

**The tourism value of nature on Bonaire**

Using choice modelling and value mapping

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## Summary

Bonairean ecosystems support touristic activities that depend on the quality of the natural environment, such as diving, snorkelling, kayaking, boating, enjoying beaches, and participating in land activities. The tourism sector is an industry with substantial size and financial contribution to the economy of Bonaire. However, the economic value of the contribution of nature to Bonaire's tourism has never been quantified, nor have the most important aspects of Bonairean nature for tourism been identified. It is essential that the economic value of the ecosystem service to tourism and the dependence of tourism on Bonairean ecosystems while impacting these same ecosystems be determined in order to further assist policy-makers in understanding this crucial relationship and support them in wise long-term decision-making.

To determine the value of Bonairean ecosystems for the tourism industry a survey among tourists visiting Bonaire is conducted. This study estimates the average expenditures of these visitors, as well as their Willingness-To-Pay (WTP) for protection of Bonairean nature. The result of this survey also elucidates tourists' perceived value of different aspects of Bonairean nature. The socio-economic value of the ecosystem services for tourism is combined with spatial data to determine which ecosystems are the most economically valuable with regards to tourism.

The expenditure by tourists on Bonaire is found to be around \$125 million annually. An estimated welfare of around \$50 million dollars is contributed by Bonaire's nature to tourism. Stay-over tourists are found to contribute more to the tourism industry than cruise tourists, and marine ecosystems are found to be more economically significant than terrestrial ecosystems on the island. The high WTP of tourists for additional nature protection in Bonaire provides opportunities for the local government to increase the current user fees of visitors to Bonaire.

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# 1 Introduction

The project “What’s Bonaire Nature Worth?” aims to perform a socio-economic valuation of Bonairean nature. The framework that is used to do so in the entire project is based on the valuation of ecosystem services. Ecosystem services are defined as goods services that human beings derive from ecosystems. Bonairean ecosystems also provide these services to tourists: coral reefs are enjoyed by divers and snorkelers, the mangroves by kayakers and one can think of many more touristic activities that depend on the quality of the natural environment. The purpose of this report is to determine the touristic value of ecosystems on Bonaire; in other words, the welfare that is created in the tourist industry and the part of the value that is attributable to the existence and health of Bonairean nature.

Tourism is a very important industry on Bonaire. The island is home to only 16,000 residents, but roughly 70,000 tourists per year visit the island by airplane and around the 200,000 tourists by cruise ship (TCB, 2010). This indicates that the tourist industry is of substantial size, although no percentages are available about the industries’ part of the Bonairean economy. Many tourists come for the marine environment, beaches or participate in other activities on land. Bonaire is known as the Caribbean’s “diver’s paradise” and around 60% of the tourists that are visiting by airplane are estimated to be divers (TCB, 2008). It is, therefore, very likely that the natural environment of Bonaire is an important attraction for visitors.

Further development of the tourism industry implies that the necessary investments have to be made in order to create an appropriate infrastructure and sufficient facilities for the visitors. On the other hand, an increase in the number of tourists and investments in infrastructure other facilities put extra pressure on the ecosystems on the island. These are the same ecosystems that attract the tourists. In other words, increasing the number of tourists might have positive effects for the economic development on the island, but the question is whether those effects are sustainable.

If excessive development degrades the ecosystems too much, it might be possible that tourism will decrease as well. Heavily degraded coral reefs (and other ecosystems) are not nearly as attractive to tourists as relatively healthy ones, so overdevelopment can have negative impacts on the attractiveness of Bonaire as a tourist destination (Asufa-Adjaye *et al* 2008). However, the tourist industry is never analysed as such. The Dutch Central Bureau of Statistics (CBS) does not provide estimations about the economic activity that is related to tourism. Nor has ever been quantified which aspects of Bonairean nature are important for the attraction of tourists.

The purpose of this study is to quantify the activities that tourists participate in during their visit on the island. The economic activity that is created with these activities is estimated in order to determine the value of Bonairean ecosystems for the tourism industry. In this study, two surveys are conducted. One survey is conducted on a face-to-face basis with departing tourists on Bonaire. Based on the email addresses and additional addresses a more substantial internet-survey followed up the first survey. Interviews with stakeholders in the tourism industry were held in order to place the results in perspective and determine the reliability of the results.

The report is structured as follows. Chapter 2 presents the context of tourism industry in Bonaire and reports a literature review in which other comparable studies are evaluated. Chapter 3 describes the methodology applied, in which valuation techniques and survey designs are explained. Chapter 4, 5 and 6 respectively present the survey results, the valuation outcome and spatial value allocation of the study. Conclusions are drawn in Chapter 6.



## 2 Background

### 2.1 The tourism industry

According to data provided by the Tourism Corporation Bonaire (2008; 2009; 2010) the arriving stay-over tourists (i.e. tourists that arrive by airplanes and stay for multiple days on the island) have shown to be reasonably stable (Figure 2.1). While there are some small fluctuations in the number of tourists, the average yearly arrivals seem to be growing to around the 70,000 stay-over tourists per year. Data for 2011 only goes as far as June, but indicates that the number of tourists increased slightly compared to previous years.

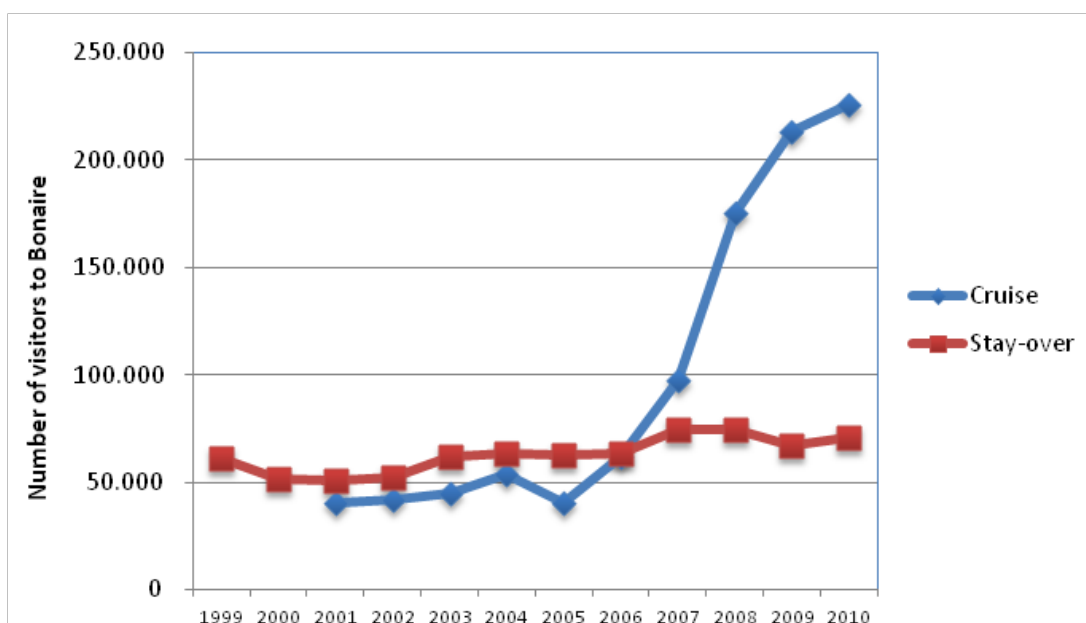


Figure 2.1 Arrival of stay-over and cruise tourists per year

Cruise tourism, however, has experienced an enormous growth after 2005. From a steady 40,000 to 50,000 arrivals per year the cruise arrivals expanded to over 200,000 tourists in 2009 and 2010. Again, for 2011 numbers are not fully published yet, but the arrivals up till June indicate that the number of arrivals will drop slightly. However, May is the end of the 2010-2011 cruise season and many local stakeholders that are involved in the cruise tourism industry complain that the season of 2011-2012 was much lower in terms of arrivals. And indeed with a total of 85 cruise ships in 2012 compared to 138 in 2010, the amount of cruise ship passengers on Bonaire is expected to decrease by 38%. Most people who are active in the cruise industry argue that Bonaire has not invested enough in marketing for the cruise ship destination market. According to them, the destination market seems to be a very competitive one, in which promotion as a destination in terms of low costs for the cruise companies and high levels of appreciation for the tourists is necessary to attract enough cruise ships. This is especially the case because Bonaire is located in the south of the Caribbean, quite far away from the other cruise destinations and it is easily dropped from the cruise itineraries (personal communication with Bonaire Destination Services, 2012).

## 2.2 Literature on nature related tourism values

As shown in Table 2.1, Van Beukering et al. (2011) presented an overview of the leading literature on the valuation of coral reef related tourism and the techniques that are used to value these ecosystem services. The focus of this study, however, is not only on coral reef ecosystems, but also on other coastal ecosystems such as mangroves as well as the value of terrestrial ecosystems for tourism. Still, reef related tourism is probably the most important part of the touristic value, so a short reflection on the various possible techniques reported in the literature is relevant.

*Table 2.1 An overview of articles on the valuation of coral reef related tourism values*

Author (year)	Location	Valuation techniques	Tourism value per year
<b>van Beukering et al. (2009)</b>	Bermuda	Travel Cost Method Net Factor Income Contingent Valuation	\$611 per tourist, \$24 WTP per tourist
<b>van Beukering et al. (2007)</b>	Guam (USA)	Benefit transfer Production function	\$94.6 per tourist
<b>Carr &amp; Mendelsohn (2003)</b>	Great Barrier Reef (Australia)	Travel Cost Method	Between \$350 and \$800 per visit
<b>Ngazy et al. (2004)</b>	Zanzibar (Tanzania)	Contingent valuation	WTP \$84.70 per diver for diving pristine coral reefs
<b>Seenprachawong (2003)</b>	Phi Phi Islands (Thailand)	Travel Cost Method Contingent Valuation	US\$1,309 per tourist or \$6243/h/year for recreation
<b>Burke et al. (2002)</b>	Indonesia	Based on other studies	\$103 million for tourism
<b>Cesar et al. (2001)</b>	Hawaii (USA)	Travel Cost Method Contingent Valuation	\$19.6 per diver/snorkeler
<b>Pham &amp; Tran (2001)</b>	Hon Mun Islands (Vietnam)	Travel Cost Method Contingent Valuation	Between \$33 and \$69 per visitor

*Source: Van Beukering et al. (2011)*

According to the definitions of Hein (2010) and van Beukering et al. (2007) tourism is identified as a direct-use value. It is different from a direct-use provisioning ecosystem service like fisheries in the sense that there are no physical goods that represent the benefits. The benefits are intangible experiences. A market valuation technique is therefore not always possible, since the services are not necessarily traded on a market; i.e. tourists can easily benefit from the ecosystems on their own. As seen in table 1, there are a few possibilities to value touristic ecosystem services, of which the net factor income and production function approach are most similar to the market valuation technique described by Hein (2010). By investigating what tourists pay to consume a particular ecosystem service, the net income value of that amount can be calculated to determine the producer surplus of the service.

If that is not possible, there are other ways to determine the value of a particular ecosystem service. The travel cost method is a popular way to value tourism ecosystem services that are not traded. The costs that consumers of a service are making to be able to consume the service can be used as an estimation of the consumer surplus. On the one hand, the travel cost method is likely to underestimate

the true value, since the amount that people are willing to pay (WTP) for such an ecosystem service might be higher than the actual travel costs. On the other hand, over-estimation of a specific ecosystem service is possible if the travel costs are not correctly allocated to the right ecosystem. According to van Beukering et al. (2007) it is difficult to determine what the travel costs are for the visit of a specific ecosystem, since most tourists visit multiple ecosystems during a trip.

A technique that is often used to determine a WTP of tourists is the contingent valuation method (CVM). Contingent valuation is a technique characterized by asking respondents what they are hypothetically willing to pay for a service. This method is theoretically very useful to determine the consumer surplus of the consumption of a certain good or service, since it determines the maximum WTP. On the one hand, the CVM derived WTP represents a hypothetical payment and therefore has led to much criticism from scientists and policy makers alike. On the other hand, Carson et al. (2000) argue that as long as the value is not interpreted too literally in an economic sense, it can be a very good indicator for the size of the consumer surplus.

All studies indicate economically significant values coming from tourism on the islands. Interestingly, different types of valuation methods generate different results. One of the reasons for this methodological impact is that different techniques often value different things. While the net factor income aims to reflect the producer surplus, the contingent valuation studies usually aim to measure the size of the consumer surplus. Naturally, the valuation of ecosystem services is also liable to quite some uncertainty, since the values to measure are not always easily identified. Also, some islands are much harder to travel to or are more expensive stay, which in turn may influence WTP.

Two valuation studies have been conducted in Bonaire before. In the early nineties, Dixon et al. (1995) measured the WTP of divers and snorkelers to coral reefs. This study formed the basis the current user fee system. Much later, Thur (2010) investigated the WTP specifically for entrance to the Bonaire National Marine Park (BNMP). The author also concludes that most other studies that investigate similar WTP for such entrance fees find a substantial WTP. At the time, entrance fees for the BNMP were \$10 per year. Thur (2010) performed a simple contingent valuation study in which the mean WTP for a yearly entrance fee was estimated to lie between \$61 and \$134. The second conclusion was that almost all diving visitors were willing to pay a fee above \$25, which indicates that increasing the fee to this amount would probably have a negligible effect on the amount of visitors, but double the income for the BNMP. Today, the current fees are indeed a \$25 for divers and a \$10 for other users of the marine park. If the mean WTP determined by the contingent valuation is a correct estimate for the real WTP, it is a very good representative of the consumer surplus of the diving tourists that visit Bonaire.

## 3 Methodology

### 3.1 Valuation methods

As most articles discussed in the literature review, this study also uses a combination of valuation techniques in order to calculate the value of Bonairean ecosystems for tourism. Because tour operators and dive shops offer many activities on Bonaire, it is possible to determine what people are actually paying to participate in activities that depend on the natural environment of Bonaire. This is the start of performing a net factor income calculation. A similar approach as for the calculations of the commercial fishing value is therefore possible: A combination of Consumer Surplus (CS) and Producer Surplus (PS). To calculate the latter it is necessary to determine the revenues that are earned by suppliers in the tourist industry, but also the costs of providing the services in order to calculate a net income benefit. As mentioned earlier, this is difficult because there are no official records kept on the size of the tourist industry by the current Dutch statistical bureau, or the previous Dutch-Antillean statistical bureau. We are working on a business survey, which is sent to all Bonairean businesses that are active in the tourist industry. The business survey will contain the necessary questions to determine the PS more specifically. In order to calculate the CS, an estimate of the WTP is necessary.

Since no official records on the revenues of the tourist industry are kept, another source is required to determine the size of the PS. Also, to estimate the WTP of the visiting tourists a survey was required to administer a similar choice experiment as in the local household survey that was used to calculate the fishing value. Both were combinable in the same survey. By investigating the WTP as well as the expenditures that were actually paid during the visit on the island the revenues and WTP can be calculated. The only thing missing are estimates of the costs. Therefore, local providers of touristic services were interviewed to gain insight on the cost structures.

In this study, the characteristics of cruise and stay-over tourists will be investigated separately. The two types of tourists fit rather different profiles: they have different durations of stay and often participate in different activities. Moreover, in calculating the PS, we distinguish between a PS that is immediately attributable to the ecosystem, (e.g. diving), and a PS that is only partly attributable to the ecosystem (e.g. accommodation). The latter PS is expected to be certainly smaller in the case degrading ecosystems, yet the PS of a business that is directly attributable to the ecosystem would be practically non-existent in case of serious ecosystem health loss.

### 3.2 Survey methods

To investigate both the net income benefit and WTP, a combination of two tourist surveys is used. The first is a face-to-face survey that was held on Bonaire in the spring of 2012. Departing tourists were asked to participate in a short interview (i.e. less than 10 minute) in which a few issues were asked (i.e. impressions of the island, the activities that were participated in, the origin of the tourists). Most importantly, the email address was asked, which was necessary for the online follow-up survey.

The online survey is a more extensive survey, with a median duration of 18 minutes.<sup>1</sup> Activities and the perception of Bonaire were investigated, enabling the verification of consistency in the answers. Some additional demographics, such as income and

<sup>1</sup> The average duration is much higher due to a few outliers that probably filled in the questionnaire in multiple sessions, without closing the program.

education were also recorded. To determine the tourists' attitudes towards the environment and acquire more information on the support of environmental measures, a number of questions were included on the environmental awareness of the respondents. Most importantly for the calculations of consumer and producer surpluses, the expenditures and WTP were registered. Table 3.1 summarised the main subjects addressed in the various surveys.

*Table 3.1 The subjects that were investigated in both surveys.*

	Face to face interviews	Online Tourist Exit Survey	Linked respondents
Sample size	1155	237	167
Demographics	X	X	X
Activities on Bonaire	X	X	X
Location of activities		X	X
Experience	X	X	X
Expenditures		X	X
Environmental awareness		X	X
Support of environmental measures		X	X
Choice Experiment (WTP)		X	X

Table 3.2 shows the number of respondents per survey and response rates. Due to the low response rates, it was necessary to collect more email addresses than we gathered with the face-to-face survey. These additional email addresses were collected from a previous surveys conducted by the Tourism Corporation Bonaire (TCB) and from an email database provided by STINAPA.

*Table 3.2 Number of respondents in both surveys and response rates.*

	# respondents in Face-to-face survey & additional email addresses	# respondents in online survey	Internet response rate
<b>Plane</b>	956	148	15,5%
<b>Cruise</b>	981	89	9,1%
<b>total</b>	1937	237	12,2%

*Note: average response rate TCB/STINAPA addresses was 9%; response rate of the face-to-face respondents in the online Tourist Exit Survey (TES) was 14%.*

### 3.3 Choice Experiment

The choice experiment (CE) that is included in the online tourist survey is very similar to the one used for the calculation of the WTP of the cultural and recreational value. Again, the experiment consisted of six attributes with which different scenarios were constructed. Every round, three different scenarios were presented of which one was the same in each round: the baseline scenario. The scenario that would most likely come true if no additional environmental management were to be implemented. The experiment had six of these rounds. The scenarios are constructed so that there is no best alternative. This means that the choice of a particular scenario reveals what the important attributes are. To include the right attributes, stakeholders (in the tourism industry and tourists) civil servants and politicians were interviewed. The attributes that were finally included and the way they are presented in the survey are the following:

1. **Quality of the marine environment** for recreation and tourist activities (diving, snorkelling, swimming, beach etc.).
2. **Quality of the terrestrial environment** for recreation and tourist activities (bird watching, mountain biking, caving etc.).
3. **Safety of the island** in terms of likelihood that you would be exposed to some form of petty criminal activity (theft, pick-pocketing, cheating).
4. **Environmental management** in terms of how "green" the government is in managing the island (waste management, renewable energy).
5. **Crowdedness** in terms of the number of fellow tourists on the island
6. **Green tax** is a tax that all tourists would pay, which would be used strictly for environmental management on the island. This tax would have to be paid per person per visit, on top of the current taxes and other expenses made by visitors.

The green tax is the payment vehicle with which is determined how much people are willing to pay for the environmental attributes on the island. Depending on the size of the tax and the state of the other attributes the WTP for a change in each attribute can be determined. This is done using Sawtooth software for choice modelling. Furthermore, since the tax is introduced as an addition to all other existing costs and environmental fees, it is a good representative of the consumer surplus.

## 4 Survey results

This Section describes the results of the tourist survey conducted among stay-over tourists and cruise visitors. First, the characteristics of the sample are described in detail. This followed by a section describing the total tourism value result and the results for each individual method used to get to this total value. This is followed by a section that addresses the differences between the islands and finally the chapter ends with a synthesizing and concluding section.

### 4.1 Demographics

As shown in Figure 4.1, most tourists visiting Bonaire visit with a household size of two people, mostly adults; 13 percent of the households visit Bonaire with children. It is important to note, however, that vacation trips with children are liable to seasonality. Since the survey was only conducted from January until May 2012, it might be possible that the actual share of children deviates from the measured share in the survey. The share of male and female respondents in the survey is respectively 51% and 49%.

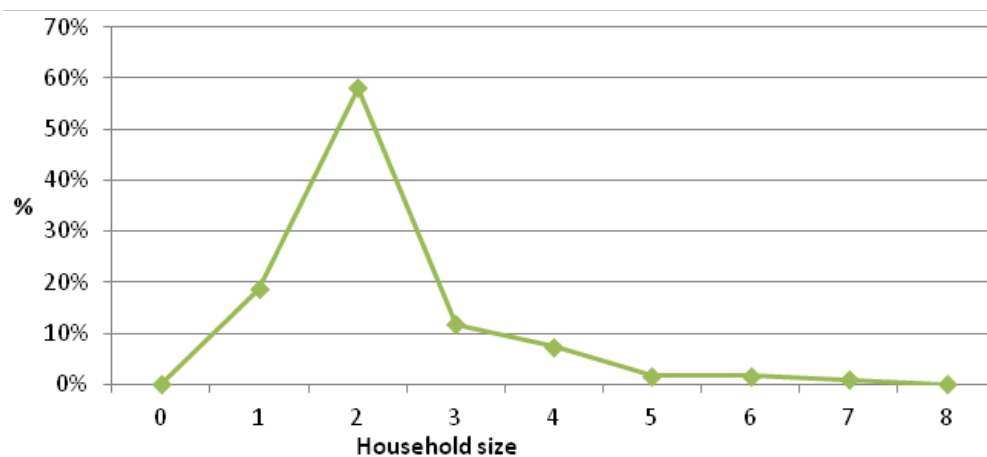


Figure 4.1 Household size distribution of the online survey.

Income is recorded as monthly household income before income taxes. As shown in Figure 4.2, income for levels for both cruise tourists and stay-over tourists are quite normally distributed until the very last category. From experience we concluded that the high peak in the category above 15,000 USD per month is rather unlikely and therefore we suspect that this question has not been filled correctly. The other unexpected observation in the income data measured in the survey is a sudden drop in the 9000-9999 USD category for cruise tourists. We suspect that this is due to the relatively low amount of cruise tourist respondents in the sample. Moreover, possibly respondents misunderstood the question and interpreted the categories as annual income. It is interesting to note that there are no large differences between cruise and stay-over tourists, implying that the profiles of these types of tourist do not differ in income levels in this survey.

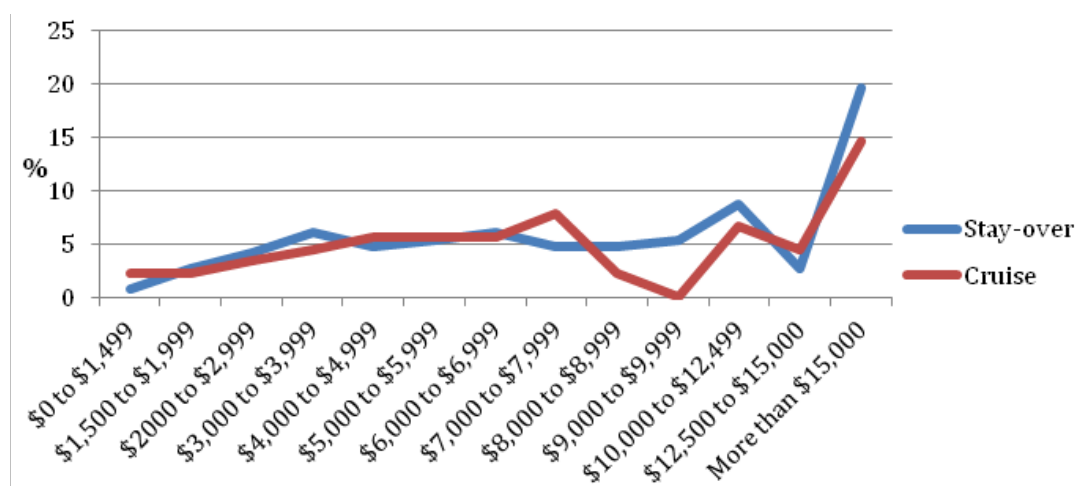


Figure 4.2 Monthly income (before income tax) distribution for Cruise and Stay-over tourist households.

As shown in Figure 4.3, the Bonairean tourist is highly educated. Over 70% in both cruise and stay-over categories has obtained a university degree. Only a very small percentage has only finished middle school. Again it is interesting that there are no significant differences between the two types of tourists. The high educational levels might explain the high income levels, but it might also be that the high education levels are liable to a selection bias (i.e. only highly educated respondents are motivated to complete the online survey).

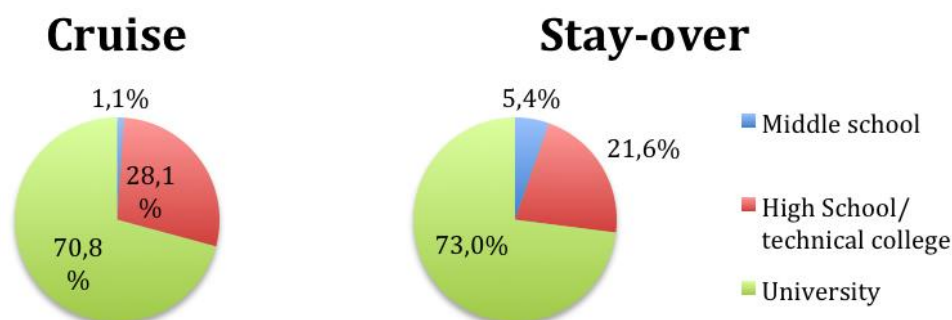


Figure 4.3 Highest completed education. "None" or "Primary school" were also options, but were not chosen by any of the respondents.

Looking at the origin of the respondents, we start to see differences (see Figure 4.4). While most stay-over and cruise tourists arrive from North America in our sample, there is a difference in the amount of European and South American tourists. Europeans seem to prefer stay-over tourism to cruise tourism, while South American visitors seem to prefer cruises. Again, there might be a selection bias caused by the slightly larger presence of Latin American cruises in the survey period. The interviewers noticed that Latin American cruise tourists were more willing to participate than English speaking tourists.

Furthermore, the TCB (2008, 2010) estimates for stay-over tourists' origins differ substantially from our estimates. It is important to note that this can be caused by the seasonality of tourism and time-frame of our data collection. The TCB used data from multiple entire years and therefore provides a more reliable estimate of the origin composition. Note that the data of the TCB is dated and that the last few years have been dominated by economic instability, which can have important effects for the purchase of luxurious vacation trips to Bonaire.



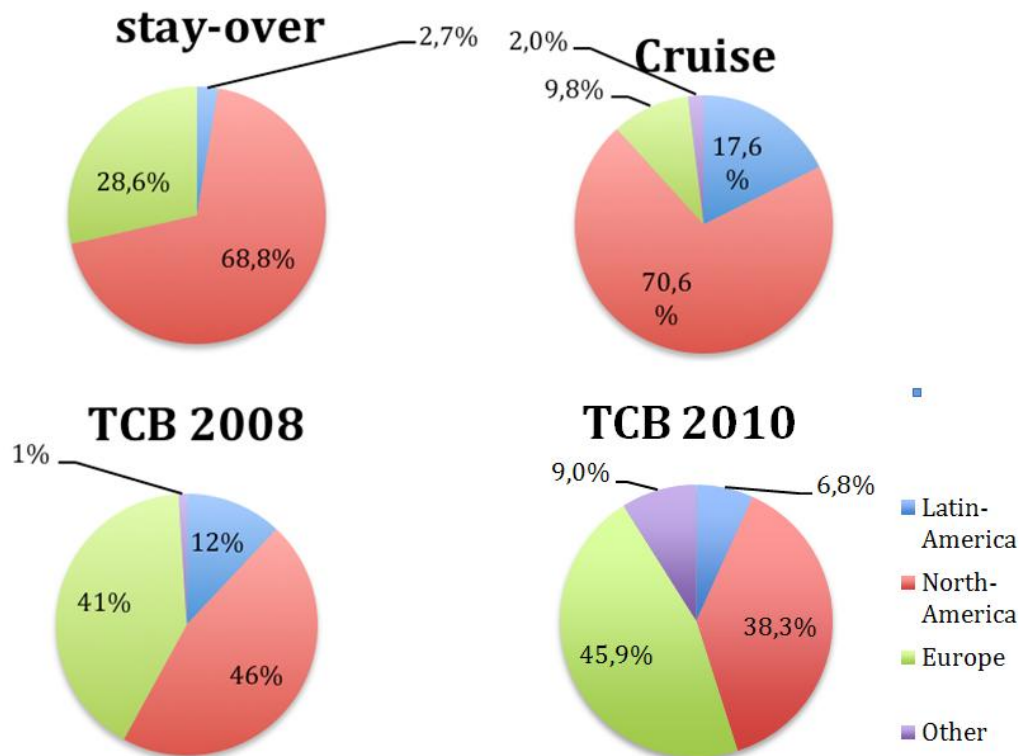


Figure 4.4 Upper two: Country of origin of the respondents in the survey. Bottom two: Country of origin for 2008 and 2010 as recorded by the Tourism Corporation Bonaire (TCB). The TCB estimates are based on stay-over tourists only.

## 4.2 Duration and expenditures

As shown in Figure 4.5, the average stay-over tourist in our sample stays on Bonaire for a little over 11 days. South Americans have the shortest trips, while Europeans visit the longest. When one keeps the travel time to Bonaire in mind, this is expected. People stay probably longer when the country of residence is further away from Bonaire. Cruise tourists stay for a day on Bonaire. They arrive in the morning and depart in the afternoon.

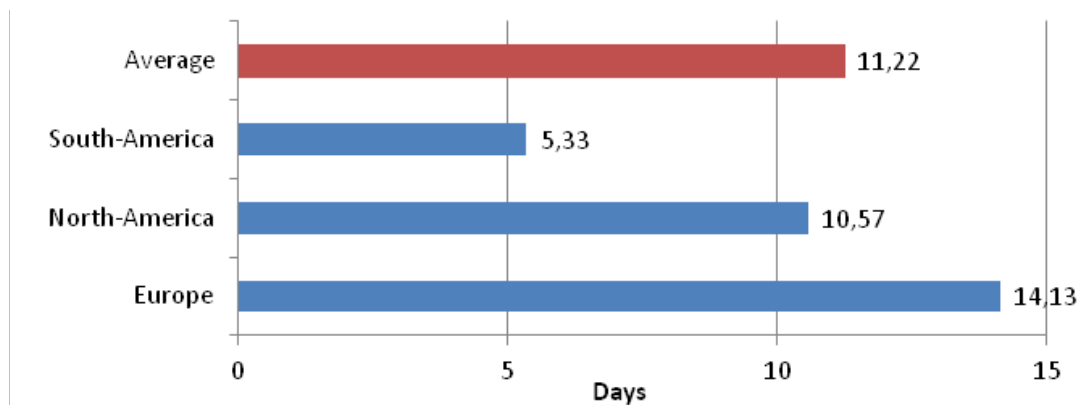


Figure 4.5 Average duration of a holiday to Bonaire. Only stay-over tourists are considered, since cruise tourists only visit the island for 1 day.

The calculation of the average stay is important for the calculation of the daily expenditures. Expenditures were asked per household for different categories as well as for the entire duration of the stay. This may complicate the comparison since household sizes and duration of the trip differ. Expenditures are therefore transformed to daily expenditures per person.

As can be seen in Table 4.1, there is a significant difference between expenditures of the cruise and stay over tourists. This difference is mainly caused by the fact that cruise tourists do not have to pay for accommodation and have breakfast and supper on board of the ship. Stay-over tourists have to spend much more money on basic needs as food and a place to stay.

*Table 4.1 Average daily expenditures per person for cruise and stay-over tourists (including airplane tickets for stay-over tourists).*

	Stay-over tourist	Cruise tourist
<b>Mean Daily expenditure</b>	<b>\$200,25</b>	<b>\$134,86</b>
<b>N</b>	142	78
<b>Std. Deviation</b>	200,035	152,395

*Note: difference between means is significant.*

As shown in Table 4.2, there is also a significant difference in spending between North American and European stay-over tourists. There are not enough respondents to identify a significant difference between cruise tourists from different countries. There were not enough Latin American respondents to give a reliable estimate of their average daily expenditures.

*Table 4.2 Difference in daily expenditures for North-American and European tourists (including airplane tickets)*

	Continent	Mean	Std. Error Mean
<b>Stay-over</b>	North America	229,19**	16,577
	Europe	151,75**	18,917
<b>Cruise</b>	North America	115,61	15,309
	Europe	300	.

*Note: \*\* Significant difference in means at the 5% level.*

Figure 4.6 shows the main categories expenditures of cruise and stay-over tourists. The interesting difference is that cruise tourists pay on average much more on tours, snorkelling and shopping. This does not necessarily imply that stay-over tourists participate in snorkelling and tours less than cruise tourists. These are activities that are easily done on an individual basis. Car rental is an alternative for booking an organized tour and snorkelling can also easily be done without a tour operator. Diving on the other hand must be done through a dive operator for every diver: even a totally independent diver must fill his tanks at a compressor, which is only allowed at a certified compressor operator (STINAPA, 2012).

While stay-over tourists spend more on average on diving per day, a diving stay-over tourist spends less per day on diving than a cruise tourist. Figure 4.6 shows the

average expenditures of all tourists and Table 4.3 and Table 4.4 summarise respectively the average expenditures per cruise and stay-over tourists that participate in a specific activity. Most mean expenditures are much lower for stay-over tourists, but the percentages of tourists participating in a specific activity are much higher. This indicates that stay-over tourists participate in a variety of activities during their stay on Bonaire, while the cruise tourists focus on a limited number of activities. This is caused by the fact that stay-over tourists stay much longer on the island than cruise tourists. The fact that average expenditures are lower for many activities for stay-over tourists does not have to mean that they pay less for the activities. The expenditures are daily. So if a stay-over tourist participates in an activity during his stay only once. The expenditure is still divided by the amount of days that the tourist is on Bonaire.

*Table 4.3 Average expenditures per cruise tourist per day for every household that spent money on each of the expenditure categories*

Cruise tourist	Mean	Std. Error	% of cruise tourists
Accommodation	-	-	-
Car rental	-	-	-
Local transport	\$18.57	4.58	0.087
Tours	\$67.65	6.9	0.4203
Diving	\$61.37	44.9	0.0435
Snorkel-ling	\$57.89	13.17	0.3043
Boats	\$82.49	33.72	0.1014
Food & drinks	\$19.33	4.64	0.4638
Shopping	\$41.99	5.77	0.6812
Casino	\$2.50	.	0.0145
Donations	\$4.37	2.87	0.0435
Other	\$22.50	7.5	0.029

*Table 4.4 Average expenditures per stay-over tourist per day for every household that spent money on each of the expenditure categories*

Stay-over:	Mean	Std. Error	% of stay-over tourists
Accommodation	\$ 66.49	5.03	0.7731
Car rental	\$ 18.39	1.5	0.6303
Local transport	\$ 2.74	0.68	0.2017
Tours	\$ 4.83	2.23	0.1261
Diving	\$ 26.34	3.11	0.5126
Snorkel-ling	\$ 3.05	0.51	0.2689
Boats	\$ 5.26	1.28	0.2185
Food & drinks	\$ 27.78	1.98	0.9076
Shopping	\$ 10.50	1.48	0.7899
Casino	\$ 4.53	1.99	0.084
Donations	\$ 2.81	1.55	0.2269
Other	\$ 33.55	15.92	0.1429

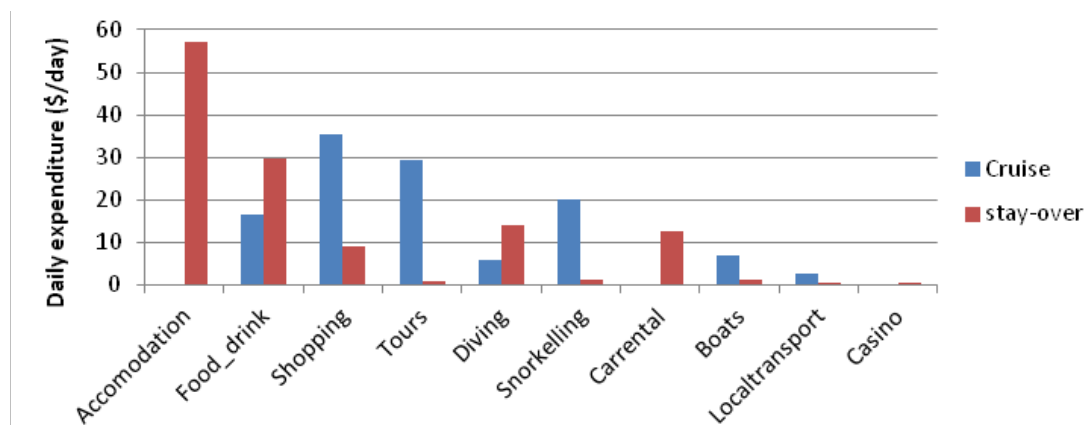


Figure 4.6 Composition of the daily average expenditures for stay-over and cruise tourists

### 4.3 Packages

An important implication for the calculation of the tourism values on Bonaire is the fact that 34% of the stay-over and 68% of the cruise tourists purchased a package. Figure 4.7 shows the percentages of all tourists that came on a package as well as the composition of the package. Around 18% of all stay-over and 11% of all cruise tourists had a package that included diving. Local experts in the tourist sector mention that this might be an underestimate of the real share of dive packages. It is problematic that we do not know which share of the package price went to a particular category, which implicates that we cannot use these expenditures for the calculation of the tourism value. It is important to keep in mind that this will cause an undervaluation of the ecosystem service value of tourism.

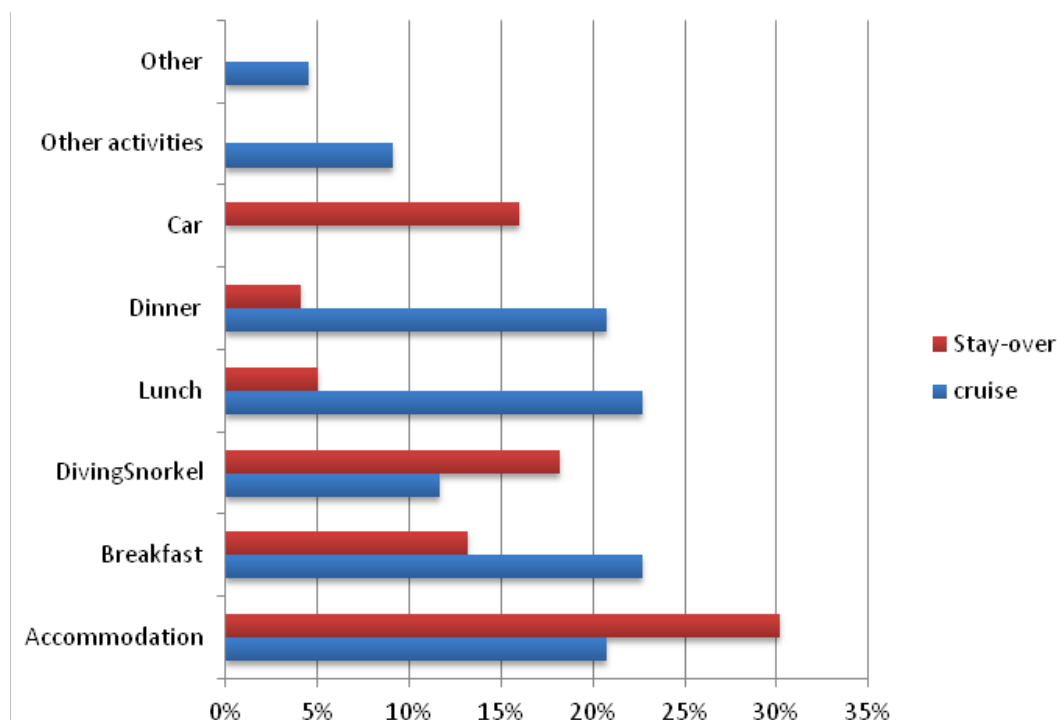


Figure 4.7 Percentage of the tourists that had bought a package deal including the expenditure categories mentioned above

#### 4.4 Experience on Bonaire

Figure 4.9 shows the overall experience on Bonaire and the aspects that tourists appreciated about the island. The first three attributes show that both cruise and stay-over tourists appreciate the fact that they are on a tropical island, the Bonairean seascape and the tranquillity on the island. The last few categories more clearly illustrate the differences between the two types of tourists. While cruise tourists are more positive about the island centre of Kralendijk, the other visitors, and the ships that visit Bonaire, the stay-over tourists mainly value the sports that can be practiced on Bonaire. This indicates that the cruise tourist might attach more value to the development of Bonaire. Since most sports are performed outdoor on Bonaire and have much to do with the Bonairean natural environment, stay-over tourists might be more concerned with this aspect of the island. It is important to note that the differences are small, except for the “view ships” and “Visitors” categories.

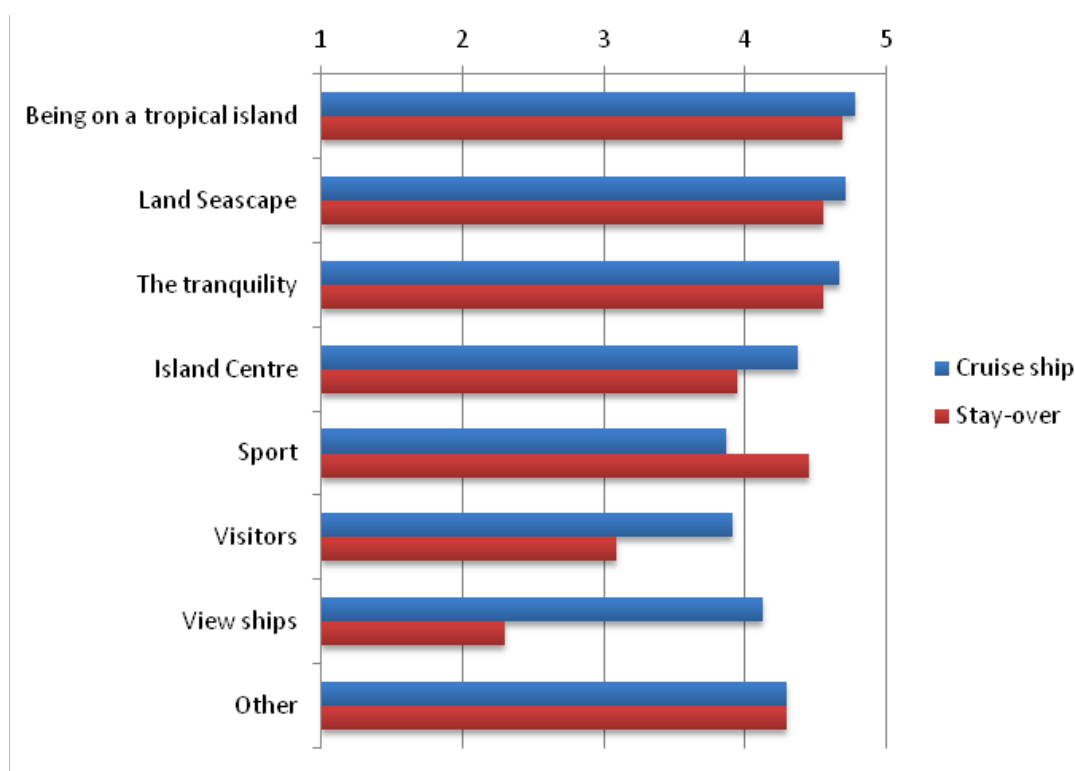


Figure 4.8 How much did you enjoy the following aspects on a scale of 1 to 5? 5 = “very much”; 1 = “not at all”

#### 4.5 Returning to Bonaire

Returning tourists are important to the tourism industry of Bonaire. As shown in Figure 4.9, especially a large share of the stay-over tourists returns to the island while cruise tourists are not returning in the same rate as the stay-over tourists. Of the cruise tourists 22% returns to Bonaire on another cruise, while stay-over tourists have a 55% return rate, mainly as a stay-over tourist.

There are two explanations for the difference in return rate between stay-over and cruise tourists. First, stay-over tourism is much more developed on Bonaire than cruise tourism. Bonaire has seen a steady amount of stay-over tourists in the last decade, while cruise tourism expanded rapidly. This recent increase may be the reason why cruise tourists simply did not have the opportunity yet to return to Bonaire. Second, it

is possible that the stay-over tourists are much more drawn to Bonaire in particular than cruise tourists are. Possibly, a tropical island is much more substitutable for a cruise tourist than for a stay-over tourist, who specifically chooses to go to Bonaire out of all islands in the Caribbean. A cruise tourist goes to many islands during the cruise trip and might not have such a strong preference for a specific island.

The survey also shows that there is little substitution between the stay-over and cruise tourists. A negligible percentage (2%) of stay-over tourists first visited Bonaire by cruise ship; only 6% of the cruise tourists visited Bonaire by plane first. Therefore, very few cruise tourists on Bonaire transform into stay-over tourists and vice-versa.

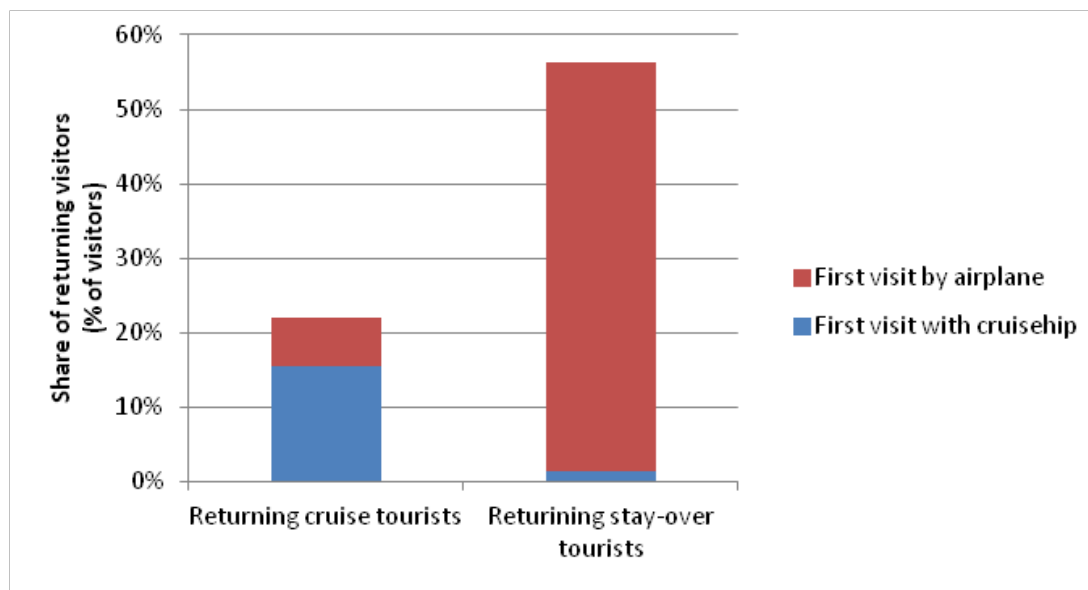


Figure 4.9 The percentage of tourist that had previously visited Bonaire. So, 22% of cruise tourists are returning visitors of which 70% visited with a cruise the first time as well

Will tourists visit Bonaire in the future? Figure 4.10 shows the answers to the question whether a tourist respondent will return to Bonaire in the future. The rate of returning visitors is comparable for the stay-over tourists to the rate presented in Figure 4.9. For the cruise tourist, however, the rate is higher: 37% says to return for sure and 42% will probably return. This is a lot higher than the 22% of actually returning tourists. This can indicate that the cruise tourist market is indeed developing. Another explanation is that only the tourists that were excited about Bonaire voluntarily filled in the survey.

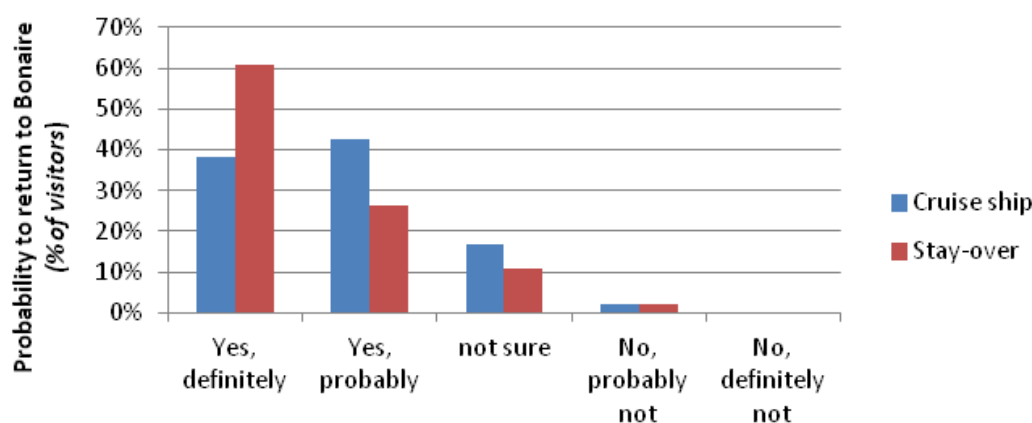


Figure 4.10 Answers to the question: "Will you return to Bonaire in the future?"

A crucial question on the context of the importance of ecosystem health for tourism is whether tourists would return to a different Bonaire: an island that is more developed and suffers from degraded coral reefs. Figure 4.11 shows that both the crowdedness on the island and the state of the reef have an influence on the return rate of both categories of tourists. Stay-over tourists seem to be somewhat more sensitive to crowdedness, and are substantially more sensitive to the quality of the coral reef. From the 60% of stay-over tourists that definitely come back according to Figure 4.9, only 10% remains if the reef degrades significantly. This is probably caused by the large amount of divers in the stay-over category. If there were to be 50% more buildings and people on Bonaire, only 13% of stay-over tourists return compared to the 60% in Figure 4.9. For cruise tourists the percentage that would definitely return does not change a lot compared to figure 11, which means that the crowdedness and quality of the reef do not have a large impact on the return rate of cruise tourists.

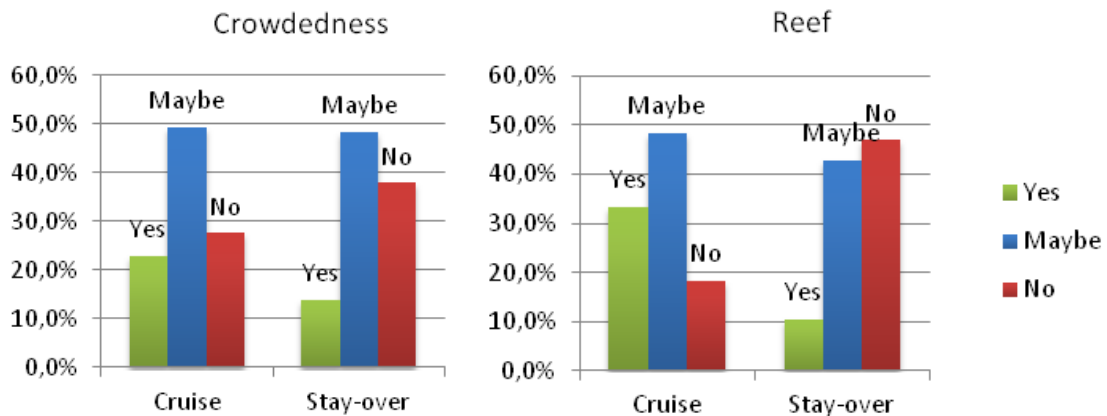


Figure 4.11 Left: Would you return to a more crowded Bonaire (50% more buildings and people)? Right: Would you return to a Bonaire with coral reefs in a significantly worse state?

In the context of crowdedness on the island, it is interesting to understand what visitors perceive to be the main cause of this negative aspect. When asked the question whether Bonaire should limit cruise tourism, especially stay-over tourist agree to this notion (see Figure 4.12). Yet, typically also more cruise ship tourists agree to the need to limit cruise tourism than disagree. All in all, the question answered in Figure 4.12 shows that cruise tourism might be a particularly important reason for the perceived crowdedness on the island.

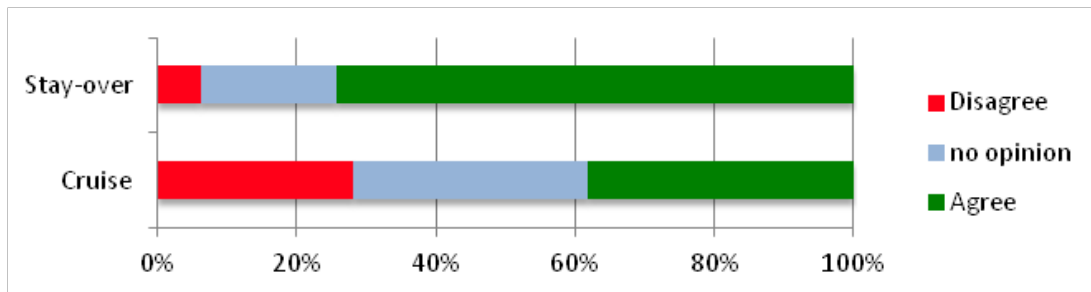


Figure 4.12 “Do you agree with the following statement: Should Bonaire limit cruise tourism?”

## 4.6 Activities

### 4.6.1 Marine-based activities

Marine-based activities are one of the most important reasons for tourists to visit Bonaire. Most of these activities depend heavily on the state of the marine ecosystems. Especially these activities are important for the value of the tourism ecosystems service value. Figure 4.13 shows the share of tourists that participate in a particular activity. Figure 4.14 shows how much visitors appreciate that marine-based activities they participated in. The most frequently performed activities are snorkelling, going to the beach and swimming for both cruise and stay-over tourists. Diving is also very important for stay-over tourists, yet cruise tourists are only moderately participating in this activity. It is important to keep in mind that the fact that cruise tourists participate in relatively few activities, does not mean that a cruise tourist is less adventurous than a stay-over tourist. Cruise tourists stay only for a day, which gives them less time to do things on Bonaire.

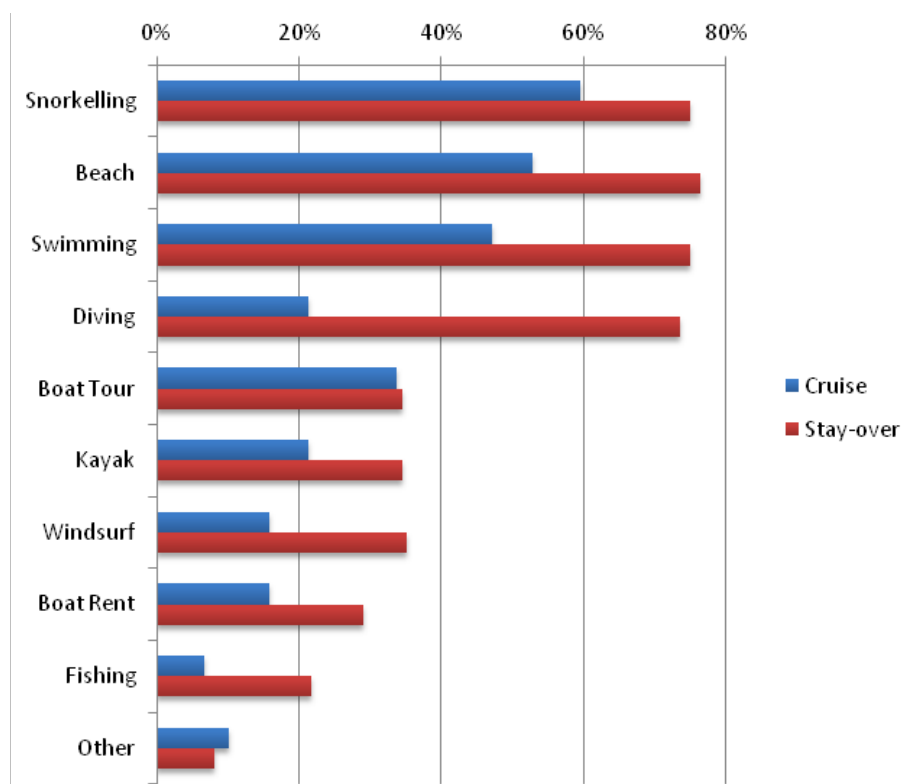


Figure 4.13 The participation rate in marine-based activities (% of visitors)



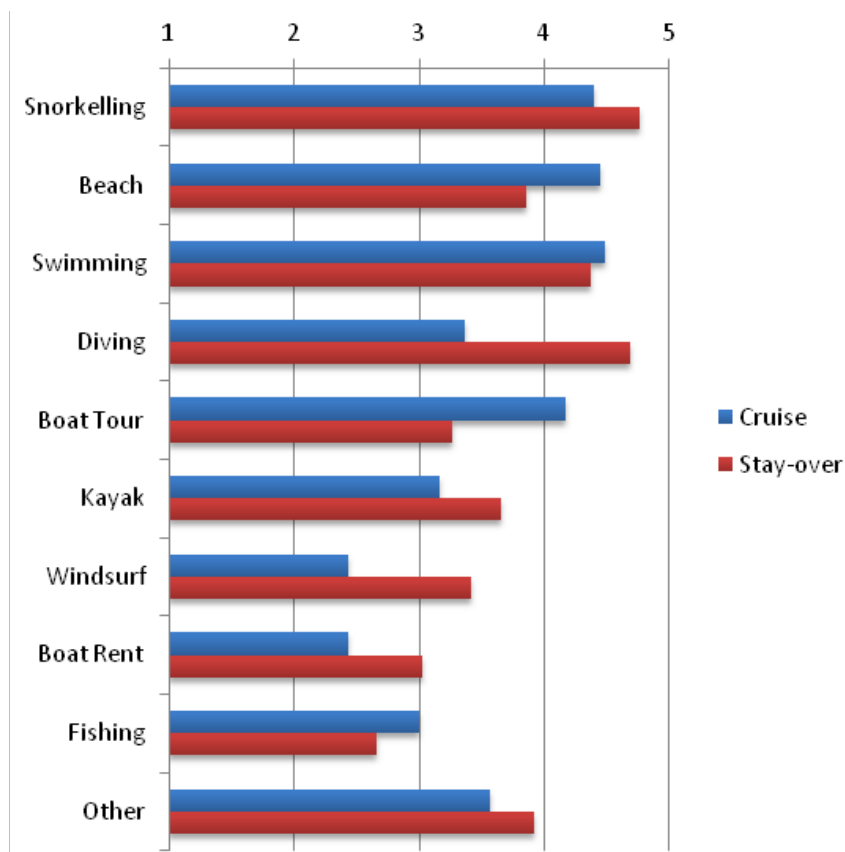


Figure 4.14 Appreciation of marine-based activities (on a scale of 1 – low appreciation to 5 – high appreciation)

As mentioned, diving is one of the most important activities on Bonaire for stay-over tourists. Naturally, there are more reasons to come to the island, but 75% of the stay over tourists in our sample is a diver. Of all the most popular activities diving is the one where Bonaire has a competitive advantage compared to other island in the Caribbean; it is called “divers paradise” for that reason. We therefore take a closer look at the number of divers in Figure 4.15.

According to the TCB, the percentage is the lowest with 60%, followed by the face-to-face survey comes next with 68%. The highest percentage of divers is found in the online survey. TCB (2008) estimated the amount of divers by looking at the number of dive tags that were sold annually and using an estimate for the number of returning divers. A dive tag is necessary for entrance to the marine park, and is bought by every diver and stays valid for a year. The returning divers are the divers that returned within a year and did not have to buy another tag. It has never become clear to us how the TCB arrived at this estimate. When the large dive operators were interviewed, they claimed they had no idea how many people returned to Bonaire within a year.

For the cruise tourists the estimates between the various sources differ even more. The survey results of the TCB show that 2.9% enjoyed diving the most in Bonaire. This might not be a good representative for the number of divers. It is also possible that the response rate to our surveys is higher for divers than non-divers. This could be caused by a higher environmental awareness. However, we find no significant difference in awareness between divers and non-divers. Since the face-to-face survey targeted random tourists at the airport and the cruise pier, it is not liable to a selection bias, while the online survey may be more prone to this bias. We therefore think that the face-to-face estimates are the most reliable of the three.

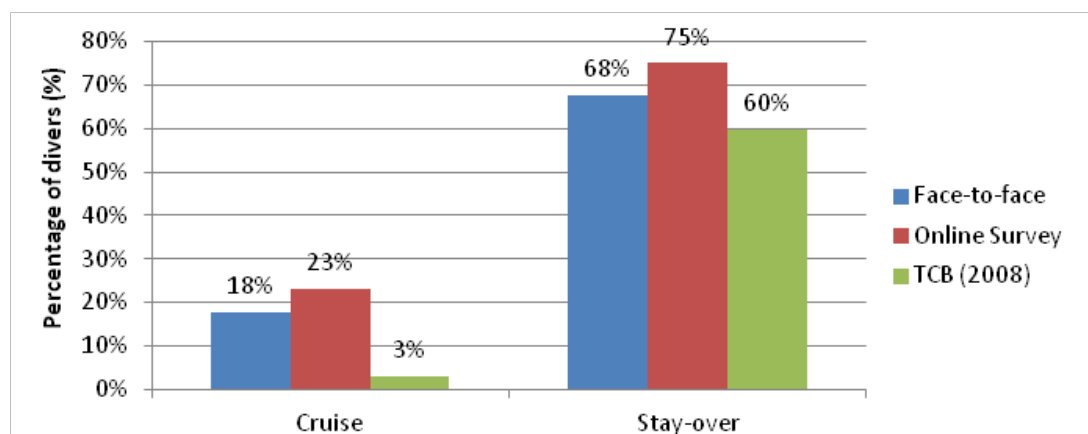


Figure 4.15 Percentage of divers according to the TCB, the face-to-face survey and the online survey

Figure 4.16 shows which factors are most appreciated by the users of the marine-related ecosystems. The factors that are mostly enjoyed in the marine park are the clarity of the water, the corals, fish and the temperature. Both fish and corals are very dependent on the state of the coral reef ecosystem around Bonaire, which again indicates its importance for tourism.

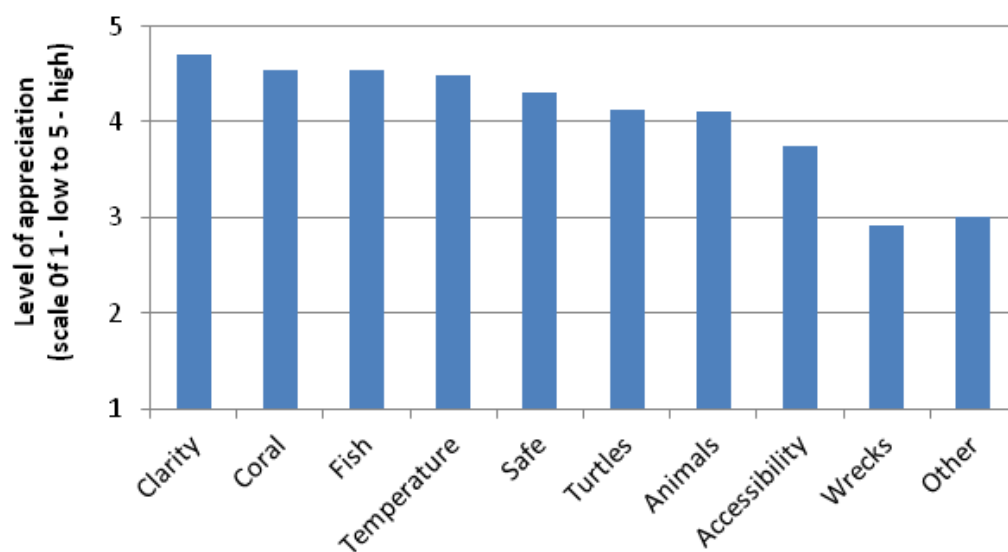


Figure 4.16 The factors that determine the appreciation of the Bonairean seascape.

#### 4.6.2 Land-based activities

Figure 4.17 shows the participation in land-based activities and Figure 4.18 presents that the appreciation of these activities. Shopping and touring are the most important land-based activities for both types of tourists. Klein Bonaire is also an important attraction. The Washington Slagbaai National Park is an important land-based destination for stay-over tourists. It is interesting to see that the marine-based activities are more important to the stay-over tourists who participate substantially more in marine-based activities than land-based activities. For cruise tourists the land-based activities seem to have an equal weight as the marine-based activities. Also the appreciation of the land-based activities is lower than for the marine-based activities, which indicates that the land-based activities are not a primary reason to visit Bonaire.

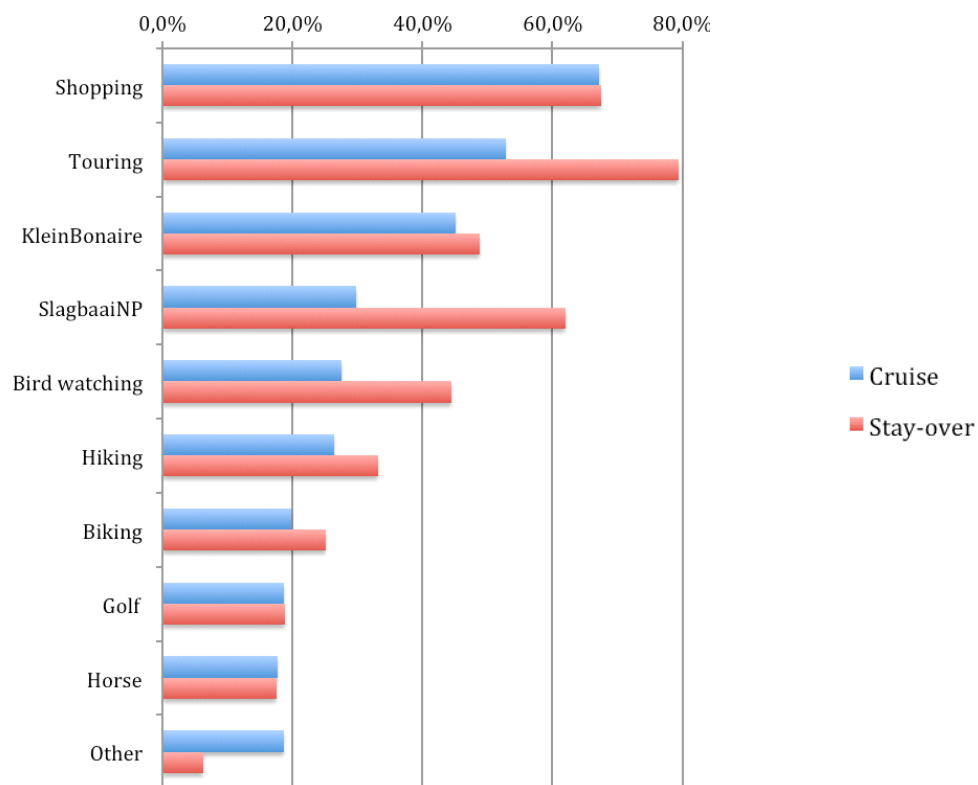


Figure 4.17 The participation rate in land-based activities (% of visitors)

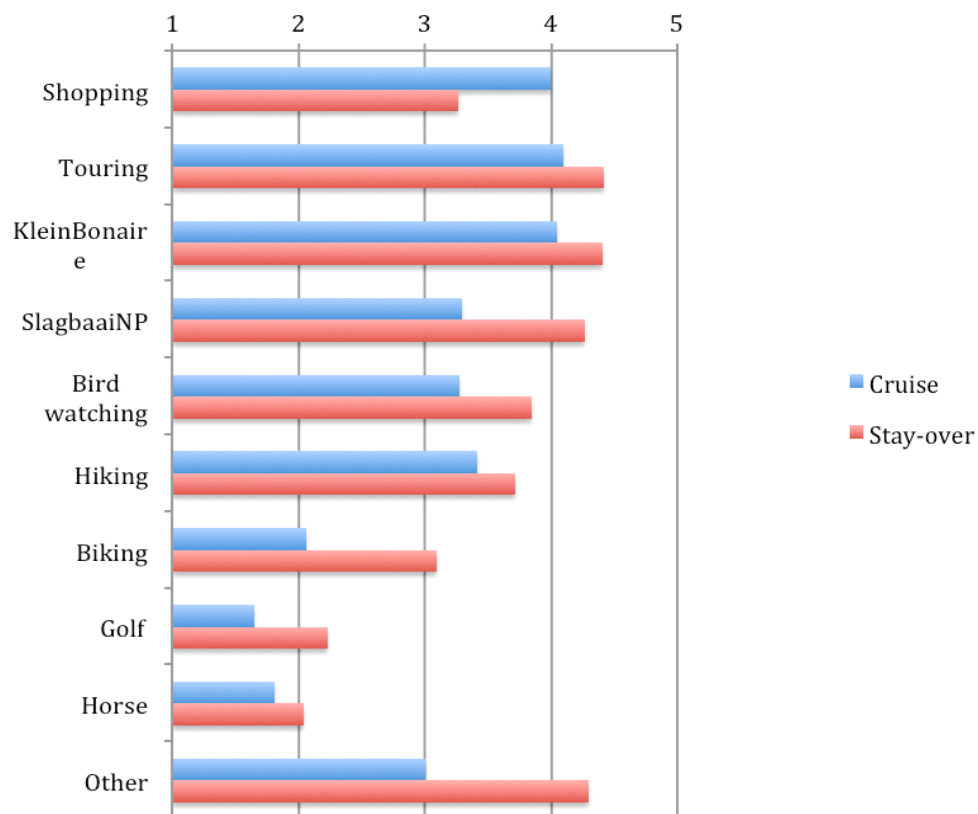


Figure 4.18 The appreciation of the land-based activities (on a scale of 1 - low appreciation to 5 - high appreciation)

Figure 4.21 shows which aspects of the Bonairean terrestrial environment are most appreciated. The figure shows that the part of the landscape that is mostly related with the seascape is valued most; all aspects are valued positively though. This supports the claim that the terrestrial ecosystems are not the main reason for a visit to Bonaire, but the very positive valuation indicates that they are a pleasant complement.

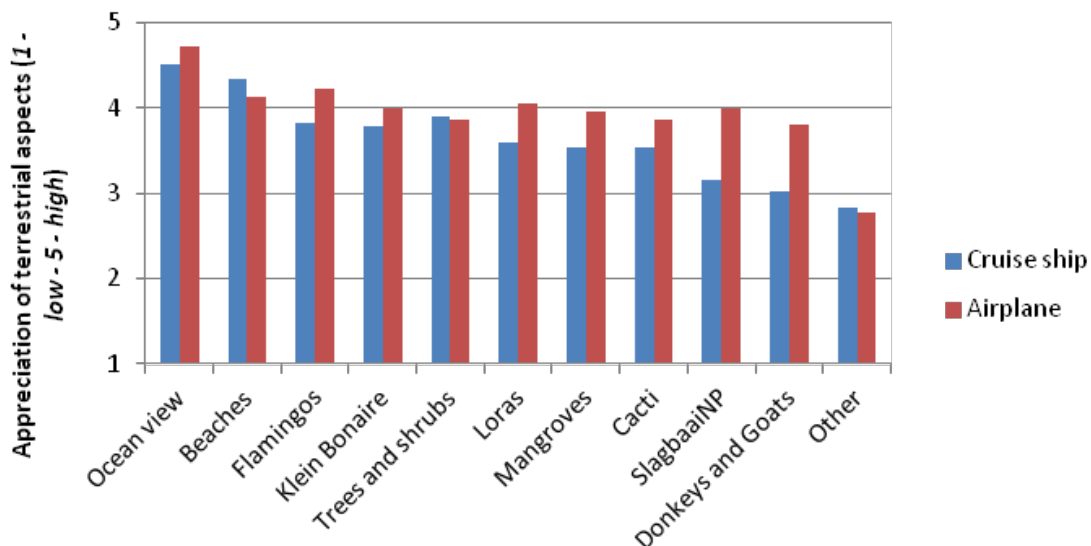


Figure 4.19 Aspects that determine the appreciation of the terrestrial environment (on a scale of 1 – low appreciation to 5 – high appreciation)

### 4.7 Environmental awareness

Figure 4.20 shows the environmental awareness of the respondents. Because we do not have the same numbers for an average American or European citizen, we cannot determine how environmentally aware tourists on Bonaire are compare to averages in their countries. We can, however, compare the environmental awareness of cruise and stay-over tourists. From the figure we can conclude that there are no important differences in the awareness of both types of tourists.

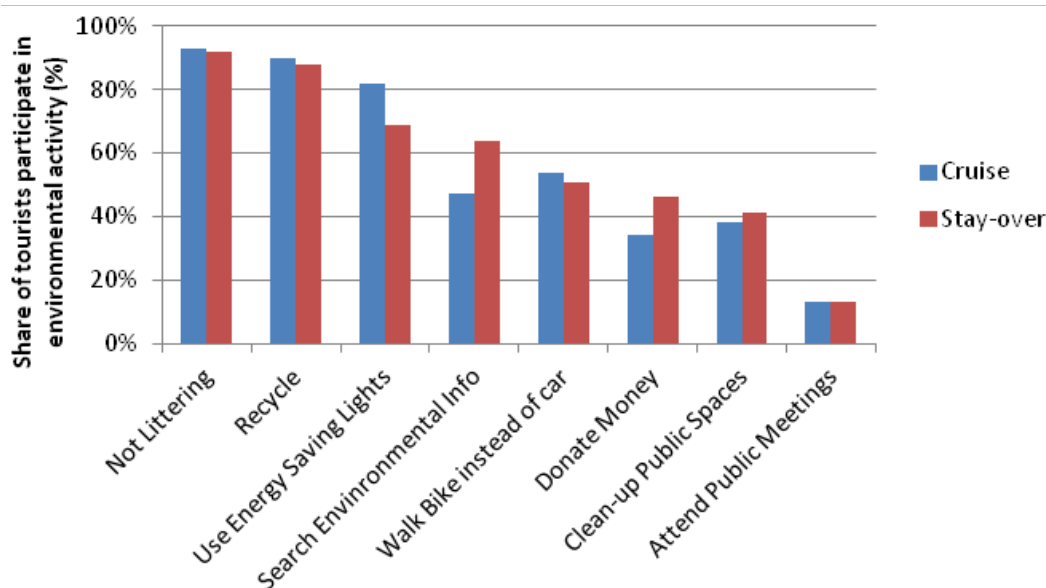


Figure 4.20 Percentage of tourists that make the effort to undertake a specific environmentally friendly activity.

## 4.8 Choice experiment

In order to determine the Willingness To Pay (WTP) for an additional fee for environmental management we performed a choice experiment, of which the results are summarised in Table 4.5. All attributes of the experiment are statistically significant, which means that they influence the choice for a specific scenario. All attributes are dummy variables. For example, marine environment is divided between a low, a medium and a high state. The coefficient shows the importance of such a state compared to the lowest possible state, which is the omitted dummy variable. We can, therefore, state that medium environmental quality is valued 4 times higher than medium terrestrial quality (both compared to respectively low marine and low terrestrial quality). The environmental fee is a continuous variable. Its coefficient shows the importance of the environmental fee for choosing a specific scenario, but it is not significantly different from 0. This has also implications for the WTP. Although we can give an estimate of the average WTP for a specific attribute, the confidence intervals are extremely high.

*Table 4.5 Multi-nomial logit regression results for the Willingness to Pay level with 95% confidence intervals (in US\$)*

	Coeff.	SE	P-value	WTP	Lower Confidence	Upper Confidence
Marine environment medium	1.0322	0.1107	0.000	1,147	219	12,769
Marine environment high	1.5346	0.1076	0.000	1,705	341	18,126
Terrestrial quality medium	0.2123	0.0989	0.032	236	21	3,759
Terrestrial quality high	0.3743	0.0955	0.000	416	84	5,016
Safety moderate	0.8564	0.1003	0.000	952	186	10,676
Safety high	0.7885	0.1036	0.000	876	180	9,571
Environmental management medium	0.2769	0.0967	0.004	308	41	4,332
Environmental management high	0.3044	0.0941	0.001	338	57	4,306
Crowdedness medium	-0.2802	0.0941	0.003	311	54	4,073
Crowdedness high	-0.5761	0.0991	0.000	640	121	7,532
Environmental fee	-0.0009	0.0019	0.643			
N	251					
R <sup>2</sup> Pseudo	0.1048					

The environmental fee in the experiment varied between the \$0 and \$40 per visit. Figure 4.21 supports the argument that this was too low to be an important attribute for choosing a specific scenario. Almost 35% of the respondents answered that the fee was not an important determinant for their choices in the choice experiment, while only 9% labelled it as an important determinant. All other attributes were much more important to the respondents; the most important one was marine environment which was important to 83% of the respondents. A higher environmental fee had probably generated more specific and accurate results for the WTP.

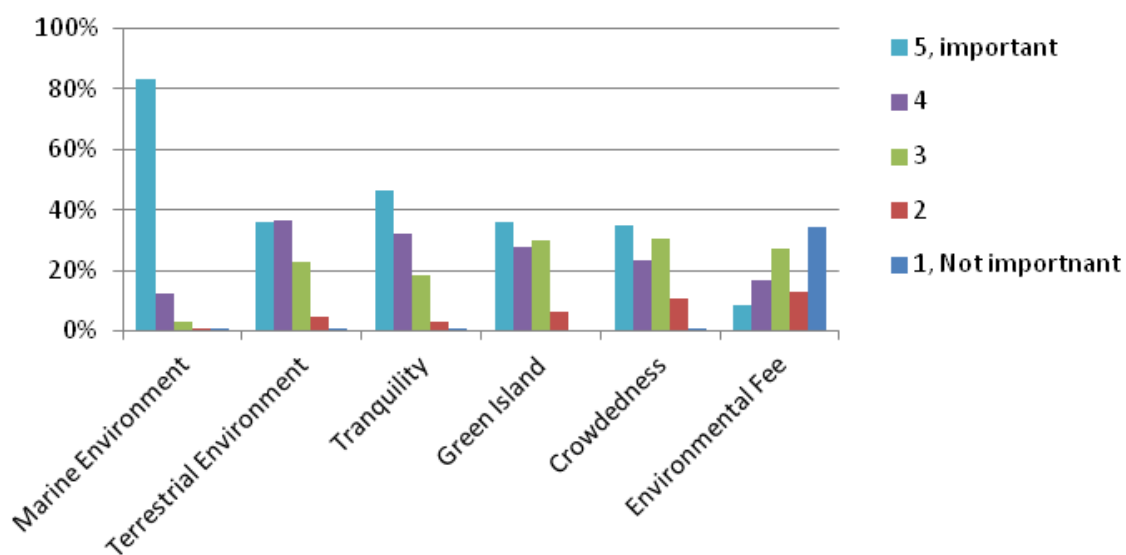


Figure 4.21 Influence of the attributes used in the choice experiment on the choices in the choice experiment

## 5 Total tourism value

The next step in the study is to calculate the total ecosystem service value of tourism on Bonaire, which is a composite of the Producer Surplus (PS) and the Consumer Surplus (CS). The valuation and aggregation procedure is explained in the following sections.

### 5.1 Producer surplus

The PS is calculated by using the net factor income method, in which the ecosystem is seen as a main asset supporting the PS. The PS can be seen as the income that is earned by people on the island in the tourist industry. However, not all expenditures and activities are directly attributable to the ecosystem. Therefore, we divide all tourist expenditures into direct and indirect values. The direct values are found in situations where the ecosystem provides a direct benefit for the supplier or consumer of good or service (e.g. diving and snorkelling). The indirect values, on the other hand, are found in situations where the ecosystem provides an indirect benefit. A hotel, for example, will fill more rooms with healthy ecosystems on Bonaire, but the quality of the hotel is not dependent on the ecosystem. Therefore, we calculate a 'indirect' dependency rate for tourist expenditures that are not directly related to the ecosystem, but would be lower in the case of a degraded ecosystem state as a result of lower tourist numbers.

#### *Direct tourism values*

The direct values are created by the services that depend directly on the ecosystem. The expenditures in the survey for ecosystem services are the expenditures for diving, snorkelling, island tours, boat rentals and boat tours. However, the experience of an island tour or a boat tour is not entirely attributable to the ecosystems. The island tours also pass cultural aspects of the island, like slave huts in the south of Bonaire and the village Rincon and cave drawings in the north. The same holds for the boat tours; the natural environment is enjoyed, but also the boat itself. We therefore attribute 50% of expenditures on island tours to the ecosystems that are visited and 25% of the boat tour expenditures. We assume that diving and snorkelling depend for 100% on the coral reefs.

#### *Division of the indirect ecosystem value*

The other expenditure categories are considered to depend indirectly on Bonairean ecosystems. In order to attribute a particular part of these tourism revenues on Bonairean nature we take a look at all the tourist activities on Bonaire. Per activity, we assume a dependency on the ecosystem, which is shown in Table 5.1 and labelled as the factor for ecosystem dependency (FED). With these dependency rates the average ecosystem dependence is determined for each respondent using the following formula:

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$$= \text{Dummy variable for an activity "i" which equals 1 if the activity is performed and 0 otherwise; } = \text{Factor for Ecosystem Dependence, the factor that determines how dependent activity "i" is on the ecosystem; } = \text{number of activities performed by the respondent.}$$

The result is an average ecosystem dependence of 70.5% for the other indirect expenditures. It is important to note that all activities are given equal weight in this analysis. For example, if a respondent has visited Washington Slagbaai National Park and went horseback riding, the average ecosystem dependence of the respondents activities is  $(0.5+1)/2=75\%$ .

Table 5.1 Assumed part of each activity that is dependent on the ecosystems of Bonaire.

<u>Water activities:</u>	<u>Factor for Ecosystem Dependence (FED)</u>	<u>Land activities:</u>	<u>Factor for Ecosystem Dependence (FED)</u>
-Snorkelling	1	-Touring	0.75
-Beach trip	0.5	-Klein Bonaire	1
-Swimming	0.25	-Washington Slagbaai NP	1
-Diving	1	-Bird watching	1
-Boat tour	0.25	-Hiking	0.75
-Kayak	1	-Biking	0.5
-Windsurf	0.25	-Golf	0.25
-Boat rent	0.25	-Horseback riding	0.5
-Fishing	0.25		

#### *From total expenditures to the ecosystem service value*

Because we lack complete information on costs structure of the tourism industry on Bonaire we assume 25% of the total expenditures to reflect the added value of the industry. Only the donations that are given by tourist are a 100% benefit to the island. Expenditures on flights and cruises are not used for calculations because of the small benefit to Bonaire. The airport fee and port charges are used instead. The airport fee is \$35 and is paid by everyone that leaves Bonaire by air.<sup>2</sup> The port charges depend on the size of the ship, but are on average \$4 per cruise passenger, including a 2\$ head tax. (personal communication with the harbour master R. Sint Jago). Table 5.2 shows the calculation of the added value and the ecosystems' net-factor benefit for stay-over tourism and Table 5.3 show the same for cruise tourism.

<sup>2</sup> All our respondents flew with Arke Fly, Continental, Delta and KLM. So this tax holds for everybody.



Table 5.2 Net-factor benefit of ecosystems for the stay-over tourism industry<sup>3</sup>

	Added value (%)	Ecosystem dependence	Average expenditure per tourist per day	Average expenditure per tourist per stay	Added value	Net factor ecosystem benefit
<u>Direct Values:</u>						
<b>Diving</b>	25%	100%	\$14.10	\$149.30	\$37.32	\$37.32
<b>Snorkel-ling</b>	25%	100%	\$1.19	\$12.62	\$3.16	\$3.16
<b>Island tours</b>	25%	75%	\$0.75	\$7.95	\$1.99	\$1.49
<b>Boats tours/rental</b>	25%	25%	\$1.38	\$14.61	\$3.65	\$0.91
<u>Indirect values:</u>						
<b>Airport fee</b>	25%	70.5%	\$3.31	\$35.00	\$8.75	\$6.17
<b>Accommodation</b>	25%	70.5%	\$56.97	\$603.27	\$150.82	\$106.33
<b>Car rental</b>	25%	70.5%	\$12.56	\$133.05	\$33.26	\$23.45
<b>Local transport</b>	25%	70.5%	\$0.55	\$5.80	\$1.45	\$1.02
<b>Food &amp; drinks</b>	25%	70.5%	\$29.63	\$313.79	\$78.45	\$55.31
<b>Shopping</b>	25%	70.5%	\$9.24	\$97.89	\$24.47	\$17.25
<b>Casino</b>	25%	70.5%	\$0.42	\$4.44	\$1.11	\$0.78
<b>Donations</b>	100%	70.5%	\$0.64	\$6.75	\$6.75	\$4.76
<b>Other</b>	25%	70.5%	\$4.79	\$50.77	\$12.69	\$8.95
<b>Total p.p.</b>			\$135.53	\$1,435.24	\$363.88	\$266.90
<b>Total stay-over</b>				\$100,467,120	\$25,471,263	<b>\$18,683,062</b>

Table 5.3 Net-factor benefit of ecosystems for the cruise tourism industry<sup>3</sup>

	Added value (%)	Ecosystem dependence	Average expenditure	Added value	Net factor ecosystem benefit
<u>Direct Values:</u>					
<b>Diving</b>	25%	100%	\$6.00	\$1.50	\$1.50
<b>Snorkel-ling</b>	25%	100%	\$19.97	\$4.99	\$4.99
<b>Island tours</b>	25%	75%	\$29.37	\$7.34	\$5.51
<b>Boats tours/rental</b>	25%	25%	\$6.82	\$1.71	\$0.43
<u>Indirect values:</u>					
<b>Port charges</b>	25%	70.5%	\$4.50	\$1.13	\$0.79
<b>Car rental</b>	25%	70.5%	\$0.20	\$0.05	\$0.03
<b>Local transport</b>	25%	70.5%	\$2.56	\$0.64	\$0.45
<b>Food &amp; drinks</b>	25%	70.5%	\$16.53	\$4.13	\$2.91
<b>Shopping</b>	25%	70.5%	\$35.49	\$8.87	\$6.25
<b>Casino</b>	25%	70.5%	\$0.31	\$0.08	\$0.05
<b>Donations</b>	100%	70.5%	\$0.19	\$0.19	\$0.13
<b>Other</b>	25%	70.5%	\$0.65	\$0.16	\$0.12
<b>Total p.p.</b>			\$122.60	\$30.79	\$23.18
<b>Total cruise</b>			\$25,133,880	\$6,312,697	<b>\$4,751,777</b>

<sup>3</sup> Added value = Average expenditure\*added value (%); Net factor ecosystem benefit = Added value\*Ecosystem dependence.

## 5.2 Consumer surplus

The CS is calculated using the WTP estimates determined in the Choice Experiment. Since this is a WTP to maintain or improve the quality of the ecosystems this value is directly and fully attributable to the ecosystem. This CS is also valid for the ecosystems services that are not paid for. For example, hiking around Bonaire is only valued by means of the CS, since it is not a service that is bought from a provider. The CS is mainly valued by the tourists that visit Bonaire, but a larger CS surplus also indicates that there are more possibilities to increase the revenues in the tourist industry, because people are willing to pay more.

One should be aware that the results of the Choice Experiment are liable to a reasonable amount of uncertainty, resulting in very large confidence intervals. It is still possible to use the WTP results, but caution is required. Therefore, we take a conservative approach and use the lower bounds of the WTP confidence intervals that were presented in Table 4.4. These are the lower bounds of a 95% confidence interval that estimates the average WTP per tourist. It is important to note that this is an average for all types of tourists. However, since stay-over tourists are a somewhat overrepresented in our sample, it is likely that the estimates are closer to the WTP of stay-over tourists. To correct for this bias, we divide the average WTP by the average days that a stay-over tourist stays on Bonaire (i.e. 11.2) to obtain the WTP for a cruise tourist. Furthermore, we use the WTP for the medium state of the attributes as an estimate for a WTP to maintain the current situation. This is done because it was not specified in the survey which states reflect the current states of the attributes.

The total WTP for each attribute is presented in Table 5.4. As expected, the WTP for the marine ecosystem is much higher than the WTP for the terrestrial ecosystems. The total WTP for ecosystem maintenance (terrestrial and marine environment) is \$21,720,000. This does not mean that everybody is willing to pay the average amount of \$219 for marine ecosystem protection, which is an amount that is much higher than the current entrance fee to the marine park. It is a conservative estimate of the mean WTP; the high standard deviations do not allow us to estimate a lower bound of the actual WTP of the tourist population, but it strongly indicates that an additional fee would not necessarily have a large impact on the amount of tourists coming to Bonaire. This is also supported by the small influence of the fee in the choice experiment on the choices for a specific scenario.

*Table 5.4 Total WTP (CS) for maintenance of the marine and terrestrial environment, for extra environmental management, and for maintaining the safety and tranquillity of the island (in US\$ per year)*

Attributes	Total WTP stay-over	Total WTP cruise
Marine environment	\$15,330,000	\$4,489,500
Terrestrial environment	\$1,470,000	\$430,500
Environmental management (e.g. renewable energy, waste management)	\$2,870,000	\$840,500
Safety	\$13,020,000	\$3,813,000
Crowdedness	\$3,780,000	\$1,107,000

## 6 Value mapping

In this research project we have given the tourism value a new dimension. Through a process referred to as value mapping, the value of ecosystem services has been made spatially explicit: it has been allocated to its geographical origins on a map. The added spatial dimension has enabled us to see that there is large variability in the spatial distribution of ecosystem services and their values: not all reefs share the same values, and values are far from equally distributed.

### 6.1 Ecosystems of Bonaire

With the total WTP and the net factor benefits that are derived from the ecosystems on Bonaire we can allocate the values spatially between different ecosystems. Spatial land-use data is used to derive the areas and location of the ecosystems. The ecosystem data that we use for the spatial analysis is specified in Figure 6.1. Kunuku's (agrarian landscape) are seen as a separate ecosystem as well as the coral reefs, mangroves and natural waters. Other natural environment, Washington-Slagbaai National Park and Klein Bonaire are shrub lands with a mixed vegetation of cacti, trees and shrubs. However, in the South, other 'natural environment' consists mainly of wetlands (salt ponds).

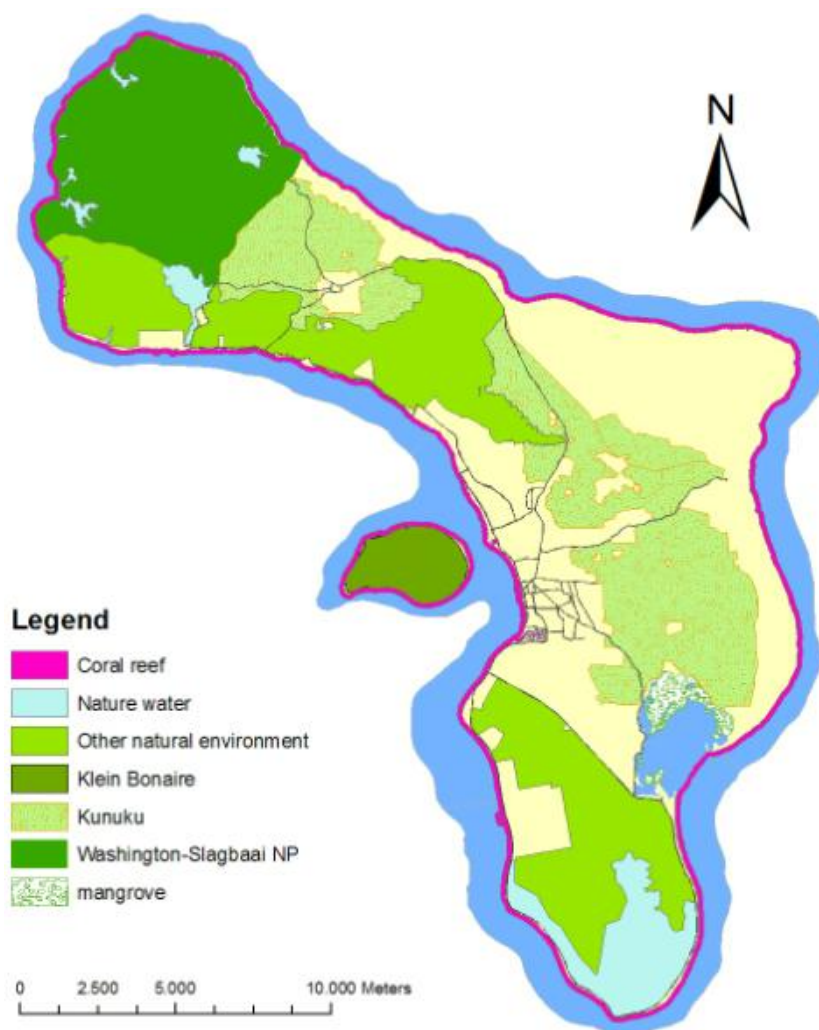


Figure 6.1 Ecosystems used for the spatial allocation of the tourism values

## 6.2 Tourism value map

To allocate the WTP (i.e. the consumer surplus) and net factor benefits (i.e. the producer surplus) calculated in Chapter 5, we use two questions in the survey. The first one investigates the amount of tourists that go on terrestrial tours in the South and in the North. The second question investigates the percentage of tourists that go snorkelling and diving at the reefs in the Far North, the North, the Centre, the South, or the East of the island near Lac. Also the visitors to Washington-Slagbaai National Park and Klein Bonaire were used, as well as the amount of kayakers and surfers at Lac.

The allocation specified in Table 6.1 is the result of the division of the values by the amount of visitors to each area. It is striking that the marine values per hectare are roughly a tenfold higher the values for land-based ecosystems. This does not imply that the terrestrial ecosystems are valued ten times lower than the marine ecosystems, as can be seen in the “total value” column in Table 6.1. Although marine ecosystems are valued more in terms of per hectare, the area of the terrestrial ecosystems is much larger than the marine area and thus still generates a large aggregated value for Bonaire as a whole.

*Table 6.1 Allocation of the aggregated ecosystem net factor benefit and WTP values (in US\$ per year)*

<b>Terrestrial</b>	<b>\$value</b>	<b>Hectare</b>	<b>\$/Ha</b>
<b>North</b>	\$5,547,884	4,265	\$1,301
<b>South</b>	\$3,947,526	4,581	\$862
<b>WSNP</b>	\$2,576,098	4,270	\$603
<b>Klein</b>	\$2,363,807	690	\$3,427
<b>Lac</b>	\$3,925,605	758	\$5,177
Total	\$18,360,921	14,564	
<b>Marine</b>	<b>Value</b>	<b>Hectares</b>	<b>\$/Ha</b>
<b>Far North</b>	\$2,399,199	173	\$13,845
<b>North</b>	\$4,956,393	122	\$40,712
<b>Centre</b>	\$4,447,295	131	\$33,873
<b>South</b>	\$5,529,860	212	\$26,135
<b>Blue Hole</b>	\$1,228,858	74	\$16,692
<b>Klein Bonaire</b>	\$4,622,846	168	\$27,470
<b>Sorobon/Lac</b>	\$8,967,808	758	\$11,827
Total	\$32,152,259	1,638	

The values specified for the various areas in Table 6.1 are converted into a tourism value map which is presented in Figure 6.2. A few observations can be made from the value map. For the terrestrial ecosystems, Klein Bonaire and the Northern ecosystems seem most valuable. This is caused by the fact that most cruise tourists go on tours to these areas. Washington Slagbaai National Park and the South are valued less, due to lower amount of visitors. The reef areas that have the highest dollar per hectare values are the reefs in the North and Centre West of the island. The reason for this is that these areas are easily accessible and most divers visited these parts of the reef. Also

the Lac area in the East of the island has a very high value, but do to the relatively large size of the mangrove area, in comparison to the number of visitors, the dollar per hectare value is somewhat lower than for the coral reef areas.

It is important to keep in mind that the calculated values are based on the consumer surplus of tourists and producer surplus values of the tourist industry. However, the interdependence of different ecosystems is hard to quantify and thus also difficult to process in the allocation of ecosystem values. For example, we make a strict distinction between marine and terrestrial ecosystems. Still, the health of terrestrial ecosystems may have serious impacts on the health of the marine ecosystems (e.g. through erosion, pollution, run-off), which can form a threat to the coral reefs around Bonaire. More specific ecological research is needed in order to incorporate such interdependences.

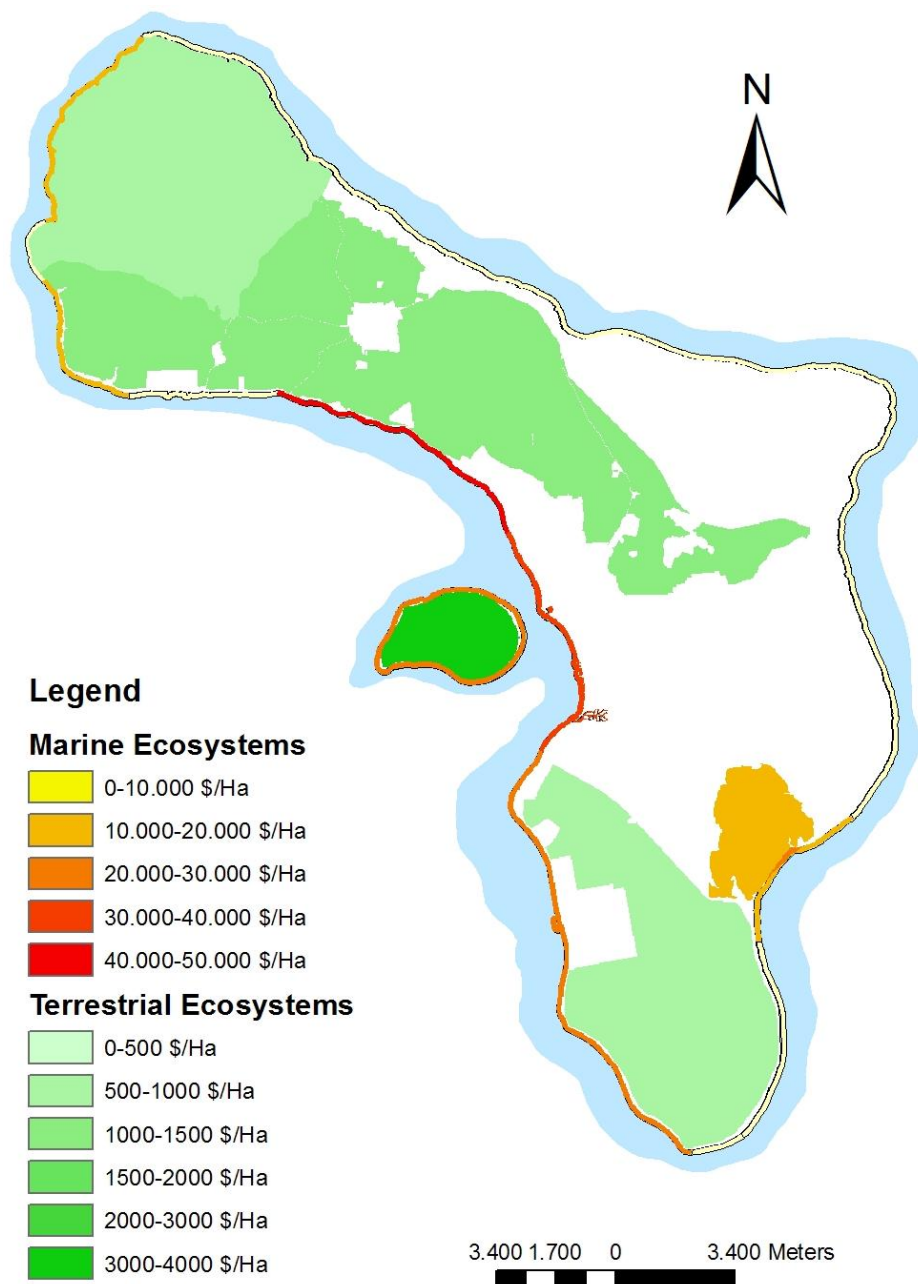


Figure 6.2 Spatial allocations of the tourist values of both marine and terrestrial ecosystems. Values are annual in USD per hectare

## 7 Discussion and conclusions

This study investigates the size of the welfare created by the tourist industry of Bonaire and the importance of different Bonairean ecosystems to support this welfare. The tourist industry is a very important industry with total tourist expenditures of around \$125 million. While stay-over tourism has experienced a fairly stable amount of around 60 to 70 thousand tourists per year, and cruise tourism have gone through a very rapid growth in the past few years which now is at a level of 200 thousand visitors per year.

With an estimated annual welfare of around \$50 million created by ecosystems on Bonaire, it becomes clear that nature is a crucial factor for the islands tourism. This is especially true for the relatively healthy marine ecosystems of Bonaire. This comes at no surprise given the fact that the most important activities on Bonaire are diving and snorkelling. However, the terrestrial ecosystems are also appreciated and thus valued substantially by both stay-over and cruise tourists.

It is important to keep in mind that this welfare is calculated by estimating the consumer and producer surpluses of tourism. Unfortunately, the added value created by the industry remains somewhat uncertain due to data limitations. There has been little research done in Bonairean industries and therefore there is no proper information on cost structures of the tourist industry. This is constraint for the measurement of the producer surplus. Another difficulty is the high uncertainty of the WTP values, which implicates that we use a very conservative calculation for the consumer surplus, and possibly undervalue the true WTP.

All values calculated in this study are presented in annual terms: the interpretation of such values requires caution. Since tourism has grown in the past decade and the status of Bonairean reefs is declining (Steneck et al. 2011) it is possible that this influences the number of visitors. Stay-over tourists have proven to return in higher numbers than cruise tourists. At the same time, the stay-over tourists are more sensitive to changes in crowdedness and a degradation of the coral reef ecosystems than the cruise tourists. Therefore, it remains uncertain if stay-over tourists will still return as much in the future in case of ecosystem degradation.

To obtain more robust results and monitor the changes in the tourism industry it would be very useful to repeat the survey used in this report on an annual basis. This would generate a more comprehensive and reliable value estimate. The final welfare calculations that are conducted without such data rely on strong assumptions about the added value rates of Bonairean companies. The realization of the business survey would provide more specific information on the exact size of the tourist industry and especially the added value of the industry.



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