Determination of Carrying Capacity Estimates of Ecotourism Attractions in the Quezon Protected Landscape, the Philippines

Gerald T. Eduarte[1], **Rogelio T. Andrada II**[2*], **Marco A. Galang**[2],
Pastor L. Malabrigo Jr.[3], **Cristino L. Tiburan Jr.**[2], and **Jan Joseph V. Dida**[2]

[1]Graduate School
[2]Institute of Renewable Natural Resources
[3]Department of Forest Biological Sciences
College of Forestry and Natural Resources
University of the Philippines Los Baños, College 4031 Laguna, Philippines

Protected areas (PAs) are becoming extremely important ecotourism destinations. These areas are at risk from uninformed and unregulated visitors who can cause pollution (air, noise, water, *etc.*) and alteration of the natural ecosystem processes. An effective ecotourism planning and management approach should consider and define an optimum threshold level for the use of ecotourism attractions while maintaining a sound biophysical and social environment. Although carrying capacity is important in regulating visitor influx, the application and practice of this concept are not currently being observed in Malabayabas Forest, Pinagbanderahan Peak, and Pinagbanderahan Trail, which are the main ecotourism destinations of the Quezon Protected Landscape (QPL) in Atimonan, Quezon Province, the Philippines. This paper focuses on the carrying capacity estimates of these attractions considering site-specific physical, biological/ecological, and social factors. Data on visitation characteristics were collected through a questionnaire-based survey administered to 82 respondents in the months of August and December 2015. The real carrying capacity (RCC) estimates were found to be 289, 25, and 951 visitors for Malabayabas Forest, Pinagbanderahan Peak, and Pinagbanderahan Trail, respectively. The results demonstrated that actual visitations in these attractions are still below the carrying capacity estimates. However, there is still a risk for congestion and overcrowding, particularly during high visitation periods; without these thresholds, the influx of visitors poses serious pressure on the natural resources as well as ecological balance, which may lead to subsequent degradation of the PA. The study results can be used as an input in crafting a responsive visitor management program for QPL. Likewise, it can serve as a model in the determination of carrying capacity for other ecotourism sites in the country.

Keywords: protected area, resource management, tourism management, visitor management

INTRODUCTION

PAs are quickly becoming extremely important ecotourism destinations because they provide an array of recreational activities and opportunities to learn more about nature's processes, services, and importance. These include some of the well-managed natural and cultural resources that are now increasingly recognized by the public as they provide unique recreational experiences that balance urban living. These inherent characteristics have contributed to the widespread and heightened interest in PAs as ecotourism

destinations. Additionally, immense support – in the form of funds – are in place in developing implementation systems towards this initiative (Jenkins and Pigram 2005).

Tourism destinations generally show increasing trends of visitation over time, contributing a large amount to the country's economy. In the Philippines, the Department of Tourism in 2018 reported that the number of tourists who visited the country is consistently increasing. In fact, the total visitor arrivals (both inbound and domestic) to the country increased by approximately 48% from 2014–2018 with 4,833,368 and 7,168,467 total visitors, respectively. This increase is equivalent to a 12.7% share of the country's gross domestic product with a 10.2% growth rate within the five-year time period (PSA 2019).

Currently, there are 240 PAs listed in the National Integrated Protected Area System (NIPAS) Law of 1992 or Republic Act (RA) 7586, the national policy for the management and conservation of the Philippines' PAs. Moreover, there are areas that have been proclaimed protected not under NIPAS but by virtue of presidential decrees and/or executive orders. These PAs are currently at various stages of undergoing an expansion of use to not only include protection and conservation activities but also educational and recreational undertakings.

As the ecotourism industry gains attention, more and more areas have been established for public use and appreciation, thus the need for its protection (Manning 2013). These areas include PAs, which are prioritized based on their management objectives for the conservation of biodiversity to achieve long-term advantages for related ecosystem services (Salemi *et al.* 2019). Without overexploitation, it can generate more benefits in terms of improving climate, provision of clean water and air, storage and supply of freshwater, biodiversity, and local community development (Masum *et al.* 2013). In contrast, abuse of these areas may disturb natural processes and resources (*i.e.* flora, fauna, soil, *etc.*), and can cause unacceptable crowding and visitor conflict (Hammitt *et al.* 2015). A paradigm resulting from these realizations was the concept of carrying capacity, which allows optimum utilization of an area without adverse impact on its quality. The concept of carrying capacity emerged from the field of range management as a framework through which use limits could be justified (Manning 2011). More so, the concept was first developed for scientific application in the fields of fisheries, wildlife, and range management (Hadwen and Palmer 1922; Odum 1971; Visser 2017). The concept has an especially rich tradition, which has been carried out concerning different aspects that predate its application to parks and PAs (Manning 2013). Some of the places in which carrying capacity has been applied are marine national parks (Davis and Tisdell 1995; Leujak and Ormond 2007), as well as tourist resorts and beaches

(Saveriades 2000; Da Silva 2002; Silva *et al.* 2007). In recent years, studies on recreational carrying capacity related to PAs are scarce, particularly in areas that do not promote their use for recreational purposes (Viñals *et al.* 2016; Ly and Nguyen 2017). Some of the applications of carrying capacity specific to PAs and national parks include the work of Amador *et al.* (1996), which examined areas for public use in the Galapagos National Park, and Sayan and Atik (2011), which estimated the recreational carrying capacity of Termessos National Park.

The concept of carrying capacity has received growing attention due to the increasing pressure on our natural environment, as well as being seen as an essential element in achieving conservation and sustainability (Marion 2016; Chougule 2011; Prato 2001). In its most generic form, the concept refers to the degree and type of use that can be accommodated in parks and related areas without unacceptable impacts to resources and/or quality of the visitor experience (Sayan and Atik 2011). Additionally, it is described as the ability of a system to support an activity or feature at a given level depending on different site-specific factors (Calanog 2015). The World Tourism Organization defined the concept as the "maximum number of people that may visit a tourist destination at the same time, without causing destruction of the physical, economic and socio-cultural environment, and an unacceptable decrease in the quality of visitors' satisfaction." As used in ecotourism and outdoor recreation management, carrying capacity means the extent of use that a particular attraction or outdoor recreation area can sustain without significant degradation (Schneider *et al.* 1978; Lime and Stankey 2019).

The Philippines is given a positive boost towards mainstreaming the operationalization of the carrying capacity concept and principles because of the enactment of RA No. 11038 of 2017 or the Expanded NIPAS Law, more commonly known as ENIPAS. Provisions in the law will require PAs to devise a management plan that is more responsive and relevant to the current trends in PA management. Furthermore, the law recognizes the need for PAs to be financially self-sustaining with regard to their conservation activities.

The application of carrying capacity principles in ecotourism management was developed from the original concept of ecological productive capacity, where the main premise is a set of environmental conditions that can support a population of organisms in an ecosystem. Studies on ecotourism carrying capacity usually consider the physical condition of the site in determining thresholds (Viñals *et al.* 2016). This study, however, includes the quantitative and qualitative aspects of both the site and its users in estimating carrying capacity for the three main ecotourism attractions: Malabayabas Forest,

Pinagbanderahan Peak, and Pinagbanderahan Trail located inside the QPL in Atimonan, Quezon Province, Philippines. It is a PA known for its unique forest and landscape formation. To date, the use of these sites for ecotourism activity is not guided by information on its carrying capacity, hence this study. The determination of this standard for some of its attractions will help in the optimization of its use as an ecotourism site. The aims of this paper were to 1) aid decision-makers in the management of the PA by providing an indicative value or limit on the number of visitors that can be accommodated in sites inside QPL that are devoted to ecotourism activity, and 2) examine the applicability of the carrying capacity estimation technique recommended for Philippine PAs by looking into the pros and cons of its use.

METHODOLOGY

Study Area
The QPL is geographically located within 121°47'00" to 121°50'00" east longitude, and 13°58'30" to 14°01'00" north latitude. It lies about 170 km southeast of Metro Manila, the capital of the Philippines (Figure 1), and straddles three municipalities of Quezon Province: Atimonan in the northeast, Pagbilao in the west, and Padre Burgos in the southeast. QPL has a number of different ecotourism sites: EME Road (popularly known as Bitukang Manok), Buenavista Spot, Cueva Santa, Nalubog River, Amao Falls, Lagoon, Picnic Area, Quezon Memorial Hill, Malabayabas Forest, and Pinagbanderahan Trail and Peak. Each site offers a different ecotourism opportunity and engagement which can enhance the visitor experience and satisfaction in QPL.

The QPL is one of the PAs that are classified under category IV of NIPAS. It is managed by the Protected Area Management Board (PAMB), which was organized and operationalized in 1995. The land cover inside QPL is classified as tropical rainforest dominated by dipterocarp species and supports unique forest formations like a stand of malabayabas (*Tristaniopsis decorticata*), a tree endemic to the Philippines. It is also rich in biodiversity and serves as an educational laboratory for local academic institutions such as the Southern Luzon State University and the University of the Philippines Los Baños. Furthermore, QPL has gained exceptional popularity because of a
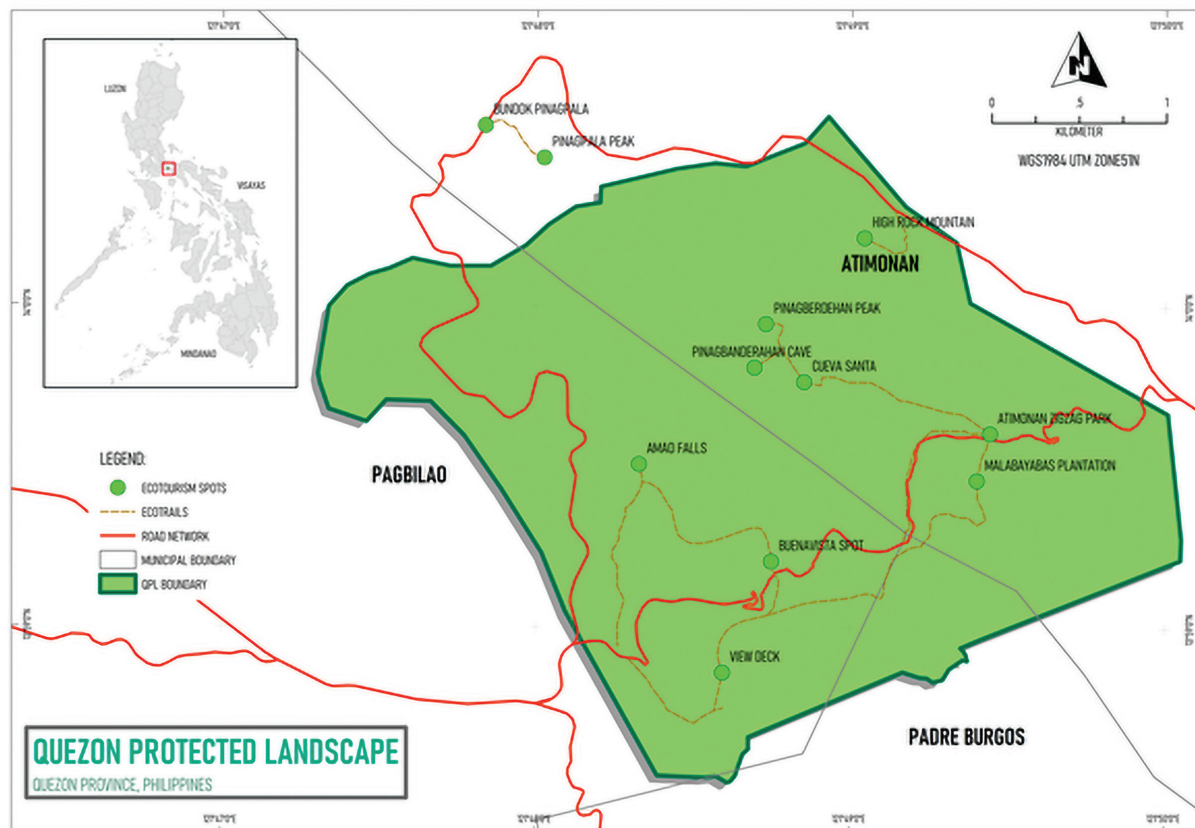

Figure 1. The location and boundary of QPL, Quezon, Philippines.

mountain peak that gives a stunning panoramic view of Pagbilao Bay.

Carrying Capacity Estimation

Several frameworks operationalize the concept of carrying capacity in managing ecotourism and outdoor recreation areas. The determination of carrying capacity values in this study involves multi-step calculations based on certain assumptions and existing conditions at the QPL. The values obtained are limited to those attractions that are established and are currently being popularly enjoyed by visitors – namely, the Malabayabas Forest, Pinagbanderahan Peak, and Pinagbanderahan Trail.

The physical, biological/ecological, social, and economic conditions of the site were assessed. Three types of carrying capacity standards (basic, potential, and RCC) were calculated based in part on the method used by Cifuentes Arias (1992) and Alampay and Libosada (2003). These methods are adopted and are being recommended by the Ecosystems Research and Development Bureau for computing carrying capacity estimates in Philippine PAs (Calanog 2015). Generally, the method is based on the regional or planimetry method of assessing ecotourism carrying capacity (Shi *et al.* 2015) and site-specific factors that reduce the level and quality of visitation. In this method, the carrying capacity is dependent on the geographical area of the ecotourism site and the tourist use area as influenced by various factors. However, other factors such as visitor's behavior influencing carrying capacity is not covered by this study. The simplicity of this method made it widely used (McCool and Lime 2001) and is now better known as the Boullon's carrying capacity equations (Quicoy and Briones 2010). The equation seems to be limited in terms of adaptability and flexibility required in various conditions on the local level. Thus, the study incorporated elements from the limits of acceptable change framework (Manning 2013) where the manifestation of visitor impacts is assessed, and the quality of experience and extent of resource protection (Hof and Lime 1997) are considered.

The basic carrying capacity (BCC) is defined as "the maximum number of visitors that can fit into a defined space, over a particular time." In this study, there are two working definitions of BCC as it will cover both stay area and path/trail walks. The first definition of BCC refers to the maximum area a site can be occupied in a day. It is defined by the relationship between the total area of the attraction to the standard space requirement of visitors. In this case, 1 m² is used as the standard space requirement per visitor as used in the equation developed by Cifuentes (1992) and cited by Sayan and Atik (2011). Using these as bases, BCC is calculated as:

$$BCC_1 = \frac{Available\ area\ for\ use\ by\ visitor\ (sq.m)}{Average\ visitor's\ standard\ space\ requirement\ (sq.m)} \quad (1)$$

The second definition of BCC refers to the relationship of the number of groups that can fit in the path multiplied by the number of persons per group. The term is expressed in the following equation:

$$BCC_2 = (NG)\ x\ Number\ of\ person\ per\ group \quad (2)$$

where NG is equivalent to the total distance of the path divided by the average distance covered per group.

Secondly, the potential carrying capacity (PCC) is also calculated. It refers to the maximum limit of visits that can be done physically in a day and is expressed as the relationship between the hours of operation for the attraction and the time needed or spent at the site for each visit:

$$PCC = BCC\ x\ RC \quad (3)$$

where RC is the rotation coefficient, defined as the relationship between the total number of hours the attraction is open for use and the average number of hours an attraction is used by visitors. It is expressed as:

$$RC = \frac{Total\ no.\ of\ hours\ an\ attraction\ is\ open\ for\ use}{Average\ no.\ of\ hours\ an\ area\ is\ used\ by\ visitors} \quad (4)$$

Thirdly, the RCC is also computed. It is defined as the maximum permissible number of uses of an area considering limiting factors. The equation for this variable is expressed in percentage as:

$$RCC = PCC\ X\ \frac{100 - Lf_1}{100}\ x\ \frac{100 - Lf_2}{100}\ x\ \frac{100 - Lf_n}{100} \quad (5)$$

The limiting factors are closely linked with the site and these affect the level and quality of visitation. It is represented by physical, biological/ecological, social, and economic variables that are expressed as:

$$Lf_{(1,2,3...n)} = \frac{M_{(a,b,c,...n)}}{MT}\ x\ 100 \quad (6)$$

where $Lf_{(1,2,3,...n)}$ represents the limiting factors, $M_{(a,b,c,...n)}$ is the limiting magnitude of the factor, and MT is the total magnitude of the factor.

Trail data (trail length and width) were collected from a recent study conducted by the Community Environment and Natural Resources Office (CENRO) of Pagbilao. Data on visitation characteristics were collected using a questionnaire-based survey, administered in August and December 2015. Respondents (82 visitors) were identified

through purposive sampling. To minimize bias, only one respondent was chosen to participate from a visitor group by asking who among the group is of legal age and had recently celebrated his/her birthday. On the other hand, visitors who came individually were readily asked to participate and answer the survey questionnaire.

RESULTS

This study focuses on two major classifications of attraction in QPL: trails (Malabayabas Forest and Pinagbanderahan Trail) and stay areas (Pinagbanderahan Peak). Information for these attractions such as average visitor group size and the crowding tolerance of the visitors were assessed prior to the computation of carrying capacity estimates using the data gathered from the questionnaire survey. Based on the survey, the average number of individuals per group is 12 for Malabayabas Forest and 30 for the Pinagbanderahan Peak, which – according to the respondents – is based on the limit that an ecotourist guide can accommodate as practiced on-site. These group size values are influenced by the limitation in the number of trained available ecotourist guides in QPL. Additionally, the average recreation duration (ARD) of groups was gathered to account for the maximum possible utilization capacity of an attraction per day. It was found that the ARD for Malabayabas Forest, Pinagbanderahan Trail, and Pinagbanderahan Peak are 15, 30, and 102 min, respectively. This information was utilized for acquiring carrying capacity estimates for each attraction.

Malabayabas Forest
Theoretically, the trail to the Malabayabas Forest can fit 168 visitors (14 groups with 12 individuals) simultaneously in its 252-m trail length considering a 1.5-m linear distance per visitor. Thus, BCC is calculated as:

$$BCC_{2(mf)} = (252 \text{ m trail length} / 18 \text{ m linear length of group}) \times 12 \text{ visitors}$$

$$= 168 \text{ visitors}$$

Moreover, a visitor can theoretically visit Malabayabas Forest 48 times during the 12-h recreation period per day assuming a 15-min ARD once visitors arrive at the site. Thus, the rotation coefficient for Malabayabas Forest (RC_{mf}) is:

$$RC_{mf} = 720 \text{ min the Malabayabas Forest is open daily} / 15 \text{ min of ARD}$$

$$= 48 \text{ recreation visits}$$

Considering the maximum number of visitors that can fit

in the trail simultaneously and the number of recreation visits per day, Malabayabas Forest can accommodate 672 group visits or 8,064 visitors per day, which is expressed as:

$$PCC_{mf} = 168 \text{ visitors} \times 48 \text{ recreation visits}$$

$$= 8,064 \text{ visitors or } 672 \text{ group visits}$$

However, these visits (individual or group) per day are practically affected by various factors that are dictated by the current condition of the site. Thus, these influential factors (limiting factors) based on the survey and ecological aspects affecting the visitation of ecotourism attractions are included in the computation. It is important to note that these factors are reflected as the magnitude of limits, which means that the factor is limiting when the computed value is close to zero. On the other hand, values that are greater than or equal to one show little to no limitation. These factors will be used for the computation of the RCC of the attractions being examined as explained further below:

Typhoon-caused closure. According to the Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA), an annual average of 20 tropical cyclones (TCs) enter the Philippine Area of Responsibility, with about eight or nine traversing the landmass of the country. It is ideal if there were studies that provide information on the average recovery period (number of days) of a particular site after a TC, which should be used to accurately calculate how the typhoon is limiting the visitation in the ecotourism site. Nonetheless, this study utilized the number of TC crossing the country as typhoon days, which is expressed as:

$$Lf_1 = (9 \text{ typhoon days} / 365 \text{ days}) \times 100 = 2.47\%$$

Accessibility. The number of hours the attractions are open daily is 12 h, which is from 5:00 AM to 5:00 PM. However, visitors are only allowed to enter until 3:00 PM to which the remaining 2 h are allotted for the return to the jump-off point or the visitor center. Thus, the accessibility limiting factor is calculated as:

$$Lf_2 = (10 \text{ recreation h} / 12 \text{ h the attractions are open}) \times 100 = 83.33\%$$

Ecotourist guide availability. The number of registered ecotourist guide in QPL is eight. Each recreation visit, either group or individual, must be accompanied by an ecotourist guide. However, on a daily basis, an average of six ecotourist guides are available to accommodate visitors. Thus, the ecotourist guide limiting factor is calculated as:

$$Lf_3 = (\text{six available ecotourist guide per day} / \text{eight registered tourist guide}) \times 100 = 75\%$$

Crowding. The number of persons simultaneously accessing the attraction can be a huge factor that affects visitation in ecotourism sites. Based on the conducted survey, the minimum and the maximum number of individuals that should be in one place should be zero and 500, respectively. On the other hand, the acceptable number of individuals to avoid overcrowding and maintain recreation enjoyment is 59. Thus, the crowding limiting factor is calculated as:

Lf_4 = (59 individuals / 500 as maximum number of individuals) x 100 = 11.80% or 12%

Finally, the RCC_{mf} for the trail to the Malabayabas Forest is 289 visitors or 24 group visits per day by considering the four limiting factors converted into coefficients expressed as:

RCC_{mf} = PCC x (100 – Lf_1) / 100 x (100 – Lf_2) / 100 x (100 – Lf_3) / 100 x (100 – Lf_4) / 100

RCC_{mf} = 8,064 x (100 – 2.47) / 100 x (100 – 83.33) / 100 x (100 – 75) / 100 x (100 – 11.80) / 100

= 289 visitors or 24 group visits per day

Pinagbanderahan Trail

The important consideration in computing the carrying capacity estimates of Pinagbanderahan Trail is almost similar to Malabayabas Forest, except for the values of site-specific factors such as the trail length of 1,659 m, average number of individuals per group of 30 visitors, and the 30-min ARD of visitors. The remaining limiting factors are the same; thus, its carrying capacity estimates are computed as follows:

$BCC_{2(pt)}$ = (1,659 m trail length / 45 m linear length of group) x 30 visitors

= 1,106 visitors

RC_{pt} = 720 min Pinagbanderahan Trail is open daily / 30 min ARD

= 24 recreation visits

PCC_{pt} = 1,106 visitors x 24 recreation visits

= 26,544 visitors or 885 group visits

RCC_{pt} = 8,064 x (100 – 2.47) / 100 x (100 – 83.33) / 100 x (100 – 75) / 100 x (100 – 11.80) / 100

= 951 visitors or 32 group visits per day

Pinagbanderahan Peak

The first definition of BCC was used for Pinagbanderahan Peak since this is considered as a stay-area attraction. Based on the maximum area of Pinagbanderahan Peak, it was computed that it can accommodate up to 100 visitors simultaneously.

$BCC_{1(pp)}$ = (0.01 ha / 0.0001 ha)

= 100 visitors

Visitors spent 102 min of ARD in and to Pinagbanderahan Peak, which means a person can visit more than once during the 12-h visitation period per day. Thus, the rotation coefficient for Pinagbanderahan Peak (RC_{pt}) is calculated as:

RC_{pp} = 720 min Pinagbanderahan Peak is open daily / 102 min ARD

= 7 recreation visits

With this, 706 visitors can potentially visit the area per day. However, this number of visitors may be theoretically possible, but – given the limiting factors at the site – this cannot be accommodated. Thus, its PCC_{pp} and RCC_{pp}, – considering the same limiting factors used for Malabayabas Forest and Pinagbanderahan trail – is computed as:

PCC_{pp} = 1,106 visitors x 7 recreation visits

= 706 visitors

RCC_{pp} = 706 x (100 – 2.47) / 100 x (100 – 83.33) / 100 x (100 – 75) / 100 x (100 – 11.80) / 100

= 25 visitors per day

DISCUSSION

The carrying capacity estimates computed in this study are maximum threshold values (Table 1). Extra care should be observed when interpreting and applying these values in guiding ecotourism activity and visitor management strategies. Furthermore, it is important to remember that these values are not permanent and can change in accordance with changes in the conditions of the ecotourism attractions, the crowding tolerance of visitors, and the other assumptions based on the management objectives of QPL. Thus, it is important to periodically update the carrying capacity estimates as deemed necessary by QPL managers.

Table 1. Carrying capacity estimates for each attraction.

Ecotourism attraction	Carrying capacity estimates (visitors per day)		
	BCC	PCC	RCC
Malabayabas Forest	168	8,064	289
Pinagbanderahan Trail	1,106	26,544	951
Pinagbanderahan Peak	100	706	25

BCC – basic carrying capacity; PCC – potential carrying capacity; RCC – real carrying capacity

As the methodology suggests consideration of characteristics (physical, biological/ecological, and social) of the area, the impact on the natural vegetation caused by tourism and recreation use has been excluded as corrective factors in the equations. This is because none of these attractions are located in areas where important ecological processes occur (*i.e.* mating of fauna, migration, *etc.*). However, it can be noted that visitors' impacts are manifested in the study sites as evidenced by the formation of social trails on certain locations where the Pinagbanderahan trail becomes muddy. Furthermore, evidence of vandalism on trees and rocks along the trail have been observed. The most common form of vandalism is writing and other marks made by visitors. The frequency of these visitor impacts is minimal and does not influence the quality of visitor experience.

Total visitors to the Malabayabas Forest and Pinagbanderahan Peak from 2012–2015 was 11,648, which means an average of 2,912 visitors per year and eight visitors per day. The results demonstrated the actual visitation (eight visitors per day) in these ecotourism attractions are still below the carrying capacity estimates for each attraction (Malabayabas Forest with 289 visitors; Pinagbanderahan Trail with 951 visitors; and Pinagbanderahan Peak with 25 visitors). However, as it gains popularity, the influx of visitors can put serious pressure on these resources, which may lead to subsequent degradation (Aranguren *et al.* 2008). Uninformed and uncontrolled visitors can cause pollution (air, noise, solid waste, aesthetic pollution, water, *etc.*), which can affect the ecology of the area (Liu *et al.* 1987). The natural and cultural characteristics of these ecotourism attractions should be maintained within the acceptable condition. It is also reported that there is still congestion of visitors in QPL, particularly in the peak season between March–April when daily visitors reached 450–500 in the last five years.

The values computed in this study are considered limiting because they only reflect the extent of visitor presence in each attraction during the study period between August–December. The budget, time, and logistical constraints prevented a more comprehensive data collection, which can provide a better picture of visitor presence in QPL. Ideally, in tourism areas, data gathering should be done for at least one year so that the lean and peak seasons of visitation are captured. In the QPL's case, religious visitors flock to the area during the Catholic Lenten Season, which causes the peak visitation to occur from March–April. Conversely, due primarily to the monsoon, visitation is at its lowest between September–November. This explains the small sample size obtained and analyzed in the study. Thus, the results are interpreted only for this segment of QPL visitors.

Furthermore, the study does not provide an accurate indication of the behavior of the visitors in the attractions. Thus, a separate study needs to be conducted to monitor the behavior of visitors as they enjoy the attractions at QPL. Another important aspect to note is the occurrence and frequency of deviant behavior from the visitors. Such behavior is among the clear manifestations of visitor impacts and, thus, may influence the carrying capacity limits based on the frequency and extent of this behavior. This information is important inputs in refining carrying capacity under the limits of an acceptable change framework.

CONCLUSION

Despite the indication that carrying capacity estimates are not consistently being reached throughout the year in QPL, future studies have to build on the results in order to address the gaps exposed by this study. For now, the implementation and management of these carrying capacity estimates can be a base value for the existing ecotourism attractions in QPL. The balance between protection of natural and cultural resources, quality of visitation experience, and economic sustainability can be established and achieved through comprehensive carrying capacity studies (Sayan and Atik 2011).

One positive observation in this study is that the current visitation is still below the estimated carrying capacity values. However, these estimates need to be refined and should be expanded to capture more respondents and other limiting factors that were not considered in this study. Doing this will increase the accuracy and applicability of the carrying capacity estimates for future use and reference. At the very least, QPL managers can use the results of the study in crafting visitor management strategies that will even out visitation within the year to avoid congestion during peak season.

Presently, new attractions have been built or offered (herb garden, multipurpose hall, and spa services) and have started gaining popularity resulting in an increase in the annual number of visitors. Therefore, these new attractions must also be included in future carrying capacity estimation studies. Also, the Department of Environment and Natural Resource and the local government unit (municipal and provincial level) have become more active in the promotion and marketing of QPL as an ecotourism site targeting primarily domestic tourists. The main avenue for promotion is social media where webpages have been created and constantly updated to engage the public.

Given these recent developments and initiatives that QPL is implementing, visitation is bound to increase in all its

attractions. It only takes a breakthrough in one of its social media engagements for QPL to become viral and visitors will flock to it. Having a standard to monitor is vital to ensure that the ecotourism activity in this PA does not negatively affect the ecology of its environment.

The findings in this study aided in charting the path of ecotourism development in the QPL. The study identified a reference line for future carrying capacity estimates and the gaps for improvement, while at the same time providing a working base value that can guide current managers in regulating ecotourism activity in the area. With the implementation of the ENIPAS in its infancy, it will open up opportunities for QPL to build on this initiative and progress towards a better managed PA. As management bodies for Pas take shape as provided in ENIPAS, the managers and personnel who will oversee and implement various strategies must be properly oriented and trained in ensuring that all functions of the Pas are equally fulfilled. Thus, it is imperative that a group of inter-disciplinary professionals be pooled in order to cover all aspects of PA management.

In a broader sense, the techniques used in this study proved their applicability to QPL. The successful implementation of the study indicates that it can be readily replicated in other PAs in the Philippines that support ecotourism activity, as well as areas that do not have to be PAs but have issues brought about by overtourism. It highlights that the application of the carrying capacity concept to ecotourism areas can be both reactive and preventive (Sayan and Atik 2011). In order to harness the latter, carrying capacity studies must be done early in the life of ecotourism attractions in anticipation of their future popularity because this is the ultimate goal of marketing them. For PAs, anticipation is critical to achieving a balance between financial sustainability and environmental conservation (Ly and Nguyen 2017).

Also, as seen in the study, complete and comprehensive data is required to derive more reflective and relevant carrying capacity estimates. Data from all aspects – visitors, management, and resources – have to be available to capture the spectrum of limiting factors that ensure carrying capacity values are reflective of the current conditions and trends. The seasonality of ecotourism activity must be captured and reflected in the data that should be plugged into the equations. Lastly, as carrying capacity studies are implemented in other PAs, improvement of its methodology is inevitable and researchers' experience will enrich the procedures and techniques applied.

In the future, more PAs in the Philippines will allow for expanded resource use to include recreational and tourism activities as they seek to use this to achieve a degree of financial independence from funds given by donors who are traditionally attracted by research and educational activities. Similarly, the implementation of ENIPAS encourages PAs to mobilize their resources for other uses, and with this expansion comes the responsibility not to lose the fundamental pillar to which these PAs are created – conservation. Thus, the concept and principles of carrying capacity as applied to ecotourism must be put in place as an internal check to balance resource conservation and economic activity. Furthermore, the managers and future staff of PAs should be equipped with knowledge, skills, and experience in this complex endeavor.

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