

# Economic Analysis of Bunaken Nasional Park Ecotourism Area Based on the Carrying Capacity and Visitation Level

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# 3 Economic Analysis of Bunaken Nasional Park Ecotourism Area Based on the Carrying Capacity and Visitation Level

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**Abstract**—Tourism is one source of revenue to government. Many authorities have been exploring and developing their tourism potentials, especially the natural based tourism. Any development should take into account the carrying capacity of the region under development to provide quality service while conserving the nature. We have carried out a study to analyze economically the ecotourism resort of Liang beach in the Bunaken National Park (BNP) in North Sulawesi, Indonesia. Analysis was conducted on the carrying capacity of the region and visit rates due to changes in admission fee to the resort. The BNP existing condition has not been developed optimally and the tourism activities have not been oriented for environmental conservation. With purposive sampling method, 80 park visitors who came from various zones of origin were selected. The carrying capacity of the region (CCR) was measured directly with the help of Google earth. The results of the study: 1. The diving area of 88 hectares is capable of accommodating 3520 tourists per week; 2. The snorkeling area of 1 ha can accommodate 67 people; 3. The boating activity with a line path of 3866 m can hold 928 people; 4. The beach with a 1176-m-coastal-line is capable of accommodating 118 people. Overall, the BNP can accommodate 4,633 people per week. In the demand side, the Zonal Travel Cost Model approach (ZTCM) shows the potential of visitors from various surrounding areas of origin an average 1890 people. Through a simulation on tariff change during holidays (demand during holidays) and during the working days (demand during working days) it was concluded that the resort still has an appeal to increase the limited carrying capacity of the region. An appropriate management policy to increase revenue is expected.

**Index Terms**—Bunaken National Park, ecotourism, carrying capacity of the region, tourist visit.

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## I. INTRODUCTION

REGIONAL carrying capacity determines the sustainability of a marine tourism activity. The carrying capacity is different from one region to others that is related to the type of tourism activities to be developed [1]. In this sense, the coral reef ecosystem carrying capacity needs to be considered in the development of a snorkeling and diving area. Likewise, the carrying capacity of sandy beaches is for beach recreation activities or fishing.

Carrying capacity is the ability to accept tourists with continuously maximum use of natural resources without damaging the environment [1, 2]. The carrying capacity of natural resources could be examined physically, environmentally, and socially, but in this study the assessments were conducted on the environmental aspect related to the number of tourists, accommodation, service types of tourism developed, and facilities [3]. For instance, the need for space determines the size of the facility to be built to serve the tourists.

The carrying capacity of an area also is defined as the visitor comfort in doing their activities (the ecological potency) in term of area occupied for the activity. It is also affected by the opening hours of the area and the time spent by the visitor to conduct the activity. The mathematical model of the regional carrying capacity (CCR) can be written as

$$CCR = K \times \frac{L_p}{L_t} \times \frac{W_t}{W_p} \quad (1)$$

where  $K$  is the visitor ecological potency (person),  $L_p$  is the zone usable area or length ( $m^2$  or  $m$ ),  $L_t$  is the unit of area or length for certain category ( $m^2$  or  $m$ ),  $W_t$  is duration of activity in on day (hours), and  $W_p$  is time spent by a visitor for a certain activity.

Visiting demand is influenced by the admission fee to the venues [4-8]. In Indonesia, the National Parks admission fee is set up by the Government through the office of the Ministry of Forestry for IDR 2,500 (about USD 0.30) per person per visit (domestic). The fee is subject to the conditions of each region [8, 9]. Government has the authority to set up and determine fees to the National Parks under their jurisdiction [10, 11].

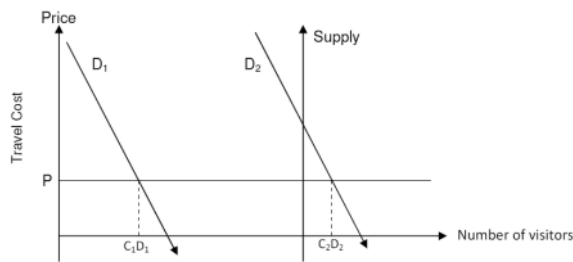


Fig. 1. The shift of the demand curve for an ecotourism area.

The admission fee is part of the travel expenses (i.e. travel expenses = travel cost + admission fee). Thus the travel expenses will influence the demands. The demand curves are depicted in Fig. 1. It can be seen that any reduction in the price (admission fee) will result in an increase in market demand [12]. Due to the limited area and carrying capacity of the region, the supply curve for a tourism area is very "inelastic" which is vertical and cannot be changed/ moved.

It can be explained from Fig. 1 that if the demand curve is  $D_1$ , then the effective demand on the price of admission for  $P$  will be satisfied, giving  $C_1D_1$  which is smaller than the CCR. It means that the area is capable of receiving the existing visitors and even more than that. However, due to some reasons such as ease of access, promotions and other programs, the demand may increase. The demand curve shifts to the right in the next year becoming curve  $D_2$ . The intercept of the  $D_2$  curve and the price  $P$  (entry fee + travel expenses) will generate demand of  $C_2D_2$  which is greater than the CCR. This indicates that the carrying capacity limit has been exceeded and will raise negative impacts on the environment, such as damage, pollution, "overcrowded" and others.

The Bunaken National Park (BNP), which is located on the island of Bunaken in the offshore of Manado city in North Sulawesi Province, is the flagship tourism resort of the Province. Liang beach is a protected area on the island that attracts many tourists to visit. An overcrowded condition due to increase of visitor number has bad impacts on the natural habitat. However, an increasing number of visitors will provide a better income for the business management of the Bunaken National Park (BNP) from the fee payment into the area. On the other hand, when the admission fee is increased the number of visitors might decline. Therefore, a study to scrutinize appropriate entrance fee rates will produce a pricing mechanism that can help conserving the park.

Apart from the entrance fee pricing aspect, the BNP's Liang beach visitation level is also affected by working days and holidays. On weekdays, the number of visitors is usually very few, yet on holidays the number of visitors can be overwhelming to even exceed the carrying capacity of the tourism site [13]. Therefore, an economic analysis on the determination of tariffs to keep the level of visitation and tourism revenues remain high is needed.

This paper discuss our study on the economical analysis to

the BNP ecotourism area based on the carrying capacity of the park and its visitation level due to the entrance fee tariffing to the ecotourism site of Liang coastal marine park.

## II. METHODS

The study was conducted in Liang beach on the Bunaken island ( $1^{\circ} 35' 53''$  North,  $124^{\circ} 46' 40''$  East), which is decreed by the Government of Indonesia as a national park in North Sulawesi. Bunaken island itself (see Fig. 2) is the iconic ecotourism park in the province that attract domestic and international visitors. It is situated about 19 km off the city of Manado.

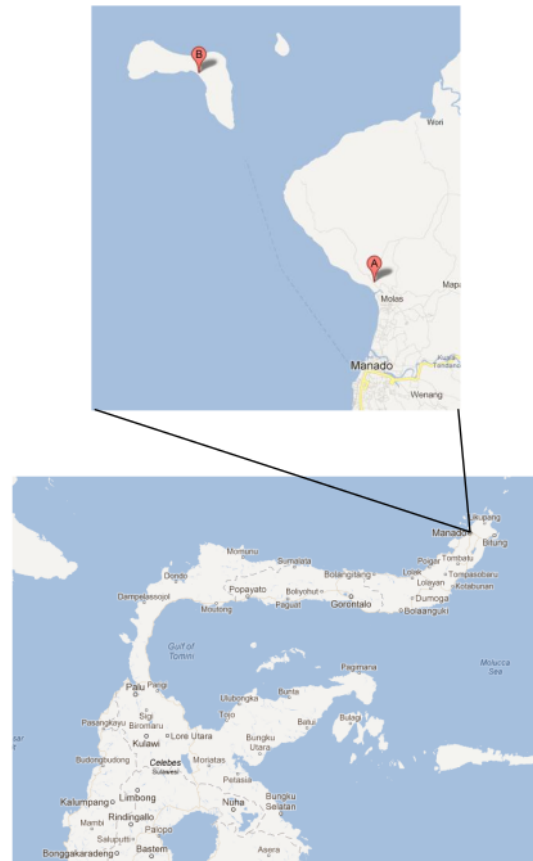


Fig. 2. Map of the location of the study showing (A) the City of Manado and (B) the Liang beach on the island of Bunaken, North Sulawesi, Indonesia.

### A. Data Collection

The primary data were collected by interviewing the respondents. The data from the visitors were acquired at the entrance gate via an accidental interview sampling technique. The interview to local residents was carried out using purposive sampling technique.

The number of samples was determined using the following Bernaulli equation [14]:

$$N \geq \frac{Z^2 pq}{e^2} \tag{2}$$

where  $N$  is the minimum number of the sample,  $Z$  is the normal distribution value,  $e$  is the error level,  $p$  is the proportion of 'true' answers, and  $q$  is the proportion of 'false' answers. Using this equation we took 80 respondents.

The secondary data was collected from relevant agencies such as the Statistics Indonesia, BNP management, and the local government (county) of Bunaken as well as from the internet.

**B. Methods of Analysis**

The data was analyzed through some approaches. Firstly, we took the CCR as tabulated in Tables I and II.

TABLE I  
MAXIMUM VISITING POTENTIAL PER ACTIVITY ZONE

Type of Activity	$K$ (persons)	$L_i$ (m <sup>2</sup> )	Remarks
Diving	2	1000	Every 2 persons in 100 m × 10 m.
Snorkeling	1	300	Every 2 persons in 100 m × 3 m.
Boating/catamaran	8	100	Taken the track length, very 8 persons/boat for 10 m.
Beach recreation	1	20	1 person per 10 m × 2 m.

TABLE II  
THE TIME REQUIRED FOR EACH CREATIONAL ACTIVITY

Type of Activity	Needed Time $W_p$ (hours)	Time per day $W_i$ (hours)
Diving	2	8
Snorkeling	3	6
Boating/catamaran	2	8
Beach recreation	3	6

The calculated CCR for the BNP using equation (1) was used as the value of supply where the number of visitors should not pass this value. The demand value was taken from the average of the visitors per day for one week period. It was assumed that the working days per month are 22 days and the holidays are 8 days (Saturdays and Sundays), then the annual number of visitors can be determined.

The second approach was used for the demand side, e.g. the hypothesis judgment approach [15]. This approach is essentially dividing the study area into zones that encircles the study area and conducting interviews to respondents about the willingness to pay an annual fee. This approach was used as the basis for assessing the impacts of monetary cost (entry fee + travel expenses) on the visitation to each tourism zone per 1000 population.

$$\text{No.of visit} = \frac{\left(\frac{V}{n}\right) \times N \times 52 \times 1000}{P} \tag{3}$$

where  $V$  is the number of visitors from zone  $i$ ,  $n$  is number of the samples,  $N$  is the number of visitors per week, and  $P$  is the total population of zone  $i$ .

In the third approach we used the travel expenses model to estimate the demand curve to the BNP ecotourism area. The demand function is written as  $Q_i = f(TC, X_1, \dots, X_n)$  where  $Q_i$  is the number of visitors from zone  $i$  per 1000 population.  $TC$  is the travel costs and  $X_1, \dots, X_n$  are other exogenous variables.

The value of recreation was formulated as [16]

$$V = a - bTC \tag{4}$$

where  $V$  is the number of visits,  $a$  the propensity to visit,  $b$  is the marginal propensity to visit, and  $TC$  is the travel cost.

A regression analysis was used to analyze the data using a linear approach in Minitab version 15. So that the parameters  $a$ ,  $b$ , and  $r^2$  (coefficient of determination) can be determined to calculate the number of visits ( $V_i$ ) as influenced by the travel cost ( $TC$ ).

**III. RESULTS AND DISCUSSION**

**A. Number of Visits**

From our survey, the number of visitors to the BNP in 2001 was 9872 visitors (data from ticket sales). In 2003 it increased by 210% to 30,609 visitors. Until 2007 it declined to only 16,082 persons. From 2009 the visitor number increased with an average of over 400 visitors per day on the weekends (Saturdays and Sundays) and during national and school holidays. While during working days the figure did not exceed 100 visitors per day.

**B. The Carrying Capacity of the BNP's Liang Beach Area**

According to equation (1), the CCR of Liang beach is presented in Table III.

TABLE III  
TYPE OF ACTIVITY, ZONE AREA AND THEIR CARRYING CAPACITY

Type of Activity	Zone Area $L_p$ (m <sup>2</sup> )	CCR (persons)	CCR per year (persons)
Diving	880,000	3,520	183,040
Snorkeling	10,000	67	3,484
Boating/catamaran	3,866	928	48,256
Beach recreation	1,176	118	6,136
Total	895,042	4,633	240,916

### C. Admission Fee

The admission fees to the BNP as per Provincial Government regulation No. 9 year 2002 are [17]:

- Students IDR 1,000
- Domestic tourists IDR 2,500
- Foreign visitors IDR 50,000
- Annual fee for diving IDR 150,000.

### D. The Attractions

Many species of unique and distinctive flora and fauna attract thousands of people to visit the BNP each year, including local and foreign researchers to discover the mystery in the BNP. There are more than 38 species of mangrove that occupy about 20% of the total area of mangrove forest in North Sulawesi. While for the fauna, there are as many as 1000 species of reef fish from 175 families. The unique Indonesian coelacanth (*Latimeria menadoensis*) and the dugong (*Dugong dugon*) also can be found in the area. There are nearly 200 species of hard corals representing 63 genera. On the land, ones can find endemic fauna to North Sulawesi such as Yaki and Kus-kus.

Other aspects that attract people to visit the island are the security of the island and the friendliness of its people as well as the adequacy of facilities to support activities for the visitors.

### E. Visitation Rate

Visitation rate is the number of visitors from a zone in 1000

people per year. The average annual number of visitors to the BNP from 2001 to 2011 was 21,275 visitors (409 visitors per week). The visitation rates calculated from equation (3) were presented in Table IV.

The calculation results using regression equation (4) was transformed into a natural log (ln) such as:  $\ln V = 9.54 - 0.587 \ln TC$  since the data distribution was irregular and not well patterned. However, in the final calculation the results were retransformed. The constant  $a = 9.54$ , regression coefficient ( $b$ ) = 0.587 with a coefficient of determination ( $R^2$ ) = 43.6% and the DW-test = 1.08. These results suggest that the increase in travel costs for one unit will reduce the visitation level to 0.587 visitation unit. The determination coefficient of 43.6% indicates that the variation in travel costs (monetary) will be 43.6% affecting the number of visitors to the BNP. This figure is acceptable as there are still some 56.4% exogenous factors that influence but was excluded from the model [18].

To get the number of visitations for each zone of origin of visitors per 1000 population to the area of the BNP ecotourism area on Liang beach with travel expenses now or in the current state (existing condition) tariff in accordance to Provincial Government regulation No. 9 year 2002 [17]. The way of the calculation begins with counting the rate of visitation per 1000 population ( $V_i$ ) as below [15, 16].

Then using equation (3) it was calculated the potential number of visitation or visitors from the zone of Manado by tariff equal to 0 (existing condition = IDR 2,500) [15].

TABLE IV  
VISITATION RATES PER 1000 POPULATIONS OF ZONE OF ORIGIN AND THE AVERAGE TRAVEL COST

Zone of Origin	Population (persons)	No. of Visitors (persons)	Percentage of Visitors	No. of Visit/1000 population/year	Average Travel Cost (IDR)
Manado	410,481	51	63.75	33	483,039
North Minahasa	188,904	3	3.75	4	896,667
Minahasa	310,384	7	8.75	6	284,286
Bitung	187,652	2	2.50	3	1,200,000
South Minahasa	195,553	4	5.00	5	186,250
Kotamobagu	107,459	3	3.75	7	398,333
Outside North Sulawesi	2,270,596	10	12.50	1	5,810,000
Total	3,671,029	80	100.00	60	-

TABLE V  
PREDICTION ON VISITATION PER VISITOR ZONE OF ORIGIN BASED ON THE INCREASE OF ADMISSION FEES

Zone of Origin	Admission Fee Scenario (IDR)							
	2,500	5,000	10,000	15,000	20,000	25,000	50,000	150,000
Manado	2630	2615	2600	2585	2570	2556	2487	2245
North Minahasa	842	837	832	827	823	818	796	718
Minahasa	2715	2699	2683	2668	2653	2638	2567	2317
Bitung	705	701	697	693	689	685	666	601
South Minahasa	2192	2179	2167	2155	2142	2130	2073	1871
Kotamobagu	771	767	762	758	753	749	729	658
Outside North Sulawesi	3379	3359	3340	3320	3302	3283	3195	2883
Total	13233	13156	13080	13006	12932	12860	12513	11293

F. Supply and Demand

TABLE VI  
TOTAL VISITATION OF THE VISITOR ZONE OF ORIGIN

Zone of Origin	Population (persons)	No. of Visit/1000 population/year	Total Visit/1000
Manado	410,481	6	2,631
North Minahasa	188,904	4	842
Minahasa	310,384	9	2,715
Bitung	187,652	4	705
South Minahasa	195,553	11	2,192
Kotamobagu	107,459	7	771
Outside North Sulawesi	2,270,596	1	3,379

Figures in Table VI represent the visitation demand of each zone. The CCR in Table III characterize the supply. Data in Tables III and V describe the demand and supply curves of Liang beach. The total carrying capacity of the area is 4633 visitors per week that consists of 3,520 people for the diving areas, 67 people for snorkeling, 928 people for catamaran and 118 people for the beach recreational area. If 2,630 people from Manado is visiting then only the diving areas is able to accommodate without being overcrowded. Meanwhile, if all of them aim the beach they will overcrowd the beach. The similar happens if they aim to do snorkeling and boating. Overcrowd will cause inconvenience to the visitors and damage to the areas. Efforts must be made by the authorities to divert visitors to other destinations outside Bunaken island. Nevertheless, the revenue will decrease. For the 842 visitors from North Minahasa, the zones that could accommodate the well are the diving boating. The situation for other visitors is reflected in Table III.

In general, the Liang beach is capable of carrying visitors from each region. But overcrowded situation will happen when all of them are coming at the same time. Thus, the distribution of visitors on will reduce the number of visits to this area.

G. Simulation of Effects of Changes in Tariff

Our survey shows that the highest travel cost expended by the visitors was IDR 3,250,000 and the lowest one was IDR 60,000. We found from equation (4) the number of visitors with the highest cost and farthest distance was 7,682 people and that with the lowest expense and closest distance was 80,017 people. It was assumed it was the demand on holidays. If the visitors on working days were 25% of the weekends and holidays then the number of visitors on the highest travel expenses and farthest was 1921 people and was 20,004 people at the lowest travel costs and closest distance.

Calculation results in Table VI indicate that when the research was conducted, a demand for a visit to the BNP ecotourism Liang beach from each zone is the total population who desire to visit in that year. With the assumption that the monetary travel costs (cost + transport tariffs) which are applicable at the survey time. The North Sulawesi local regulations for entering BNP ecotourism area which is IDR 2,500 per visitor. The simulation results by increasing the

entrance fee as a multiplication of 100% are presented in Table V.

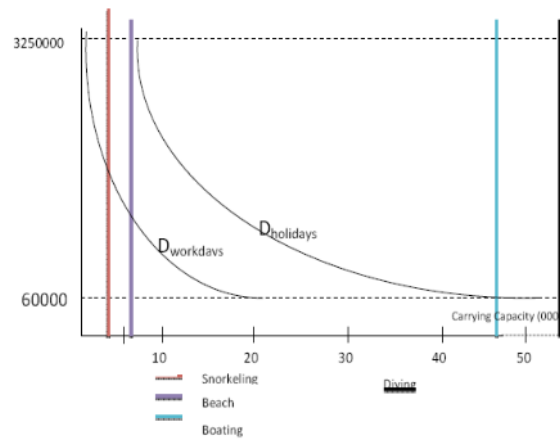


Fig. 3. The visitation demand for holidays and working days.

Table V indicates that the increase in the admission fee will cause a decrease in the number of visitors. This means that the rate will increase affects in the level of tourists visitation from each zone. As the decision makers, the manger of BNP will seek to raise tariffs when the visitor numbers boost due to large-scale promotional and the presence of international and local events that scheduled a visit to the BNP ecotourism area coincided on holidays. An exception of this condition is the weather and climate factor that are not possible in sea travel

The increase in admission rates are also very influential on the sustainability of Bunaken line park because it limits visitation that impact negatively on the condition of the natural resources of this location. Preservation of resources on this site have an impact on the income that are earned by the trustees and beneficiaries of the visit because consumer surplus is very small. Visitors with the highest travel costs because of distance or because of high monetary cost will not receive the benefit of their visit, which the consumer surplus equal to zero.

TABLE VII  
TRAVEL COSTS AND VISITOR NUMBER FOR WORKING AND HOLIDAYS

Travel Cost (IDR)	No. of Visitor during Holidays (persons)	No. of Visitor during Working Days (persons)
10,000	229,064	57,266
60,000	80,017	20,004
100,000	59,287	14,822
200,000	39,469	9,867
300,000	31,109	7,777
400,000	26,275	6,569
500,000	23,050	5,762
600,000	20,710	5,178
700,000	18,918	4,730
800,000	17,492	4,373
900,000	16,324	4,081
1,000,000	15,345	3,836
2,000,000	10,215	2,554
3,000,000	8,052	2,013
3,250,000	7,682	1,921

In this study, observational data indicate that the smallest beneficiary is at the highest travel costs of IDR 3,250,000 while the largest is the lowest trip cost of IDR 60,000. Table VII gives an overview over the demand curve during holidays and the demand during weekdays with a range of travel costs lowest to highest.

In Fig. 3, it can be explained that the highest travel cost in weekdays are very little so that the entire carrying capacity in a year can sustain the number of visits which is only 1921 people per year. But on holidays with the highest number of visitors travel expenses have passed the carrying capacity of snorkeling and beach recreation areas, but the carrying capacity of diving and boat areas are still likely to pass through promotion to visitors and offer other facilities. As for the lowest travel expenses, the total visitors on weekdays exceed the carrying capacity of the snorkeling and beach recreation areas, but for the diving and boating do not reach its carrying capacity. But during holidays, the carrying capacity of snorkeling, beaches and boating areas can exceed. Only the carrying capacity of diving areas that are not exceeded even though on holidays with a trip cost of only IDR 60,000.

#### H. Tariff Policy Scenarios in Entering BNP Ecotourism Areas

BNP ecotourism area is a marine park which is located on the coast of Bunaken Island and managed by the BBNP from the Ministry of Forestry and Bunaken National Park Management Board (BNPMB) formed by the provincial government of North Sulawesi to make annual work plans, evaluate progress, design, fund and supervise the conservation program; and commercialization activities in the area, coordinate the policies and activities of other stakeholders associated with the park, assessing the implementation of the park, conduct supervision of park management, reporting to government.

Since it was formed, the BNPMB has made the ecotourism Liang beach area becoming a coastal area that offers beautiful natural resources while paying attention to its sustainability.

BNPMB can also propose tariffs that are precise for visitors that enter the BNP ecotourism Liang beach area. According to the economic analysis, the increase tariffs will cause a reduction in consumer surplus because part of the visitors no longer wish to enjoy the beauty of Bunaken marine park, because they think that the "marginal valuation" was smaller than the "marginal cost".

In reality, the determination of the entrance tariffs of an ecotourism area is a fairly complex problem, because of the involvement of the local government so that the manager must follow the decision approval of the local government and the local parliament (DPRD). The one that needs to be noticed is the constraint of capacity. With a certain broad measurement, as well as the vulnerability of the protected area (Marine protected area), then there is a carrying capacity from that area that are impassable.

Because it is a national park which shares some of the zone with a specific area in which the visitors can perform a variety

of activities and provide facilities and infrastructure that is needed. This zone is called utilization. While the protected zone is a specific broad and area region that cannot be used for certain activities. This is the reason that the curve supply form from the protected area is inelastic and does not change even though the value/tariff changes [19].

The supply curve also indicates the capacity constraints that are impassable. When this border is passed it will cause "marginal cost" to be positive, which is an inconvenience for the visitors because it is "overcrowd" [18]. This is where pricing/tariffs may play a role, which determines the exact tariff entry so it does not exceed the carrying capacity or occur in-elastic because under consumption which means lack of income/revenue for the manager of the DPBNP and their impact on local revenue enhancement.

Based on data in Tables III, V and VI, a determination scenario can be made for the appropriate entry fee to the BNP ecotourism area as a reference that can be used by stakeholders such as BNP management and BBNP as a policy of preservation and conservation for BNP ecotourism are without the help of private institutions that are concerned with BNP's conservation.

First scenario, the price/rate that is determined by the current manager is IDR 2,500. The number of visitors with the prices/tariffs was as many as 13,233 people. With capacity constraints or the carrying capacity in ecotourism Liang beach area of 240,916 people per year. This carrying capacity value is a vertical supply curve number at  $q = 240,916$ . A perfect inelastic supply curve because any travel cost or value/tariffs that are determined then the carrying capacity will be the same or will not change. Thus, at the current price/ tariff still takes a massive campaign or facilitate access and provision of free transport fare, this ecotourism Liang beach area can still accommodate the number of visitors. This means the income of trustees will be greater and the benefits received by visitors are still quite large because the consumer surplus has not reached the point of marginal. With such supply curve, if the tariff rates are set higher than IDR 2,500 it will reduce consumer surplus and the number of visitors. When the price is lower than IDR 2,500, the number of visitors will exceed its carrying capacity and lead to crowding or congestion. The second scenario, if the supply curve is  $S'$  with  $q = 4633$  people, then what happens now with the number of visitors 13,233 people shows the existence of "overconsumption". In this condition, there should be sought a solution to reduce the excess number of visitors which is to issue a new tariff regulation so the people who come do not exceed the capacity. In the third scenario, if the  $S$  curve is  $S'$  with  $q$  over 48,256 people, then under consumption will occur. To meet the increase in the number of visitors is not possible by lowering admission rates below zero. The policies undertaken that increase attract (g) to BNP's ecotourism Liang beach area to attract visitors will cause the Demand Curve to shift to the right. This can be achieved by promotion and natural recreation activities that have not existed yet (now it is limited

to enjoying diving, snorkeling, boating and beach recreation).

#### IV. CONCLUSION

The carrying capacity of BNP ecotourism Liang beach per year can sustain the flow of tourists per year with entrance fee according to Provincial Government regulation No. 9 year 2002 which is IDR 2,500. The number of visitation from the 7 zones with an entrance fee of IDR 2,500 is as many as 13,233 people with an estimated revenue amount of IDR 33,0825,500. With the level of visits of 22,745 people in 2011 so the revenue in 2011 was estimated at IDR 56,187,500 for domestic visitors.

The analysis shows that the BNP ecotourism area attractions, especially at the entrance of Liang beach is still very attractive to the visitors from each zone because the level of visits from each zone are in excess of the carrying capacity of one activity.

The fee charged to each visitor of BNP ecotourism Liang beach area is done at the entrance ticket box that are provided (the gate).

The limited land area and carrying capacity of the area, portrays this BNP ecotourism area to become very inelastic which means it cannot be changed or moved. So if there is a burst of visitors it will affect the comfort of visitors.

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