits of Improved Protection for MVNP

This study attempts to determine households' amount of willingness to pay as a contribution to the environment relative to the benefits they get from the natural resources of MVNP, thus getting the net economic benefit of protecting MVNP. The contingent valuation method was used to determine the cost that households are willing to contribute to the improved protection while the market-based provisioning values served as the benefits gained by the households from the MVNP's ecosystem services. Based on the survey and analysis, it was revealed that MVNP is providing an economic value of about PhP16,848 per year per household in Mahagnao community while each of the households is willing to contribute for the improved protection of MVNP by PhP486 per year, which have resulted to a net economic annual benefit of PhP16,362 per year or PhP1,364 per month or PhP48.70 per day. This positive economic benefit is reflecting the Mahagnao household's surplus of benefit attributed to the significant amount they have gained from the ecosystem services relative to the lower amount of cost they are willing to shoulder for the improved protection of MVNP. On the other community, it was found out that each of the households in Bocawon on average was gaining the benefit of PhP11,531 per year while only willing to pay with PhP178 per year as their contribution to the improved protection of MVNP. For Bocawon, each of the households had an economic surplus of PhP11,353 per year as their benefit from the significant provisioning value of MVNP (see Table 6).

The Daily Benefit-Cost Ratio of MVNP's Protection

Table 7 shows the total benefits gained by the communities within MVNP amount to PhP84.46 per day while the total costs of their willingness to contribute to improving the protection of MVNP's provisioning ecosystem service amount to PhP1.98 per day, which resulted to a total net benefit of PhP82.49 per day. Moreover, the results also determined that for 1 PHP cost of household's willingness to contribute for the protection per day, each household was gaining PhP99.27 per day, which implies significantly higher incentive that is going to the communities if the Volcano Natural Park is continuously protected.

Conclusions and Policy Implications

Certainly, Mahagnao Volcano Natural Park (MVNP) provides critically important ecosystem services. The natural ecosystem services of MVNP play an important role in maintaining the well-being of the families in the protected area through the provision of a wide array of services ranging from income support to food and recreation. This resource valuation has helped to put a price tag on the provisioning ecosystem service of MVNP. Based on the results, it was found out that the most common and more evident benefits that households derived from MVNP are the provisioning services which include the provision of fishes as a source of income, fuelwood as a source of fuel for cooking, and coconut and banana farming as the main source of income. These results highlight the need to preserve and

Table 6. Demographic profiles of Mahagnao and Bocawon in MVNP

Economic Benefits and Costs per household	Mahagnao PHP	Bocawon PHP
Benefits-gained from the resources - MBM		
Benefits gained from the Resource, Annual	16,848.26	11,531.16
Benefits gained from the Resource, Monthly	1,404.02	960.93
Benefits gained from the Resource, Weekly	351.01	240.23
Benefits gained from the Resource, Daily	50.14	34.32
Cost willing to contribute to the improved protection of the resource - CVM		
Cost willing to contribute for the Resource, Annual	485.93	178.50
Cost willing to contribute for the Resource, Monthly	40.49	14.88
Cost willing to contribute for the Resource, Weekly	10.12	3.72
Cost willing to contribute for the Resource, Daily	1.45	0.53
Net Economic Benefits		
Net Benefits, Annual (PHP) Net Benefits, Annual ($, PPP)	16,362.33 896.57	11,352.66 622.06
Net Benefits, Monthly (PHP) Net Benefits, Monthly ($, PPP)	1,363.53 74.71	946.06 51.84
Net Benefits, Weekly (PHP) Net Benefits, Weekly ($, PPP)	340.88 18.68	236.51 12.96
Net Benefits, Daily (PHP) Net Benefits, Weekly ($, PPP)	48.70 2.67	33.79 1.85

Source: Actual Household Surveys in MVNP

Table 7. Demographic profiles of Mahagnao and Bocawon in MVNP

Net Economic Daily Benefits per household:	Mahagnao	Bocawon	Total
Benefits gained from the Resource (PHP) Benefits gained from the Resource ($, PPP)	50.14 2.75	34.32 1.88	84.46 4.63
Cost willing to contribute for the Resource (PHP) Cost willing to contribute for the Resource ($, PPP)	1.45 0.08	0.53 0.03	1.98 0.11
Net Benefits (PHP) Net Benefits ($, PPP)	48.70 2.67	33.79 1.85	82.49 4.52
Benefit-Cost Ratio per household (PHP) Benefit-Cost Ratio per household ($, PPP)	34.67 1.90	64.60 3.54	99.27 5.44

Source: Actual Household Surveys in MVNP

Note: Purchasing Power Parity (PPP) conversion factor in 2018 for the Philippines per international $ is 18.25 based from IndexMundi.com

conserve the protected resource like the Mahagnao Volcano Natural Park as this area provides increased welfare for households. By preserving the environment, households could also gain sustained benefits from the area. The primary questions "how much is the total value of the provisioning services provided by MVNP to households and how much do households willing to pay to improve the protection of MVNP?" are measured in this study through the combination of market-based valuation and contingent valuation approaches which were applied through the underlying principle benefit-cost analysis (BCA). Results revealed that the annual value of MVNP's provisioning resource for Mahagnao is about PhP2,779,963 per year while Bocawon is PhP645,745 per year, which translated to a total provisioning value for both communities with an amount of PhP3,425,708 per year. On average, each household within MVNP is gaining the benefit of PhP90,174 per year. In contrast to the household's willingness to pay for the improved protection, survey results from the contingent valuation method reveal that households in Mahagnao and Bocawon are only willing to pay (WTP), PhP486 and PhP178.50 per year, respectively. In total for these two communities, the benefit-cost assessment in terms of daily average revealed that each household had benefited PhP84.46 per day while only willing to pay PhP1.98 per day as their costs to be shouldered for the improved protection of MVNP. Incorporating the benefit-cost principle of assessing the net economic benefit of the provisioning value of MVNP highlights an effective tool for evaluating critically both the benefits gained and the willingness to pay associated with the protection of MVNP. Generally, it was found that there is a huge economic surplus on having the Mahagnao Volcano Natural Park protected as it provides support for the economic activities for the two local communities in the area. These huge benefits must be carefully demonstrated and presented to the local communities to increase their willingness to help in protecting their natural resources in any way possible. In addition to quantifying the quantifiable market-based value of the provisioning ecosystem services of MVNP, this research also may serve as a benchmark for future research in measuring the other ecosystem services and calculating the total economic value (tangible and intangible benefits) of Mahagnao's Volcano Natural Park.

Acknowledgement

This study acknowledges the funding support provided by the Department of Environment and Natural Resources (DENR) in the conduct of the study under the program "Resource Valuation Studies for Payment for Ecosystem Services of Protected Areas". Special thanks are conveyed to the DENR-CDD Chief, researchers, and staff who have facilitated the smooth implementation of the research activities during the entire duration of the study. Through the strong collaboration and partnership with Visayas State University (VSU) in Visca, Baybay City, Leyte, this economic valuation study of the Mahagnao Volcano Natural Park's ecosystem services was successfully achieved. We are also grateful for the cooperation and permission of the local government units of the municipalities of Burauen and La Paz for the permission to conduct the surveys in their localities.

† Co-author Fernando Polenio passed away on May 28, 2020, two months before publication.

References Cited

Berghöfer, A. (2010). Protected areas: The weakness of calls for strict protection. GAIA – Ecological Perspectives for Science and Society. Retrieved from https://www.researchgate.net/publication/233546471_Protected_Areas_The_Weakness_of_Calls_for_Strict_Protection

Brander, L., Gomez-Baggethun, E., Martin-Lopez, B., & Verma, M. (2010). The economics of valuing ecosystem services and biodiversity. The Ecological and Economic Foundations. Retrieved from https://www.researchgate.net/publication/303444184_The_Economics_of_Valuing_Ecosystem_Services_and_Biodiversity

Carpenter, S.R., Mooney, H.A., Agard, K., Capistrano, D., DeFries, R.S., Di'az, S., Dietz, T., Duraiappah, A.K., Oteng-Yeboah, A., Pereira, H.M., Perrings, C., Reid, W.V., Sarukhan, J., Scholes, R.J., & Whyte, A. (2009). Science for managing ecosystem services: beyond the Millennium Ecosystem Assessment. *Proceedings of the National Academy of Sciences, 106*(5), 1305–1312. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2635788/

Daily, G.C., Polasky, S., Goldstein, J., Kareiva, P.M., Mooney, H.A., Pejchar, L., Ricketts, T.H., Salzman, J., & Shallenberger, R. (2009). Ecosystem services in decision making: time to deliver. *Frontiers in Ecology and the Environment, 7*(1), 21–28. Retrieved from https://esajournals.onlinelibrary.wiley.com/doi/full/10.1890/080025

Food and Agriculture Organization of the United Nations. (1999). Guidelines for the routine collection of capture fishery data. FAO Fisheries Technical Paper 382. Retrieved from http://www.fao.org/3/x2465e/x2465e00.htm#Contents

Gbadegesin, A., & Ayileka, O. (2000). Avoiding the mistakes of the past: towards a community oriented management strategy for the proposed national park in Abuja-Nigeria. *Land Use Policy, 17*(2), 89-100. Retrieved from https://www.researchgate.net/publication/223096628_Avoiding_the_mistakes_of_the_past_Towards_a_community_oriented_management_strategy_for_the_proposed_National_Park_in_Abuja-Nigeria

Hirschnitz-Garbers, M., & Stoll-Kleeman, S. (2011). Opportunities and barriers in the implementation of protected area management: A qualitative meta-analysis of case studies from European protected areas. *The Geographical Journal, 177*(4), 321-334. Retrieved from https://www.researchgate.net/publication/230254312_Opportunities_and_barriers_in_the_implementation_of_protected_area_management_A_qualitative_meta-analysis_of_case_studies_from_European_protected_areas

Hoole, A., & Berkes, F. (2010). Breaking down fences: recoupling social-ecological systems for biodiversity conservation in Namibia. *Geoforum, 41*(2), 304-317. Retrieved from https://www.researchgate.net/publication/248434028_Breaking_down_fences_Recoupling_social-ecological_systems_for_biodiversity_conservation_in_Namibia

Jeong, D. (1997). A sociological implication of environment in social development. *Korean Journal of Population and Development, 26*(2), 1-13. Retrieved from https://pubmed.ncbi.nlm.nih.gov/12293790/

Millenium Ecosystem Assessment [MEA]. (2005). Millennium ecosystem assessment. Ecosystems and Human Well-Being. *Synthesis*. Island Press, Washington, DC. Retrieved from https://www.researchgate.net/publication/297563785_Millennium_Ecosystem_Assessment_Ecosystems_and_human_well-being_synthesis

Navarro, G., Paca, E., Rimas, C. (2008). The eco-tourism of national park: A case study from the Philippines. Retrieved from

https://123doc.org/document/1244843-the-eco-tourism-value-of-national-park-a-case-study-from-the-philippines-pdf.htm.

Olander, L., Johnston, T., Tallis, H., Kagan, J., Maguire, L., Polasky, S., Urban, D.,Boyd, J., Wainger, L., & Palmer, M. (2018). Benefit relevant indicators: Ecosystem services measures that link ecological and social outcomes. *Ecological Indicators, 85*, 1262-1272, https://doi.org/10.1016/j.ecolind.2017.12.001

Pearce, D., Atkinson, G., & Mourato, S. (2006). Cost-benefit analysis and the environment: Recent developments. Paris:OECD. Retrieved from https://www.oecd-ilibrary.org/environment/cost-benefit-analysis-and-the-environment_9789264010055-en

Phillips, A. (1998). Economic value of protected area. Guidelines for protected area managers. The World Conservation Union. Retrieved from https://www.iucn.org/downloads/pag_002.pdf

Predo, D. (1995). Estimating the recreation and preservation benefits of Lake Danao National Park. *University of Philippines - Los Banos*. Retrieved from https://agris.fao.org/agris-search/search.do?recordID=PH9511292

Republic Act 7586. (1992). An act providing for the establishment and management of National Integrated Protected Area System (NIPAS), defining its scope and coverage, and for other purposes. Philippine Environment Laws. Retrieved from https://www.officialgazette.gov.ph/1992/06/01/republic-act-no-7586/

Small, N., Munday, M., & Durance, I. (2017). The challenge of valuing ecosystem services that have no material benefits. *Global Environmental Change, 44*, 55-67. Retrieved from https://www.researchgate.net/publication/315922355_The_challenge_of_valuing_ecosystem_services_that_have_no_material_benefits

The Economics of Ecosystems and Biodiversity [TEEB]. (2010). Ecological and economic foundations. Earthscan. Retrieved from http://www.teebweb.org/our-publications /teeb-study-reports/ecological-and-economic-foundations/

Thompson, J., & Peepre, J. (2000). Economic benefits of protected areas, canadian parks and wilderness society. Retrieved from https://www.worldcat.org/title/economic-benefits-of-protected-areas/oclc/613463701

Van Beukering, P. J. H., Brouwer, R., & Koetse, M. J. (2015). Economic values of ecosystem services. In *Ecosystem Services: From Concept to Practice* (pp. 89-107). Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9781107477612.008. Retrieved from https://research.vu.nl/en/publications /economic-values-of-ecosystem-services-2

Wegner, G., & Pascual U. (2011). Cost-benefit analysis in the context of ecosystem services for human well-being: A multidisciplinary critique. *Global Environmental Change*. doi:10.1016/j.gloenvcha. 2010.12.008. Retrieved from https://www.sciencedirect.com/science/article/pii/S0959378010001226