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Economic Value of Cultural Ecosystem Services from Recreation in Popa Mountain National Park, Myanmar: A Comparison of Two Rapid Valuation Techniques

Wai Soe Zin [1], Aya Suzuki [2], Kelvin S.-H. Peh [3,4,*] and Alexandros Gasparatos [5]

[1] Environmental Conservation Department, P.O. Box 30522, 000100 Naypyidaw, Myanmar; soezin.wai@gmail.com
[2] Department of International Studies, University of Tokyo, Chiba 277-0882, Japan; ayaszk@k.u-tokyo.ac.jp
[3] School of Biological Sciences, University of Southampton, University Road, Southampton SO17 1BJ, UK
[4] Conservation Science Group, Department of Zoology, University of Cambridge, Downing Street, Cambridge CB2 3EJ, UK
[5] Institute for Future Initiatives (IFI), University of Tokyo, Tokyo 113-8654, Japan; gasparatos@ifi.u-tokyo.ac.jp
* Correspondence: kelvin.peh@gmail.com; Tel.: +44-(0)23-8059-4367

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Abstract: Protected areas offer diverse ecosystem services, including cultural services related to recreation, which contribute manifold to human wellbeing and the economy. However, multiple pressures from other human activities often compromise ecosystem service delivery from protected areas. It is thus fundamental for effective management to understand the recreational values and visitor behaviors in such areas. This paper undertakes a rapid assessment of the economic value of cultural ecosystem services related to recreation in a national park in Myanmar using two valuation techniques, the individual travel cost method (TCM) and the Toolkit for Ecosystem Service Site-based Assessment (TESSA v.1.2). We focus on the Popa Mountain National Park, a protected area visited by approximately 800,000 domestic and 25,000 international tourists annually. Individual TCM estimates that each domestic visitor spent USD 20–24 per trip, and the total annual recreational value contributed by these visitors was estimated at USD 16.1–19.6 million (USD 916–1111 ha^{-1}). TESSA estimated the annual recreational expenditure from domestic and international visitors at USD 15.1 million (USD 858 ha^{-1}) and USD 5.04 million (USD 286 ha^{-1}), respectively. Both methods may be employed as practical approaches to assess the recreational values of protected areas (and other land uses with recreational value), and they have rather complementary approaches. We recommend that both techniques be combined into a single survey protocol.

Keywords: cultural ecosystem services; eco-tourism; nature-based recreation; tourism; travel cost method; TESSA

1. Introduction

Despite the growing international recognition of nature's contribution to human wellbeing, ecosystems globally are facing increasing pressure from a multitude of human activities [1]. Ecosystem services are often not adequately valued or integrated in decision-making [1], leading to their degradation or loss [2,3], with considerable cost to society [4]. This is particularly prevalent in many developing countries due to the combined effects of the prioritization of economic growth, lack of knowledge on the contributions of ecosystems to the economy, and a low local capacity to design and implement ecosystem conservation interventions [5,6]. Increasingly, governments are required to deliver on a range of international and national policy processes aimed at integrating ecosystems and development in order to steer towards sustainable development. This includes processes as diverse as environmental mainstreaming [7], achieving sustainable development goals [8], and facilitating the transition to a green economy [9], reflecting the growing recognition that healthy and functioning ecosystems are indispensable for achieving sustainable development [10].

Cultural ecosystem services from recreation and nature-based tourism feature strongly in much of the debate about ecosystem contributions to human wellbeing, sustainable development, and green economy transitions. On the one hand, several studies have suggested that such ecosystem services can contribute to a range of constituents of human wellbeing, such as physical and mental health [11,12], while supporting local and national economic growth [13,14]. On the other hand, there has been criticism about the negative effects of nature-based tourism on fragile ecosystems and protected areas [15] and the elite's monopolization of the benefits accrued from tourism [16]. We argue that if nature-based tourism and recreation are to contribute positively to sustainable development, there is a need to better understand and measure at a finer scale the delivery of the relevant ecosystem services.

In order to inform financial decisions on the maintenance and development of recreational infrastructure, there is a growing need to valuate cultural ecosystem services from recreation at individual sites, such as protected areas [17]. First, land use decisions are typically made at this scale and need to be informed [18,19]. Second, although ecosystem services related to recreation can be delivered spatially across a wide landscape, within a matrix of diverse human social, political, and ecological interactions (e.g., [20–23]), studies looking at this large scale can only be useful in understanding the broader context. Third, assessing and valuing ecosystem services based on nature-based recreation at broad scales is mostly reliant on modelling approaches (see above), which are often limited by the coarse resolution of the data input [24,25].

Thus, only fine-grain assessment at the site-level can shed information on the differences in recreational demand for protected areas among different social groups (e.g., local day-trippers, domestic tourists, and international tourists) [26–28] and equity issues among the beneficiaries of different social-demographic characteristics (e.g., education level, income, gender, and age.) in terms of a site's accessibility [29,30].

To be useful at the site scale, methods for quantifying nature-based recreation, however, need to produce locally relevant data and should be practical and affordable in terms of expertise, manpower, time, financial resources, and equipment [18]. Moreover, the outcomes of these methods need to be provided in an accessible format to policy-makers, planners, and land managers [18]. Such information is vital for establishing whether there are utilitarian or intrinsic arguments in support of conserving particular areas and for informing decision-makers whether preserving, or restoring, a site has broader benefits for society as a whole [4].

Most of the existing approaches to assess and map cultural ecosystem services based on recreation may be insufficient for these needs [24]. These methods tend to involve either technically demanding or expensive fieldwork, modeling, or extrapolation from data collected in other locations, which may not reflect local conditions [20–23]. Tools that enable stakeholders to obtain accessible, robust, and locally relevant information (e.g., the expenditure of visitors, the type of recreational activities they engaged in, and their level of participation in these activities, as well as their motivations) are necessary for preserving and monitoring recreational areas and for prioritizing the maintenance and possible development of recreational infrastructure and facilities [18].

Many studies have assessed cultural ecosystem services related to recreation in protected areas through revealed preference methods, such as the travel cost method (TCM) [31–33]. This approach focuses on the travel costs associated with people's use of a natural area for recreational purposes and derives its economic value of recreation based on the actual behavior and preferences of visitors in terms of the frequency of their visits, travel cost, and time [4]. Recently, other rapid methodologies have been developed to valuate such ecosystem services, such as the Toolkit for Ecosystem Service Site-based Assessment (TESSA v. 1.2), whose relevant module focuses on the direct expenditure of domestic and international visitors to a site [18,28,34,35]. Apart from individual TCM and TESSA (v. 1.2), there are many other techniques used to elicit the value of recreational ecosystem services in the context of protected areas with varying degrees of complexity. Some of these techniques include, among others, zonal TCM [36], choice experiments [37], contingent valuation method [38], techniques based on photo-sharing and social media [39], hybrids of ecosystem services mapping and modelling [40], and combinations of the above techniques [41,42].

Individual TCM and TESSA are practical methods for valuing ecosystem services at the scale of an individual site, as they are relatively rapid and inexpensive to apply by non-experts, they do not entail the development of complicated study designs, and their results are easy to interpret for non-experts [11]. Such rapid techniques can be very useful in contexts with a high potential to deliver ecosystem services and little capacity for the deployment of more complicated techniques, as is the case in several developing countries [43]. Furthermore, due to their simplicity, these techniques can be useful tools for engaging with stakeholders and for highlighting the potential outcomes of land use decisions on ecosystem services [35].

Myanmar is an example of a country that currently has a high reliance on and future potential for ecosystem services delivery (including cultural ecosystem services from recreation) because of its diverse ecosystems [44–46]. However, this country also faces a series of challenges to protect and capitalize on these ecosystem services, including a lack of knowledge of the links between some ecosystem services and the economy and low levels of institutional capacity (WWF, 2016). After decades of economic and political seclusion, Myanmar's national economy is rapidly growing through an influx of national and international investments [47]. The tourism sector has been identified as a key growth sector, with a dedicated Ministry of Hotels and Tourism overseeing relevant activities. Indeed, tourism has increased rapidly in the country, from 0.82 million arrivals in 2011 to 4.68 million arrivals in 2015 [48]. With its high biological diversity and unique cultural heritage, Myanmar has a large potential for nature-based tourism [49]. Indeed, the tourism sector has been identified one of the green growth opportunities in the country and a priority area for transitioning to a green economy [50]. However, despite this manifested demand and potential for nature-based tourism, there has been very little research concerning the value of cultural ecosystem services from recreation in the country, as most studies either do not consider such ecosystem services or use them as a secondary focus [46,51,52].

This paper undertakes a rapid assessment of the economic value of the cultural ecosystem services related to recreation in a national park in Myanmar. We use two valuation techniques, the individual travel cost method (TCM) and the Toolkit for Ecosystem Services Site-based Assessment (TESSA v. 1.2), and contrast their findings. We focus on the Popa Mountain National Park, a protected area with unique natural and cultural assets, which is one of the main touristic attractions of Myanmar. This study fills two significant gaps in the current literature. First, it contributes to the practically non-existent literature on the economic valuation of cultural ecosystem services from recreation in Myanmar, as discussed above. To our best knowledge, the individual TCM has not been used to value such ecosystem services in Myanmar, while TESSA (v. 1.2) has been applied only once in the country [53]. Second, it presents the outputs of two rapid valuation techniques, which to our best knowledge, no studies have used jointly. This would allow the identification of the main inputs, results, performance, and thus their relative merits for influencing land use decisions in protected area settings.

2. Materials and Methods

2.1. Study Area

The Popa Mountain National Park (hereafter called the park) is located in the Kyaukpadaung Township, Nyaung Oo District of Mandalay Region in the central dry zone of Myanmar (Figure 1). Mount Popa is an extinct volcano that was gazetted as the Popa Reserved Forest in 1902 and then was declared as a protected area in 1989. It officially opened to the public in 1993 and covers an area of 17,606 ha, comprising a core zone of 12,854 ha and a buffer zone of 4752 ha (Nature and Wildlife Conservation Division, unpublished data).

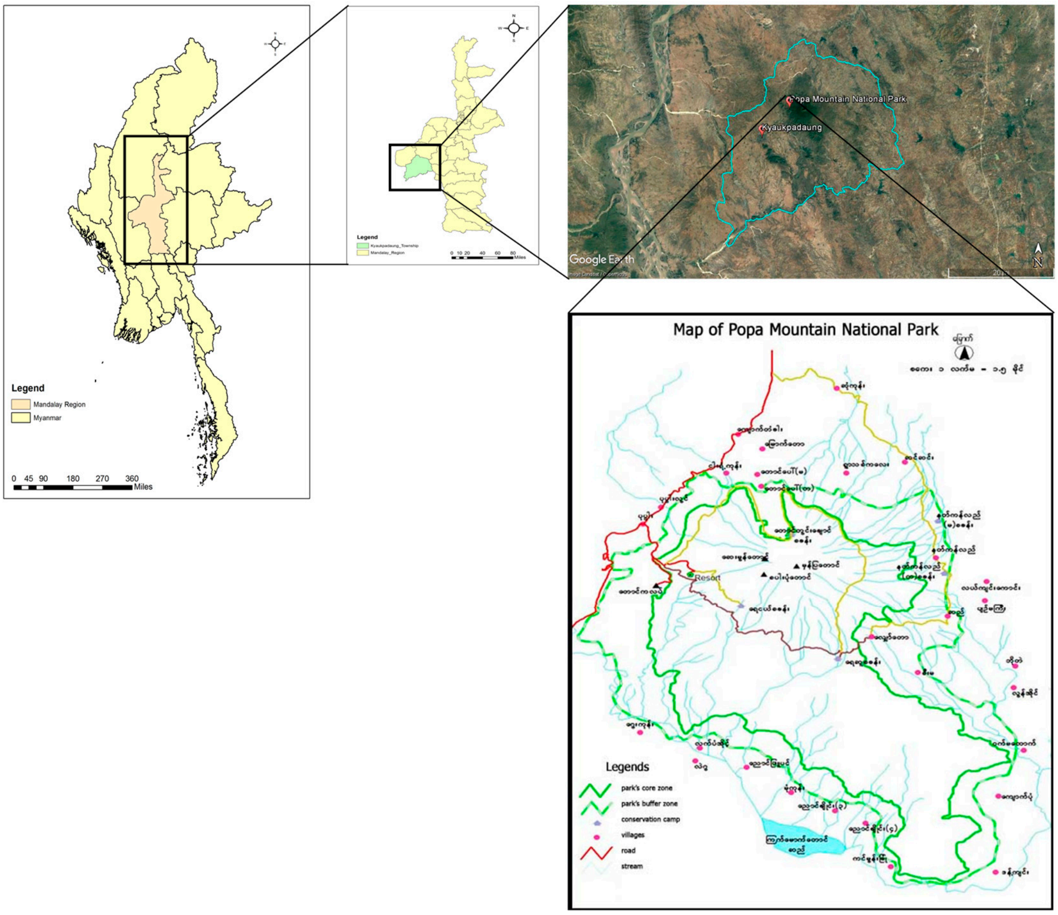

Figure 1. Map of Popa Mountain National Park, Myanmar.

Approximately 89% of the park is covered by a seasonally dry forest ecosystem that contains diverse vegetation communities, consisting of mixed deciduous forest, Eucalyptus-dominated forest, scrub 'indaing' forest, 'Than-dahat' forest, and hill (evergreen) forest [54]. This park has been designated as a "Key Biodiversity Area" for its significant and diverse fauna, with more than 10 species of mammals, 173 species of birds, and 100 species of butterflies found within its borders (Nature and Wildlife Conservation Division, 2014, unpublished data). Its elevation ranges between 285–1490 m above sea level [55]. Its monthly maximum and minimum mean temperatures are 42.2 °C and 12.8 °C , and its average annual precipitation is 1143 mm (Nature and Wildlife Conservation Division, unpublished data).

A total of 40 villages containing approximately 10,732 households are scattered in the plains surrounding the park. Besides farming, the villagers sell food, non-timber forest products such as traditional medicinal plants, and souvenirs to the park visitors.

The park is currently managed with the following objectives [56]:

- To preserve the unique dry zone ecosystem within the park;
- To conserve the existing cultural and religious sites within the park;
- To protect the watershed area for the reservoir in the park;
- To ensure the sustainable harvest of traditional medicinal plants;
- To maintain water supply from a network of natural springs;
- To promote nature-based recreation.

The Popa Mountain National Park is unique in Myanmar in that it is the only national park that contains significant and unique cultural and natural assets. This allows for the provision of multiple cultural ecosystem services, such as nature-based recreation, spiritual experiences, education, and aesthetical appreciation. No other national park in Myanmar offers such a combination of cultural and natural assets. Some reserve forests contain some cultural assets, such as pagodas and monasteries, but they are not completely protected as they usually also contain logging operations and thus do not offer nature-based recreation to the same extent.

In terms of nature-based recreation, the park offers possibilities to observe protected dry zone ecosystems, avifauna, and other wild animals, as well as to hike to Mount Popa's top on foot or on horseback along the forest paths. In terms of aesthetic appreciation, the summit of Mt Popa offers outstanding views of the surrounding plains, while the top of Popa Taung Kalat is a volcanic plug, and a prominent landmark in its own right. Regarding spiritual experience and education, the park plays an important role in Myanmar culture, religion, and history. The Popa Taung Kalat is a pilgrimage site that contains numerous Nat temples and relic sites atop the mountain, where it is possible to study Myanmar's ancient animist traditions.

The park is visited each year by 800,000 national and 25,000 international visitors because of its proximity to Bagan, the ancient capital of Myanmar and one of the most visited sites in the country (Department of National Parks and Wildlife Conservation, personal communication, 2015). Most of the domestic visitors visit the park for cultural services related to the religious and spiritual sites at the Popa Taung Kalat, wildlife viewing, and hiking up Mount Popa (Department of National Parks and Wildlife Conservation, personal communication, 2015). International visitors visit the park mainly to study Myanmar's traditions and culture, enjoy panoramic views of the landscape, observe the unique ecosystem, and hike to Mount Popa (Department of National Parks and Wildlife Conservation, personal communication, 2015).

2.2. Data Collection

In order to assess the ecosystem services related to recreation in the park, we undertook a field survey in July–August 2015 to collect empirical data on the expenditure of visitors and visitation behaviour. This survey was undertaken through in-person interviews with domestic (n = 72) and international visitors (n = 42) who were randomly selected (every 5th domestic visitor and every 3rd international visitor) near the entrance road or inside the park.

The questionnaire contained questions about the socioeconomic status of the respondents, their experience visiting the park, and details about their overall trip (e.g., the number of sites visited, duration, costs, and modes of transport). We converted all monetary values in this study from Myanmar Kyat to US dollars using an average exchange for the period between 2014 and 2015.

Secondary data were obtained from the Department of National Parks and Wildlife Conservation. These included information about the annual total number of visitors visiting the park for the period between August 2014 and July 2015.

2.3. Data Analysis

2.3.1. Travel Cost Method

The travel cost method (TCM) has been identified by several economists as the best approach for estimating the economic value of recreational sites [57,58]. The TCM assumes that the time and travel cost expenses that people incur for visiting a site represent the "price" of access to the site and drive a demand curve for that site [59]. The TCM evaluates the value of a recreational site by relating the demand for that site (measured as site visits) to its price (measured as the costs of a visit). Following [60], a simple TCM model can be defined by a 'trip-generation function':

$$V = f\ (C, X) \tag{1}$$

where V is visits to a site, C is visit costs, and X is other socioeconomic variables that significantly explain V.

TCM can be classified into the Individual Travel Cost Method (ITCM) and the Zonal Travel Cost Method (ZTCM) [60]. ITCM defines the dependent variable (V) as the number of visits made by each visitor to a site over a specific period, for example within one year. Conversely, the ZTCM partitions the entire area from which the visitors originated into a set of visitor zones and then defines the dependent variable as the visitor rate (i.e., visits year^{-1}) made from a particular zone in a period divided by the population of that zone [60]. For the purpose of this study, we use the ITCM.

2.3.2. Econometric Models for Count Data

Since for the ITCM the dependent variable (i.e., visits year^{-1}) is a discrete parameter (count number) and follows a Poisson distribution, we use Poisson regression models in this study [32]. Given that Poisson distribution does not include negative integers, the mean of the expected number of visits is an exponential function of the independent variables (i.e., parameters affecting the visitation rate). Therefore, the expected trip demand function in the Poisson model is expressed as

$$\mathrm{E(y)} = \exp\,(\mathrm{X_i}\ \beta) \tag{2}$$

where E(y) is the expected number of visits, $\mathrm{X_i}$ is a vector of the variables affecting the number of visits, and β is a vector of the parameters of the variables [61–64].

As the values of the dependent variable (i.e., visits year^{-1}) are not zero, we employed a zero-truncated Poisson regression instead of ordinary Poisson regression [61,65].

2.3.3. Model Variables

The dependent variable of the model is the number of visits year^{-1} visitor^{-1}, and the independent variables are: (1) travel cost, (2) travel time, (3) age, (4) gender, (5) education level, (6) household income, (7) site substitutability, and (8) recreational quality (Table 1). We also included in the model a 'Visitor type' dummy variable for the entire dataset (i.e., for both international and domestic visitors). Hence, the trip demand function for the entire dataset (international and domestic visitors) is

$$\begin{gathered} Number\_of\_visits = \exp\,(\beta_0 + \beta_1 TC + \beta_2\ Visitor\_type + \beta_3\ Gender + \beta_4\ Age + \beta_5 \\ Education\_level + \beta_6\ Household\_income + \beta_7\ Travel\_time + \beta_8\ Number\_in\_party + \beta_9 \\ Park\_rating + \beta_{10}\ Substitute\_site) + U_i \end{gathered} \tag{3}$$

and the trip demand functions for domestic visitors is

$$\begin{gathered} Number\_of\_visits = \exp\,(\beta_0 + \beta_1\ TC + \beta_2\ Gender + \beta_3\ Age + \beta_4\ Education\_level + \beta_5 \\ Household\_income + \beta_6\ Travel\_time + \beta_7\ Number\_in\_party + \beta_8\ Park\_rating + \beta_9 \\ Substitute\_site) + U_i. \end{gathered} \tag{4}$$

The key independent variable is the travel cost (TC), and we calculate six different type of travel cost in our analysis (TC1–TC6), see Table 1. TC1 is the transportation cost per person incurred for visiting the park. For international visitors, the transportation cost comprised two parts: the transportation cost outside Myanmar (i.e., the return flight ticket fees from the respondent's home country to Myanmar) and the transportation cost inside Myanmar (i.e., the cost of travelling to the park during the respondent's stay in Myanmar).

The international visitors to the park, however, usually visit more than one destination during their visit to Myanmar (Table 2). Therefore, to estimate their international travel costs from outside Myanmar to the park, we divide their return airfares by the number of places visited in the country. To estimate the domestic transportation cost of international visitors (i.e., the cost to reach the park from inside Myanmar), we account only for the cost of travelling the distance from their previous in-country location. In our case, all international visitors arrived at the park from Bagan, which is only a 1 h drive by car. Therefore, we consider the return transportation cost from Bagan to the park as the international visitors' cost of travelling to the park inside Myanmar. Thus, TC1 has been calculated as below:

- For international visitors, TC1 = (Return airfare to Myanmar divided number of sites visited in Myanmar) + Return transport cost from Bagan to the park.
- For domestic visitors, TC1 = Individual return transport cost for those who travelled to visit the park only; and TC1 = Round trip transport cost divided by number of places visited for those who travelled to multiple places during the same trip to the park.

Table 1. Description of the variables used in the regression model.

Variable	Definition
Number of visits	Number of times the person visited the park in the past 12 months
TC1	Travel expenses per person (USD)
TC2	TC1 + Opportunity cost of travel time (USD)
TC3	TC2 + Opportunity cost of time spent on-site (USD)
TC4	TC2 + On-site expenditure (USD)
TC5	TC3 + On-site expenditure (USD)
TC6	TC1 + On-site expenditure (USD)
Gender	Gender of respondent; 0 = Male; 1 = Female
Age	Age of respondent (Years)
Education level	1 = No high school education; 2 = Completed some high School; 3 = High school graduate; 4 = Bachelor's degree; 5 = Master's degree and above
Household income	Average monthly income (USD)
Travel time	Travelling time to the park (number of hours)
Number in party	Number of people in travelling group
Park rating	Perception of quality of recreation in the park: Lowest score = 0 (very poor) to the Highest score = 10 (excellent)
Substitute site	Respondent visiting a similar site in the past 12 months; 0 = Had not visited; 1 = Had visited
Visitor type	0 = Domestic visitor; 1 = International visitor

Table 2. Number of places visited by international and domestic visitors during their trip.

Visitor Type	Number of Places Visited	Number of Visitors	Fraction of Visitors (%)
International	3	3	7.1
	4	10	23.8
	5	9	21.4
	6	8	19.1
	7	5	11.9
	8	3	7.1
	9	3	7.1
	10	1	2.4
	Total	42	
Domestic	1	9	12.5
	2	52	72.2
	3	6	8.3
	4	4	5.6
	5	1	1.4
	Total	72	

Arguably, the opportunity cost of travel time should be included when calculating the travel costs for visiting a recreational site [62,66]. Hence, TC2 is the sum of TC1 and the opportunity cost of the travel time, which is represented by the monetary value of the time taken for travelling to the park. The total time spent travelling to visit the park by international and domestic visitors is calculated in the same way as the transport costs. For international visitors, we derive their total travel time for visiting the park by summing their travel time outside Myanmar (i.e., their total travel time, including the time spent on the return journey divided by the number of places visited in Myanmar) and their travel time inside Myanmar. For the domestic visitors who travel to visit only the park, the travel time is taken as the time spent travelling to the park and back home. For those who travel to multiple destinations, we divide their total time spent on the round trip by the number of places they visited during the trip.

Some studies have considered the opportunity cost of travel time (i.e., the time spent on the site in addition to the time spent travelling (see [62,67,68])). Therefore, in TC3, we include the opportunity cost of the time spent on-site (Table 1). TC4 is the sum of the individual round-trip transportation cost, the opportunity cost of the travel time, and individual on-site expenditures on food, drink, donations, souvenirs, and accommodation. TC5 is the sum of the individual round-trip transportation cost, the opportunity cost of travel time, the opportunity cost of the time spent on-site, and individual on-site expenditure. Lastly, TC6 is the sum of the individual round-trip transportation costs and individual on-site expenditures.

The methodology for valuing the opportunity costs of travel time in monetary terms is still under debate for TCM. One approach is to use a fixed percentage of the visitor's income, considering the travel time as an opportunity cost related to the loss of wages and salaries [69], varying between 25% and 100% [55–57]. Following [69–71], we apply 40% in our analysis, based on the fact that an average of 40 working hours per week is typical around the world (we also applied this to calculate the hourly wage rate in Myanmar). This amounts to approximately 173 h per month, which we use to divide the visitor's monthly wage to get the average hourly wage. This is then multiplied by the total travel time of the visitor and a conversion factor of 0.4 to derive the opportunity cost of travel time.

The recreational quality of the park is included in the model and is derived from the scores provided by the respondents on a scale from 0 (extremely poor) to 10 (excellent). The substitutability of the park is also included as a dummy variable, with 0 = respondent had not visited similar mountain park during the last 12 months, and 1 = otherwise.

2.3.4. Zero-Truncated Poisson Regression

The application of the Poisson model requires that the mean number of trips be exactly equal to the variance of the trips (equi-dispersion). The combined data of the international and domestic visitors (i.e., all visitors) have a mean of 1.41 visits, with the variance of the distribution being 0.59. For domestic visitors only, the mean number of visits is 1.65, and the variance of the distribution is 0.79. Both variances of distribution are lower than their means, which implies that there is under-dispersion in our count data. We, therefore, run Zero-Truncated Poisson (ZTP) regressions with the *vce* (robust) option as recommended by [72]. This enables us to obtain robust standard errors for the parameter estimates to constrain mild violations of the underlying assumptions [72].

We use the Maximum Likelihood Estimation to estimate the regression models for the Poisson distributed data. STATA (version 12.0) is used with all variables analyzed as continuous variables, except for the *Education_level*, which is analyzed as a categorical variable. To determine whether the different types of visitors have different demands for recreation, we run three separate ZTP regressions, one for the international tourists, one for domestic visitors, and one for all visitors.

2.3.5. Willingness to Pay (WTP) and Consumer Surplus (CS)

The observed travel costs of the visitors indicate their direct expenditure to the park but not the maximum amount they were willing to pay to make such a visit. The difference between the total travel costs incurred by a visitor to a recreational site and the maximum amount the visitor is willing to pay to make a visit to that site is known as a consumer surplus [64] (Figure 2). Based on the ZTP models, we estimate the consumer surplus person^{-1} trip^{-1} using Equation (5) [32,62,73]:

$$CS_{\text{per trip}} = -\frac{1}{\beta TC} \tag{5}$$

where βTC is the regression coefficient related to the travel cost variable.

The total annual consumer surplus, which is equal to the annual recreational value of the site, can then be calculated by multiplying the individual consumer surplus with the total number of visits during a year:

$$CS_{\text{total}} = (-\frac{1}{\beta TC}) \times \text{Total number of trips year}^{-1} \tag{6}$$

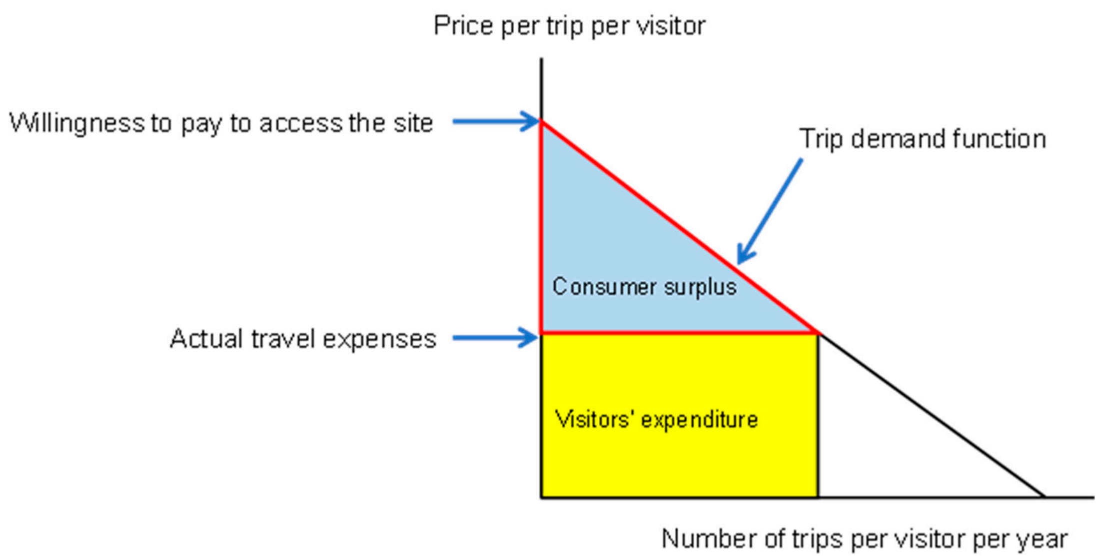

Figure 2. Trip demand function and consumer surplus.

2.3.6. TESSA (v. 1.2) Method

TESSA is a suite of rapid ecosystem service assessment tools for valuing ecosystem services at the site level using readily available or easy to collect data [18]. According to the TESSA (v. 1.2) protocol, the value of nature-based recreation can be derived into two stages. First, it is derived separately for each visitor group (i.e., domestics and international visitors), where the annual number of visits in a site (expressed as number of visits per year) is multiplied with the direct mean expenditure per day to estimate the annual total expenditure (expressed as USD per year) for the site in the current state. Second, the total expenditure is multiplied with the percentage of people in each visitor group who reported that they would not visit the same site under an alternative state (e.g., if the natural habitat were converted to agriculture). This result reflects the estimate of the nature-based recreation value of the site in its current state [18]. However, since there is no alternative state for the park, the estimate derived from TESSA (v. 1.2) method in this study represents the total annual value from tourism and recreation for the park [26–28,53,74].

For the TESSA approach, data can be obtained from existing databases, expert interviews, or field surveys. In this study, we collected data following a two-stage process. First, we interviewed key informants from the Department of National Parks and Wildlife Conservation to obtain the annual total number of visits to the park. Second, we collected primary data from park visitors following the field survey approach explained in Section 2.2. Visitor surveys are used to obtain information about the travel expenditure and on-site spending to estimate the mean spending of visitors.

Much like ITCM, visitors are classified into local and international tourists. Based on the sample size of each visitor type, we estimate the precision level of their mean expenditures using power analysis [74]. To estimate the annual contributions to the recreation value of the park for both visitor types, we multiply their average spending by the annual total number of visits for that visitor category.

The annual expenditures when visiting the park are then derived by summing the annual contributions from both national and international visitors.

Considering the above, the TESSA (v. 1.2) method is essentially a simplified travel cost method combined with visitation data for assessing the recreational value of the park. However, this analysis does not incorporate considerations of the negative impacts of tourism and recreation on biodiversity and the environment. Hence, it does not consider the sustainability aspects of tourism at the park.

3. Results

3.1. Respondent Characteristics

The annual number of person-visits was estimated at 800,000 domestic visitors and 25,000 international tourists (Department of National Parks and Wildlife Conservation, personal communication, 2015). Unsurprisingly, the average visitation rate of domestic visitors (1.65 visits year^{-1}) was higher than that of international tourists (1 visit year^{-1}) (Table 3).

The gender ratio (male: female) of the respondents was 3:2, and the ages ranged from 17 to 73 years, with a mean of 38 and 49 years for domestic and international visitors, respectively (Table 3). Generally, international tourists had a higher level of education and mean monthly household income (at USD 5,482 compared to USD 608 for domestic visitors) (Table 3). The average travel time spent for visiting the park by the international and domestic visitors was not significantly different (Table 3). However, on average, international tourists consistently spent more than domestic visitors across all travel cost measures (Table 3).

Most respondents (84%) rated the recreational quality of the park with a score of ≥5 (Table 4), with the international and domestic visitors giving an average rating of 5.5 and 6.2 respectively. Half of the respondents (both domestic and international) reported that they had visited other similar mountain parks in the past 12 months (Table 3).

Table 3. Descriptive statistics of variables used in the regression model.

Variable	Entire Sample (n = 114)				International Visitors (n = 42)				Domestic Visitors (n = 72)			
	Mean	Std. dev.	Min	Max	Mean	Std. dev.	Min	Max	Mean	Std.dev.	Min	Max
Number_of_visits	1.41	0.77	1.00	4.00	1.00	0.00	1.00	1.00	1.65	0.89	1.00	4.00
TC1 (USD)	69.76	89.87	0.35	357.00	177.26	59.10	85.40	357.00	7.05	3.63	0.35	16.67
TC2 (USD)	103.00	133.07	1.46	472.00	257.55	99.80	122.25	472.00	12.84	7.69	1.46	39.48
TC3 (USD)	134.92	189.82	2.92	1008.67	333.06	186.10	152.25	1008.67	19.34	24.03	2.92	164.48
TC4 (USD)	119.38	143.15	5.00	512.00	281.75	113.43	128.92	512.00	24.67	22.18	5.00	170.83
TC5 (USD)	151.30	206.14	5.00	1108.67	357.26	214.41	153.25	1108.67	31.17	36.86	5.00	258.33
TC6 (USD)	86.14	100.82	5.00	377.00	201.46	75.87	85.40	377.00	18.87	19.93	5.00	156.25
Gender (1 = Female)	0.42	0.50	0.00	1.00	0.45	0.50	0.00	1.00	0.40	0.49	0.00	1.00
Age (Years)	42.24	14.14	17.00	73.00	48.79	15.80	20.00	73.00	38.42	11.56	17.00	65.00
Education_level (Range 1–5)	3.61	1.02	1.00	5.00	4.17	0.58	3.00	5.00	3.29	1.08	1.00	4.00
Household_income (USD)	2403.68	3169.06	241.67	20,000.00	5481.62	3454.69	1600.00	20,000.00	608.22	467.54	241.67	2916.67
Travel_time (Hours)	7.35	2.85	1.00	16.00	7.65	2.09	3.00	12.00	7.17	3.21	1.00	16.00
Number_in_party (Number)	5.97	5.68	1.00	34.00	2.31	1.24	1.00	8.00	8.11	6.16	1.00	34.00
Park_rating (Range 1–10)	5.94	1.24	2.00	9.00	5.50	1.15	2.00	7.00	6.19	1.23	2.00	9.00
Substitute_site (1 = Had visited)	0.50	0.50	0.00	1.00	0.50	0.51	0.00	1.00	0.50	0.50	0.00	1.00
Visitor_type (1 = International)	0.37	0.48	0.00	1.00								

Table 4. Rating of the park's recreational quality.

Park Rating	Domestic Visitors		International Visitors		Total Visitors	
	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)
0—Extremely poor	0	0.0	0	0	0	0
1	0	0.0	0	0	0	0
2	1	1.4	1	2.4	1	2.4
3	1	1.4	1	2.4	1	2.4
4	1	1.4	3	7.1	3	7.1
5—Average	18	25.0	18	42.9	18	42.9
6	20	27.8	9	21.4	9	21.4
7	22	30.6	10	23.8	10	23.8
8	8	11.1	0	0	0	0
9	1	1.4	0	0	0	0
10—Excellent	0	0.0	0	0	0	0
Total	72	100	42	100	42	100

3.2. Travel Cost Method (TCM)

3.2.1. Zero-Truncated Poisson Regression

All surveyed international visitors undertook only one visit to the park in the past 12 months. Hence, we could not run a ZTP regression for the international visitors only, as its sole dependent variable (i.e., the visitation rate) has no elasticity. Thus, we ran two separate sets of Poisson regressions with different types of travel costs: one for all visitors and another for domestic visitors only.

The ZTP model converges properly for all different travel cost categories applied to the domestic visitors. However, the regression models for all visitors converged only for TC4 and TC6 (i.e., TC1, TC2, TC3, and TC5 do not converge). This could be due to the differences between the two visitor types in terms of their visitation rate, travelling costs, and average monthly income (Table 3). Although both models fit well in terms of the goodness of fit (i.e., Wald chi-square tests are highly significant), their focus variables, i.e., travel costs, were not significant.

For the domestic visitors, all models fit well, as their Wald chi-square tests are highly significant. Indeed, for three models (TC1, TC2, and TC3) out of the six, the estimated travel costs are statistically significant. The coefficients for the travel cost variables are negative across all models (except for TC6), which is consistent with our expectations (Tables 5 and 6). This indicates that the number of trips to a site by a visitor is negatively related to the travel costs—i.e., people visit the park less frequently when the travel cost is high. The estimated coefficients of travel cost are statistically significant for TC1 (Model 1), TC2 (Model 2), and TC3 (Model 3) (Table 6).

Table 5. Zero-Truncated Poisson (ZTP) regression with TC4 and TC6 for the entire sample.

Variable	**Number of Visits**	
	TC4	TC6
TC4	−0.00188	
	(0.0198)	
TC6		0.00251
		(0.0151)
Gender	−0.282 *	−0.285 *
	(0.144)	(0.150)
Age	0.00300	0.00244
	(0.00527)	(0.00549)
Education_level		
Completed some high school	0.138	0.159
	(0.276)	(0.250)
High school graduate	−0.170	−0.172
	(0.395)	(0.398)
Bachelor's degree	−0.120	−0.118
	(0.197)	(0.197)
Master's degree and above	−0.540	−0.493
	(0.699)	(0.545)
Household income	-2.88×10^{-5}	-8.08×10^{-5}
	(0.000397)	(0.000294)
Travel_time	−0.0616 *	−0.0661 ***
	(0.0357)	(0.0245)
Number in party	−0.0114	−0.0118
	(0.0119)	(0.0125)
Rating of park	0.315 ***	0.312 ***
	(0.0800)	(0.0822)
Substitute site	−2.001 ***	−2.046 ***
	(0.534)	(0.530)
Visitor type	−17.09 ***	−17.74 ***
	(3.241)	(2.145)
Constant	−0.975	−0.944
	(0.841)	(0.871)
Diagnostics		
Wald chi^2 (13)	6722.35 ***	7193.23 ***
Pseudo R^2	0.5336	0.5337
Log pseudolikelihood	−53.027468	−53.021331

Note: Robust standard errors are in parentheses. *** $p < 0.01$, * $p < 0.1$.

Table 6. Zero-Truncated Poisson (ZTP) regression results with different travel cost levels for domestic visitors.

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Variable	Number of visits					
TC1	−0.0440 **					
	(0.0178)					
TC2		−0.0496 ***				
		(0.0171)				
TC3			−0.0409 **			
			(0.0162)			
TC4				−0.0019		
				(0.0199)		
TC5					−0.0064	
					(0.0163)	
TC6						0.00251
						(0.0151)
Gender	−0.209	−0.250 *	−0.279 *	−0.282 *	−0.287 **	−0.285 *
	(0.154)	(0.147)	(0.145)	(0.145)	(0.139)	(0.0151)
Age	0.00819	0.0101 *	0.00876	0.00300	0.00351	0.00244
	(0.00596)	(0.00607)	(0.00589)	(0.00528)	(0.00512)	(0.00550)
Education_level						
Completed some high school	−0.0241	−0.125	−0.127	0.138	0.0994	0.159
	(0.264)	(0.280)	(0.296)	(0.277)	(0.274)	(0.250)
High school graduate	−0.193	−0.168	−0.158	−0.170	−0.169	−0.172
	(0.364)	(0.362)	(0.352)	(0.396)	(0.389)	(0.399)
Bachelor’s degree	−0.0970	−0.130	−0.139	−0.120	−0.130	−0.118
	(0.173)	(0.204)	(0.215)	(0.197)	(0.194)	(0.197)
Household income	−0.000078	0.000200	0.000243	−0.0000288	0.0000561	-0.08×10^{-5}
	(0.000208)	(0.000196)	(0.000201)	(0.000398)	(0.000369)	(0.000295)
Travel time	−0.0281	0.00154	−0.00770	−0.0616 *	−0.0548 *	−0.0661 ***
	(0.0298)	(0.0316)	(0.0305)	(0.0358)	(0.0330)	(0.0246)
Number in party	−0.00991	−0.0148	−0.0155	−0.0114	−0.0117	−0.0118
	(0.0109)	(0.0119)	(0.0120)	(0.0120)	(0.0117)	(0.0125)
Park rating	0.332 ***	0.336 ***	0.346 ***	0.315 ***	0.321 ***	0.312 ***
	(0.0894)	(0.0892)	(0.0897)	(0.0802)	(0.0788)	(0.0824)
Substitute site	−1.968 ***	−1.853 ***	−1.750 ***	−2.001 ***	−1.924 ***	−2.046 ***
	(0.568)	(0.578)	(0.572)	(0.535)	(0.539)	(0.532)
Constant	−1.280	−1.423	−1.396	−0.975	−1.018	−0.943
	(0.919)	(0.908)	(0.902)	(0.843)	(0.828)	(0.874)
Diagnostics						
Wald chi^2 (11)	121.51 ***	128.38 ***	129.88 ***	109.03 ***	109.40 ***	106.53 ***
Pseudo R^2	0.3733	0.3787	0.3814	0.3687	0.3699	0.3688
Log pseudolikelihood	−52.639242	−52.189434	−51.963804	−53.027467	−52.924537	53.021331

Note: Robust stand errors are in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Both site substitutability and recreational quality have significant effects in all models. Locals who had visited other similar mountain parks in the past 12 months tended to visit the park less frequently, while those who had rated the recreational quality of the park positively tended to visit it more frequently. Generally, the domestic visitors in the park were more likely to be female and elderly, and their visitation rate was negatively correlated to their travelling time to the park. At least 37% of the variability in the recreational visits for domestic visitors is explained by the variables included in the models.

3.2.2. Willingness to Pay (WTP) and Consumer Surplus (CS) Estimation

Only the statistically significant coefficients of the travel costs could be used for calculating the consumer surplus per visit. This means that we could not estimate the consumer surplus for international tourists or from the pooled dataset. Nevertheless, based on the significant coefficients of the travel costs from regression models 1–3, the consumer surplus per visit ranged from USD 20 to 24 (Table 7). The total annual recreational value of the park, therefore, ranged from USD 16.1 to 19.6 million (i.e., 916–1111 USD ha^{-1}).

Table 7. Economic value of the ecosystem services from recreation in Popa Mountain National Park for domestic visitors.

Value	TC1	TC2	TC3
Individual (USD $person^{-1}$)	22.72	20.16	24.45
Total (USD $year^{-1}$)	18,176,000	16,128,000	19,560,000
Total per unit area (USD ha^{-1})	1032	916	1111

3.3. TESSA (v. 1.2) Approach

The value of the cultural ecosystem services from recreation assessed using the TESSA (v. 1.2) method was based on the information obtained from the 72 domestic visitors and 42 international visitors (Section 2.2). On average, international visitors spent USD 177 per person on travelling to the park and USD 24 per person on-site, for a total expenditure of USD 201 per person. Domestic visitors spent USD 7 on travelling and USD 12 on-site, for a total expenditure of USD 19 per person. The precision levels of the mean total expenditure for domestic and international visitors are 22% and 10%, respectively. The estimated total expenditure generated from domestic visitors, international tourists, and all visits was USD 15.1 million $year^{-1}$ (USD 858 ha^{-1}), USD 5.04 million $year^{-1}$ (USD 286 ha^{-1}), and USD 20.1 million $year^{-1}$ (USD 1144 ha^{-1}), respectively.

4. Discussion

Results from both the individual TCM and TESSA (v. 1.2) methods confirm that there is a high demand for cultural ecosystem services related to recreation in the park by domestic visitors. Based on the individual TCM, we value the recreational benefits for domestic visitors in the park at USD 16.1–19.6 million (USD 916–1111 ha^{-1}). Conversely, TESSA (v. 1.2) assessment estimates the expenditures generated by domestic visitors and international tourists at USD 15.1 million $year^{-1}$ and USD 5.02 million $year^{-1}$ respectively, for a total annual expenditure of $20.1 million.

However, since these two methods follow slightly different methodologies, their results are not directly comparable. TCM, which is based on estimates of consumer surplus (i.e., the difference between the total travel cost incurred by a visitor and the maximum WTP of the visitor), can estimate the economic value of the benefits of recreational visits (i.e., the welfare value), whereas the TESSA (v. 1.2) assessment captures only the actual observed travel costs and on-site expenditures, thus providing only indirect estimates of the impact on the local (site-based) economy in terms of visitor spending. Nevertheless, through the joint application of these two techniques, we can extract various interesting lessons to inform land use decisions in the context of recreation in protected areas (Table 8).

Table 8. Comparative characteristics of the two valuation techniques.

Category	TCM	TESSA (v. 1.2)
Data needs	Travel costs On-site expenditures Opportunity costs Respondent characteristics Travel behavior	Travel costs On-site expenditures
Analytical expertise	Advanced statistical skills	Basic statistical skills
Advantages	Can factor park and trip quality characteristics (e.g., quality of park//experience) Widely accepted in academic literature	Can estimate values regardless of visitation rates Can use primary or secondary data Rapid assessment
Disadvantages	Cannot estimate values of one-off visitors	Cannot factor the quality of ecosystem services related to recreation
Application	Inform investments in park infrastructure and management practices	Estimate net consequences of a counterfactual to inform decision

First, the estimates are clearly influenced by the valuation mechanisms embedded in each tool. Each valuation mechanism has different data requirements and, therefore, different advantages and disadvantages. The individual TCM accounts for the visitors' WTP and may better reflect the value that individuals place on a recreational site [32]. However, individual TCM estimates can also be plagued by uncertainty due to the difficulty in estimating the opportunity cost of time. The individual TCM also has a tendency to overestimate the value of recreation because each trip may have more than one destination or purpose. In contrast, TESSA (v. 1.2) does not take visitors' WTP and opportunity costs into account, and its estimates tend to be conservative compared to those of individual TCM (even though the estimates of the two methods cannot be directly comparable).

Second, considering their different methodologies and data needs, analysts and end-users (e.g., park managers and tourism associations) need to have a clear understanding of their objectives and data constraints before choosing each method. For example, among others, TCM models can be used to extract information about the role that recreational experience plays in recreational value, which can inform decisions about investment in appropriate infrastructure of management practices. In particular, our results clearly show that the recreational quality of the park can influence the visitation frequency of domestic visitors and that these visitors are more likely to be female and older. Hence, the provision of amenities and facilities for this group of visitors may be critical for increasing recreational visits to the park.

However, individual TCM cannot measure the recreation values for tourists that visit the site once, as the TCM elicits individual demands for recreation through endogenous changes in visitation frequency. Hence, it was impossible to estimate the recreational values for international tourists (despite them being an increasingly relevant group in the park), as all visits from international tourists were one-off events. Furthermore, as individual TCM is unable to value recreation beyond current visitation levels, it might not be particularly useful for informing counterfactual planning for the economic value of nature-based recreation in an alternative state of the park [75].

An assessment using TESSA (v. 1.2), on the other hand, has the advantage of being capable of estimating the net consequences of a particular action (e.g., improving facilities) for the delivery of ecosystem services related to recreation, which is often the question of greatest interest to decision-makers (see [18]). Furthermore, it can be used to elicit recreational values for all visitors, regardless of their visitation rates. This approach, however, cannot capture the quality of the ecosystem services related to recreation.

In this sense, the results of the two techniques are complementary. Furthermore, they use similar data, as a standard TCM questionnaire would have captured all the information required for the TESSA (v. 1.2) method. However, if an assessment of an alternative state of the park is required, we could combine both techniques into a single survey protocol by inserting an additional question: "Imagine if the site was (specify the details of the alternative state). Would you come here for recreation?" (see Section 2.3.6.).

Overall, our results estimate the major economic benefits derived from recreation in a protected area with substantial cultural assets. This suggests that investing in natural capital (a key element of the green economy agenda in Myanmar) in the form of environmental conservation in areas of high cultural value can indeed create spaces that provide substantial economic benefits. This can have important ramifications for the ongoing efforts to transition to a green economy (Section 1). Our results also offer information about the preferences and spending behavior of visitors disaggregated by group, which is useful for improving the recreational potential and service delivery in the park. This type of information can be extremely useful for a country such as Myanmar that seeks to become a major tourism destination.

However, even though these two techniques are standardized and can be used across different protected areas and land uses with recreational potential, the actual economic value of ecosystem services related to recreation can be site-specific due to the heterogeneity in preferences, site characteristics, and broader recreational opportunities [76]. For example, the high visitation rates of the park by domestic visitors can be possibly explained by its proximity (and hence low travel costs) to Bagan, which is one of the major tourist attractions in Myanmar. As a result, the estimated consumer surplus is not likely to be the same for a similar site with considerably different accessibility. This might preclude a benefit transfer to other parks in Myanmar (see [77,78]). This, therefore, stresses the importance of a practical method or approach for the site-based economic valuation of ecosystem services related to recreation.

Finally, despite the useful practical information derived from this study, there are some limitations. First, our study did not distinguish clearly between the values of the different cultural ecosystem services or the characteristics of the landscape providing these services. Both the individual TCM and TESSA (v. 1.2) methods provide an aggregate value of these services, reducing the explanatory power of the results. To achieve a more fine-grained assessment, it would be necessary to employ techniques like participatory mapping with a clear distinction of the different cultural services and landscape elements [40]. Second, despite eliciting the overall economic value of the ecosystem services, we did not capture information to inform some of the management practices in the park, such as the necessary infrastructure or pricing mechanisms. This would require additional techniques, such as choice experiments or contingent valuation methods. Finally, as this is a study for a single park (and considering the growing importance of tourism within the national green economy and sustainable development agendas), more studies should be performed in other parks of the country that have very different characteristics from Popa Mountain National Park (Section 2.1).

5. Conclusions

Our study provided insights into the application of the individual TCM and the TESSA (v. 1.2) approach for valuing ecosystem services related to recreation at a protected area in Myanmar. We have demonstrated that both methods can be applied relatively rapidly and inexpensively. Due to their operational characteristics, both are fit to be used in contexts that lack resources and the capacity to employ more sophisticated techniques to valuate such ecosystem services. Furthermore, they can be a good option for follow-up surveys to monitor any potential changes in ecosystem services from recreation. This makes them ideal in countries like Myanmar that face a rapid increase in tourism but lack the extensive capacity and resources to make well-informed decisions.

It should be mentioned that the individual TCM and TESSA (v. 1.2) methods capture different components of ecosystem services from recreation due to their different embedded valuation mechanisms. Thus, even though they use similar data, their results cannot be compared directly. We recommend that both techniques be combined into single survey protocols; this would be a relatively straightforward process considering that both techniques use similar underlying data. The TCM and TESSA (v. 1.2) methods estimate the value of the benefits of a visit and the impact on the economy (in terms of visitor spend), respectively. Both types of information are sought after from decisionmakers for different purposes and used in different ways. For example, the value of the benefits obtained from a visit (derived from TCM) indicates the societal benefits from recreation. This can be harnessed to inform the utilization of public sector funding or national government intervention in the recreation sector. On the other hand, the impact on the local economy (derived from the TESSA v. 1.2 method) indicates how people who live or work locally benefit economically from recreational visitor spending. This is useful information for businesses and local administrations or governments, to help support the case for private sector funding, or for funding by local governments. Hence, by harnessing the merits of both methodologies, their combined results can produce a wealth of information that will be valuable for management and decision-making in protected areas and other land uses with recreational potential.

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