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Carrying capacity assessment of the ecotourism site of day-asan, Surigao City towards sustainable ecotourism

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Abstract

Carrying Capacity is a tool to prevent and control overutilization of the tourist spots through the identification of the ideal use level of visitors who can use the site. Recently, numerous eco-tourism has been developed and the uncontrolled growth of visitors leading to overcrowding has brought immense concern for sustainable tourism. The study assessed the carrying capacity of Day-asan ecotourism area as a basis for management planning. The Limits of Acceptable Change (LAC) framework was used to assess the carrying capacity. An opportunity sampling was conducted to 182 visitors and stratified random sampling for the 206 residents using a structured questionnaire. Key Informant Interview (KII) was carried out to the members of the Barangay Council, tourism investors/operators, and staff of the local tourism staff. Results showed that the current condition of the ecotourism in Day-asan does not pose any threat to its build environment, ecology, people, and economic status of the area. The maximum number of visitors received in a day in the area is 345 spent mostly on swimming, and the calculated carrying capacity estimate is 813 visitors per day which is way higher than the maximum number of visitors received in the area in a day. The results of this study can serve as a basis for the Local Government Unit (LGU) and Surigao Tourism Office in crafting the Tourism Management Plan for the sustainability of the ecotourism site in Day-asan.

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Introduction

Ecotourism generates profits for the host communities and provides revenue for the protection and conservation of the area. It is usually an excursion to natural areas to learn the cultural and natural antiquity of the environment without altering the natural ecosystem while providing opportunities in the economy for the conservation of natural resources. When it provides a positive change in the economy, ecotourism can urge conservation and societal building however, it somehow introduces several changes to the host communities that may impact the social and economic structure of the area positively or negatively. (Hunter, 1997). Ecotourism became an integral activity in natural areas all over the world as it gives an opportunity to the visitors to ascertain the significance of conserving biodiversity and local culture. The International Ecotourism Society (2020) defined ecotourism as environmentally responsible tourism to natural areas that encompasses understanding and education to the travelers, and at the same time, sustain the well-being of local people while conserving the environment. It is said that ecotourism influences to enhance the natural environment where can funds be generated for the use of conservation and protection of the natural resource, to preserve the culture and history, as well as to set limits for sustainable use (Okech & Bob, 2009).

Carrying Capacity is a tool to prevent and control overutilization of the tourist spots through the identification of the ideal use level of visitors who can use the site. Recently, numerous ecotourism has been developed and the uncontrolled growth of visitors leading to overcrowding has brought immense concern for sustainable tourism. In a global context, carrying capacity developed functional management in terms of economical, ecological, and agricultural aspects. Whereas the local context of carrying capacity mostly applies such tools for economic and ecological aspects, specifically, tourism carrying capacity. Since tourism is booming in the Philippines, carrying capacity is important in planning towards a sustainable and lasting ecotourism site (H.A. Adorado, personal communication, September 2020).

The concept of carrying capacity is engaged in an unusual broad-spectrum of studies and arguments, and it has been compellingly criticized by different fields (Hobbs *et al*., 2008). The study of Butler (1996) argues that utilization of such instruments gives instruments rise to imperceptibly incremental advancement and alters the profile of the tourists with regards to those more exposed to higher usage. However, it is essential for the concept of carrying capacity to be incorporated in the preparation of tourism and environmental sustainability regardless of challenges in measurement as introduced by administrations and other developers. There are many aspects of carrying capacity depending on focus. However, this study focuses on the four aspects of carrying capacity, the physical, ecological, social, and economic carrying capacity. The purpose of this research is to understand the current conditions of eco-tourism of Day-asan that will serve as an essential instrument for strengthening tourism and sustainability of the area.

Siargao which is part of the Province of Surigao del Norte became popular as the surfing capital of the Philippines. Because of this, the area became one of the favorite tourist spots in the country. Besides surfing, Surigao offers an array of natural wonders, there are the Silop multi-caves, Mabua Pebble Beach, Basul Island hopping, Lake Mainit, Rock Mineral Museum, and many others. But there are still a lot of people or travelers who don't know that this off-the-beaten-path Surigao City has many other attractions to offer. One of them is Day-Asan Floating Village which is very accessible from the city center. This is one of the reasons why Day-asan Ecotourism is chosen as a study site.

Though many other tourist sites are surrounding Surigao City, the Day-as an is the nearest and has the easiest access. Most tourists prefer to stay in Day-asan where they could experience all in one what all other tourism spots can offer. The results of this study can contribute to the crafting of policies of the Barangay Local Government of Day-asan as well as to the tourism plan of Surigao City for the sustainability of the existing and the proposed ecotourism sites in the city and within the province.

Material and methods

Study Area

Day-asan is one of the barangays in Surigao City, the province of Surigao del Norte in the Caraga Region of Mindanao which belongs to cluster C Rural Mainland under coastal areas which can be travelled for about two miles from the city proper by land and sea transportation within 30 minutes or so (Fig. 1).

The primary livelihood of the area's inhabitants is fishing and aquaculture. Day-asan is a booming ecotourism that offers a water play area for kids with a pool area and water slide, kayaking, island hopping, sightseeing, floating cottages for relaxing, snorkeling, and many more. Day-asan Floating Village is a community of people living whose livelihood depends on fishing and wood picking. They inhabit the vast mangrove protected area of Barangay Day-asan erecting houses over shallow waters or on top of mangrove itself using available woods as posts to keep their commune above waters. Some used rocks and stones - from nearby mining concession as the foundation.

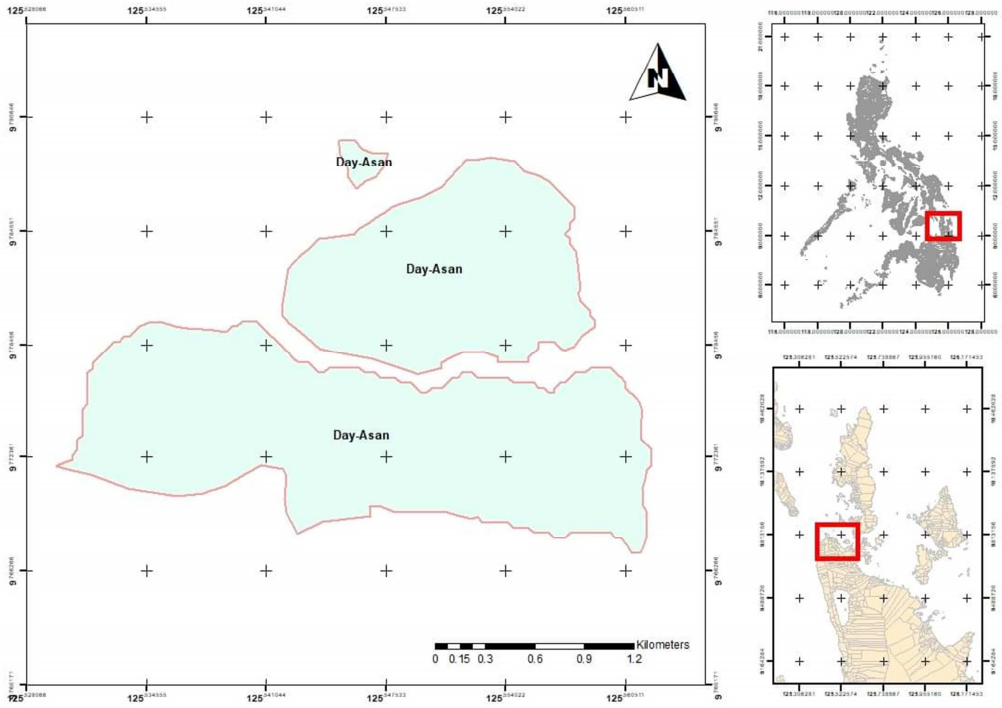

Fig. 1. Map of the Study Area.

Data Gathering

Key Informant Interview (KII) was applied to get data on the management measures and current and potential tourism activities. Staff from the tourism management office, tourist guides, Barangay Officials, boatmen were interviewed using a guided questionnaire to get the management measure implemented in the area for the protection and conservation of the tourism site. While the managers/owners of the floating cottages were interviewed to get data for the current and potential tourism activities. For the data used in the calculation of the carrying capacity, different groups were interviewed. The first was the residents of the Barangay Day-asan through a random survey of the representative of the households. While for the tourists, several means were done to complete the 182 participants.

The GIS-based analysis adopted from Faiz and Komalasari (2020) was used in the measurement of the total area of each tourism site. While, the data that was used in the limiting factors (e.g. rainfall, strong winds, typhoon, accessibility) were from the secondary data, from the PAGASA website (www.bagong.pagasa.dost.gov.ph), while the extreme sunshine was adopted from Calanog (2015) which is 4 hours (11 am–3 pm). For the swimming

area, the standard area for swimming per person was adopted from WTO (2015), which 30 sq. m. The standards for snorkeling of 150 sq.m. was adopted from Pangemanan *et al*., 2012.

Carrying Capacity Calculation

In calculating the carrying capacity, the Boullon's Carrying Capacity Mathematical Model (BCCMM) was used. The Limit of Acceptable Change (LAC) framework was considered in taking the standards to be used in the calculation. 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). There are three types of carrying capacity standards, Basic Carrying Capacity (BCC), Potential Carrying Capacity (PCC), and Real Carrying Capacity (RCC). Both BCCMM and LAC is measured at three degrees: BBC, PCC, and RCC following the formula below;

1. First level: Basic Carrying Capacity (BCC)

$$BCC = \frac{Area\ used\ by\ visitors\ (sq.m.)}{Average\ visitor's tandard\ (sq.m.)}$$

2. Second level: Potential Carrying Capacity (PCC) $PCC = BCC\ x\ RC$

Where,

$$RC = \frac{Total\ no.of\ hours\ a\ specific\ area\ is\ open\ for\ use}{Average\ no.of\ hours\ an\ area\ is\ used\ by\ visitors}$$

3. Third level: Real Carrying Capacity (RCC)

$$RCC = PCC\ x\ \frac{100 - Lf1}{100}\ x\ \frac{100 - Lf2}{100}\ x\ \frac{100 - Lf3}{100}\ x\ \frac{100 - Lfn}{100}$$

$$Limiting\ Factors\ (Lf\ 1,2,3\ \ldots n) = \frac{M\ (a,b,c\ \ldots n)}{MT}\ x\ 100$$

Where,

M(a,b,c,n) = limiting magnitude of the factor/variable

MT = total magnitude of the factor/variable

$$RCC = PCC\ x\ \frac{100 - Lf1}{100}\ x\ \frac{100 - Lf2}{100}\ x\ \frac{100 - Lf3}{100}\ x\ \frac{100 - Lfn}{100}$$

Result and discussion

Current Tourism Activities and Status of Day-asan

For those who wanted to visit Day-asan, an ecotourism site for relaxing, bonding, and de-stressing, the travel agencies in Surigao City are offering day tours. These travel and tours agencies have linkage with the local tourism office of Day-asan for mangrove tours, kayaking, fishing, and swimming at some beaches in the area.

The mangrove excursion will take about two hours around the area wherein will allow the visitors to reap sea grapes in which the area is abundant (Fig. 2). There are also designated areas for a photoshoot and of course snorkeling in which visitors will be able to see the fascinating coral reef in the area. The Day-asan ecotourism site has beach shores and islets where the visitors can do a picnic, these are the Tanghanuhan island, Dapya island and sandbar, Tenente beach, and Berok beach (Fig. 3). Currently, there are four floating cottages installed that offer overnight stay for those who wish to do night swimming, diving, videoke, and dining. This allows the visitors to witness beautiful and spectacular sunrise and sunset in the area.

The morning breeze also in the area is so enticing, very relaxing, and will totally takes away stress. These floating cottages have exclusive swimming pools wherein it is properly fenced and safeguarded for the safety of those who wanted to have night swimming. The diving area was also constructed in one of the floating cottages for recreational purposes. It is just about a five-meter high diving board constructed in a safe manner wherein each visitor can do the diving or jumping one at a time.

Fig. 2. The vast mangrove forest in Day-asan.
Source: https://businessmirror.com.ph/2021/03/13/explore-surigao-citys-island-mangrove-getaway-of-day-asan/

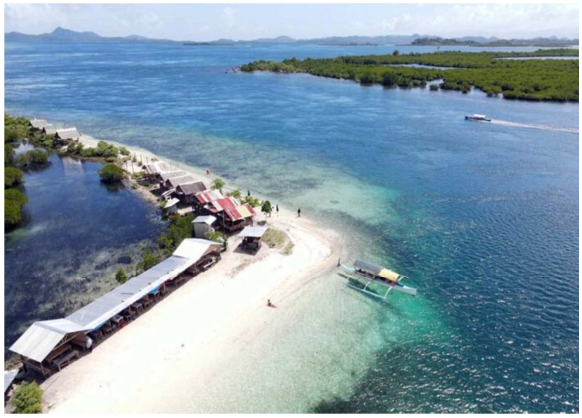

Fig. 3. The Berok beach, the known white sand beach in Day-asan.

Source:https://businessmirror.com.ph/2021/03/13/explore-surigao-citys-island-mangrove-getaway-of-day-asan/

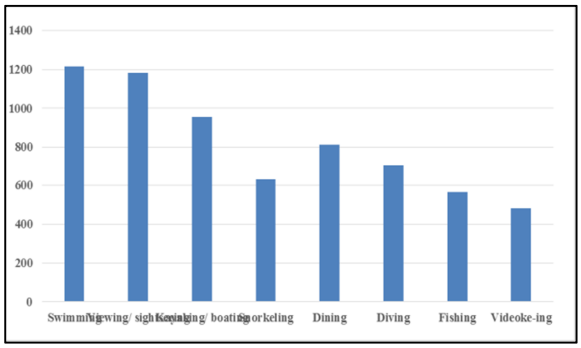

Fig. 4. Activities in Day-asan tourist sites ranked based on enjoyment.

In terms of the visitor's preference according to the current activities, they were asked to rate their most preferred activity in visiting the area (Fig. 4). The topmost activity that the visitors enjoyed much is the swimming, followed by viewing/sightseeing/ mangrove tour, then boating/kayaking, dining, diving, fishing, snorkeling, and the last one is videoke.

Swimming activities as an intervention program was proven to be effective in various impairments (Declerck, *et al.*, 2016). This is probably one of the reasons why mostly of the visitor preferred swimming because aside from the fun it can provide to the visitors; it is also a form of exercise that can enhance one's physical health.

The tourists were asked their level of satisfaction with the characteristics of ecotourism sites in Day-asan. Presented in Table 1 below were their responses. The mean of the responses in all of the characteristics in the area ranges from 4.23-4.47 which provides a qualitative description of very satisfied. The area accessibility has the highest mean, this goes to show that this is one of the major reasons visitors choose Day-asan when in Surigao City because it is very accessible. This result conformed to the study of Quicoy and Briones (2010) in Batangas that the area accessibility is the topmost reason why the area is chockfull with tourists.

Table 1. Satisfaction on the characteristics of Day-asan Ecotourism.

Characteristics at Day-asan Tourist spots	VU	U	N	S	VS	Mean	QD
Legislation (rules and regulations)	1	2	10	79	90	4.40	Very satisfied
Location (Area accessibility)	0	1	10	74	97	4.47	Very satisfied
Information signs (direction going to the area)	1	2	10	85	84	4.37	Very satisfied
People (hospitable/ welcoming/ accommodating)	0	0	8	82	92	4.46	Very satisfied
Clean ocean water	0	5	11	85	80	4.30	Very satisfied
Concern to tourist well being	0	3	11	80	87	4.36	Very satisfied
Transportation (availability of transport to/from the area)	2	3	10	77	89	4.35	Very satisfied
Communication (availability of any mode of communication)	0	11	17	68	85	4.23	Very satisfied
Overall experience	1	0	8	76	96	4.45	Very satisfied

Legend: 1-1.80 – Very unsatisfied (VU); 1.81-2.60 – Unsatisfied (U); 2.61-3.40 – Neither (N); 3.41-4.20 – Satisfied (S); 4.21-5.0 – Very satisfied (VS)

Carrying Capacity of Day-asan Ecotourism Infrastructure using BCCMM

There is an ongoing construction of a mangrove walkway and firefly watching, pool slides, and extension of snorkeling area to add more to the current activities. The BLGU of Day-asan together with the Surigao Tourism Office has limited the activities to be offered in the area to light activities only. Activities that required adrenaline are being discouraged such as a banana boat, jetski, scuba

diving, etc. because they believed that it could destroy the ecosystem such as the mangroves, coral reefs, and others. Currently, there are about four floating cottages installed in the area in which the only one as of the moment is operational. These 4 cottages have a total capacity of 1,111 visitors. When all the 32 floating cottages will be installed in the area, the calculated carrying capacity (Table 2).

Table 2. Total capacity of the floating cottages area.

	No. of Cottages	Average visitors per cottage	Capacity
Total area of the floating cottages	32	278	8,896 visitors

According to the survey, about 93% of the participants are very satisfied with the physical characteristics of the tourism spots in Day-asan. This is a good point to promote the ecotourism area because, in the study of Patil and Patil (2008), the majority of the participants expressed dissatisfaction with the accommodation and the room layout of the study area, only about 14% were quite happy with the accommodation and facilities. The primary reason for this is overcrowding that became the area congested that tourists became less likely to enjoy the area.

The popularity of the area attracted more tourists that lead to numerous issues such as heavy traffic jams, long queuing, and difficulty in maintaining the area (Patil and Patil, 2008). One positive finding of the study was that the majority of participants agreed with the notion of carrying capacity and were eager to conform to the norms. Although around 12% of tourists do not grasp or understand the notion of carrying capacity. Saveriades (2000) pointed that with continues education and when tourism development can already make changes in the social status of the local residents, acceptance is already inevitable.

Carrying Capacity Calculation using the Limit of Acceptable Change (LAC) Framework

Based on interviews with key informants, in Table 3 are the preferred distance of boats from one another while on a cruise.

Table 3. Summary of LAC data for Day-asan Ecotourism Site.

Limit of Acceptable Change (LAC)	Value
LAC_1 = views/preference of the visitors or users	51 m
LAC_2 = views/opinion of the STO staff	100 m
LAC_3 = computed distance [(LAC_2 – LAC_1)/2]	24.5 m
LAC_4 = compromised distance [(LAC_1*2)]	102 m
Length of area used for cruise/tour	9,500 m
Available boats for the mangrove tour	29 boats
Average capacity per boat	10 passengers
The average length of boat use in mangrove tour	10 m
Number of hours the area is open for tour	12 hours
Average time for mangrove tour	2 hours
Lf_1 = Capacity of anchorage area (number of boats)	5 boats
Lf_2 = Number of available boatmen	29 boatmen
Lf_3 = Capacity of holding area	202 visitors
Lf_4 = Number of days the area is closed for visitors	66 days
Lf_5 = Average number of visitors who expressed unsatisfactory with the water quality	16 visitors
Lf_6 = Average number of visitors who expressed unsatisfactory with the economic indicators	25 visitors

Table 3. Computed number of visitors by LAC and by level of carrying capacity.

Level of Carrying Capacity	LAC_1	LAC_2	LAC_3	LAC_4
BCC	1,560	860	2,750	850
PCC	9,360	5,160	16,500	5,100
RCC	842	464	1,485	459

The summary of the calculation is presented in Table 3: From the result, it can be assumed that:

a. In applying the distance of 51m between boats, the ecotourism area of Day-asan can accommodate as much as 842 visitors per day;
b. For a 102 m distance between boats, the allowable number of visitors per day is 459;
c. If the distance is 100m, the number of visitors that can be accommodated will be 464 visitors a day; and
d. At a distance of 24.5 m, the computed carrying capacity is 1,485 visitors in one day.

This calculation gives an average carrying capacity of 813 visitors considering the four identified indicators of LAC. Based on the total area allowed for cruise during the mangrove tour and sightseeing which is 9,500, each visitor distance requirement is about 12m. Thus, if using LAC, each visitor requires more

space to fully enjoy and to have a comfortable activity and quite close to the result of the study of Brandolini and Mosetti (2004) in Italy. Furthermore, Quicoy, and Briones (2010) calculation of the Coastal Ecotourism in Calatagan, Batangas, each visitor requires only about 4.65 – 9.30m² to fully enjoy the activities in which a way lower than the requirements of the visitors in Day-asan ecotourism site. However, each ecotourism site has its characteristics and can have different carrying capacities for respective activities such as sightseeing/ relaxing, swimming, snorkeling, diving, fishing, mangrove tours, firefly/bird watching, etc. (Sadikin *et al*., 2017). Carrying Capacity can be adjusted depending on the biophysical characteristics of the ecotourism site and the socio-political rehearses in the area. The tourist's perception tends to have higher distance and space requirements compared to an actual mapping activity (De Vera, 2019).

Considering that the total area that is open for visitors is 18,734m², the calculated carrying capacity is 813 visitors per day. Thus, each swimmer requires about 23 m² to be able to enjoy and do the activity comfortably. This result is lower than the standard set by WTO that the visitor requirement is 30m².

The studies of carrying capacity in the context of ecotourism have been acknowledged in recent years but it is hardly adopted as it remains unconvincing because it encompasses several variables that to some putting Fig.s as acceptable numbers on tourism is next to impossible (Butler, 2019). Despite the criticisms, still many researchers vested in the carrying capacity assessment with high optimism that this method will address degradation issues and will lead to sustainability. The decline of countless natural resources is imminent as 15 out of 17 fisheries in the world have already deteriorated, water tables are dropping in aquifers, topsoil loss, species mass extinction of species, environmental pollution (Abernethy, 2001), and many others.

The implementation of carrying capacity will provide high significance in the local policies. Disregarding the carrying capacity is threatening (Butler, 2019). There have been several ecotourism sites specifically here in the Philippines that have been closed because of overcrowding, one is the popular Boracay Island. If this may happen in Day-asan chances are that tourists will divert to other tourism areas nearby and this would have a negative effect on the area especially on the economic status. Since the sustainable development concept has already been introduced to ecotourism, it is worth engaging to adopt the notion of carrying capacity, putting limits on the visitors because this will help balance the ecosystem sustainability and economic growth of the area.

Conclusion

Swimming is the topmost activity visited in the area followed by sightseeing and mangrove tour while the least preferred activities are videoke and fishing. The existing four floating cottages installed in the area have exclusive swimming pools and diving boards that can be used by the visitors for safe swimming and other recreational activities. The current activities can still be expanded to more adrenaline activities for the thrill-seekers if the management is open to it. There is still a lot to be improved in the current management measures implemented in the area by BLGU and the tourism management. No monitoring plan is in place to monitor the tourism operators to ensure that the area is not abused and mistreated. Though it can be concluded that the current setup of the ecotourism in Day-asan does not pose a threat to its build environment, ecology, people, and the economic status of the area. However, if the tourism management and BLGU will continue to be reluctant, the area is vulnerable to deterioration especially if the wastes are mismanaged. Before the global pandemic was declared, the ecotourism site has received a maximum of 345 visitors daily that spend mostly on swimming. The calculated carrying capacity implies that the maximum number of visitors recorded so far is still under its estimated carrying capacity of 813 visitors per day. Further, the calculated physical carrying capacity for the number of floating cottages that the area can accommodate is about 32, while the existing installed floating cottages are only four. Given these data, the plan of the BLGU for expansion

is highly feasible and if those will be realized, it will increase the economic status of Day-asan and most probably will provide opportunities for employment of the residents. The space requirements of the tourists for comfortable occupancy greatly affect the calculated social carrying capacity and the less employment opportunity has a huge impact on the resident's perception of the economic carrying capacity. Carrying capacity in any area is not constant but dynamic, thus there is a tendency that the calculated levels of carrying capacity may increase or decrease in any given period. To attain the optimum sustainable management of ecotourism, a sustainable development strategy is essential for the management of natural resources sustainability. Management of tourism is determined based on the ability of the manager to manage resources and potential, with attention to the impact on the environment.

Recommendations

In line with this, the following are recommended to achieve the sustainability of ecotourism in the area;

1. Encourage the tourism operators to add more activities to cater to the diverse interest of tourists. To look into offering adrenaline activities for thrill-seekers and not limiting them to the common activities that are offered in other ecotourism sites in Surigao City.
2. Preparation of Tourism Management Plan that will incorporate managing on the built environment, ecology, social, and economy emphasizing the implementation of the carrying capacity. The plan must include the following;

a. Effective monitoring of BLGU especially to the new business entrants that wish to construct/install floating cottages or any ecotourism activity in the area. To require them to conduct an Environmental Impact Assessment (EIA) and Environmental Compliance Certificate (ECC) from DENR-EMB Regional Office, if necessary.

b. Regular inspection on the floating cottages operators in terms of solid waste management, sewage treatment, etc. and encourage the resort owners to plan activities towards environmental conservation and protection (i.e., coastal clean-up; putting signages or warnings against getting souvenirs, proper waste disposal, etc.) to be conducting by the BLGU, and to require each floating cottage operator to conduct at least a quarterly water quality monitoring to ensure that they are not causing any adverse impact to the water quality.

c. Process on the conduct of Information, Education, and Communication (IEC) campaign together with the concerned government agencies like the Surigao Tourism Office (STO) and the Department of Environment and Natural Resources (DENR). The people in Day-asan, especially the stakeholders, should be informed of the importance of natural resources and how they could be protected, conserved, and preserved. In this way, the people can also inform the tourists coming to the area of protecting and conserving the ecological system.

d. The community, as stakeholders, shall be encouraged to participate in the formulation and implementation of the various environmental programs. As part of the process, incline them to do their part to protect what belongs to them and help in keeping their environment clean and by policing those activities that can cause degradation of the coastal environment.

e. Initiate an agreement with the tourism operators to form an initial of at least 60-40 system in the employment in which 60% are coming from the local, while 40% are from outside Day-asan. This is to open job opportunities to the locals.

3. Implement limits on the visitors coming to the area to 813 daily. Adopting the calculated carrying capacity is recommended because there is a high possibility that the economic carrying capacity is changed as the development of ecotourism in the area is taking place. For the allowable number of floating cottages to be installed in the area, the BLGU is urged to adapt the calculated which is 32 floating cottages.
4. Further, encourage residents to enroll and acquire certificates on the areas needed in the ecotourism such as tour guide, cook, bartending, lifeguards, etc. because currently the BLGU of Day-asan cannot provide or support the manpower needed

by the tourism operators. Moreover, encourage the tourism operators to support local products for their needs in the daily operation.

5. Further studies are recommended to consider all aspects and indicators specifically on economic carrying capacity and an ecological carrying capacity is also recommended specifically on the mangrove and coral reef ecosystems.

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