
Cultural Ecosystem Service (CES) for Local Community in Aruba

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Summary

This research is based on the **TEEB framework- The Economics of Ecosystem Services and Biodiversity**. TEEB is a branch in United Nations Environment Programme's (UNEP) Ecosystem Divisions work, which aims to derive insight in the strong link between **Economy and Nature**. The objective of this research - which forms part of a larger umbrella TEEB Aruba research project - is to determine **the cultural ecosystem service (CES)** value that the marine and terrestrial environment of Aruba provides to its **local community**. The latter in order to improve decision making on conservation efforts on the island by internalizing externalities in policies that affect the environment and its ecosystems in favor of residents. Governments around the world are taking a keen interest in the measurement of subjective well-being, with a view to measuring progress more effectively, improving their policy decisions, and increasing the well-being of citizens. Aruba has started the process of implementing and localizing the **United Nations Sustainable Development Goals**.

The research employed a multi-method approach to value the CES of Aruba. For the economic/monetary value both Choice Experiment (CE) and Contingent Valuation (CV) were employed. To elicit information within the socio-cultural domain, Public Participation Geographic Information System (PPGIS) and Crowdsourcing for CES mapping. The results of this research are useful for feeding into spatial development planning, identifying areas of high cultural value, identifying opportunities for sustainable financing for conservation efforts and identifying the current gaps to efficiently monitor the sustainability of ecosystems on Aruba such that these can keep providing services for future generations.

The TEEB Aruba research shows that nature plays an important role in the lives of the local population, 95% of the local community has the perception that nature has an influence on their overall well-being and the majority finds it extremely influential. Around 70% visit natural environments to destress and relax and natural areas also serve as a bonding opportunity with around 25% of the local community on Aruba visiting a natural environment to spend time with family and friends at least once a week and another 39% at least once a month. The average amount that households are willing to pay per month towards management of Aruba's marine and terrestrial environment can be ranged between 25 AWG (14 USD) (CV) and 64 AWG (36 USD¹) (CE). Taking the conservative side of the range leads to **a yearly willingness-to-pay towards management of Aruba's marine and terrestrial environment of 6.5 million AWG (3.6 million USD) by the local community**.

¹ 1 USD = 1.80 AWG

List of acronyms

TEEB - The Economics of Ecosystems and Biodiversity

TEV - Total Economic Valuation

GDP - Gross Domestic Product

CES - Cultural Ecosystem Services

SDG - Sustainable Development Goals

MEA - Millennium Ecosystem Assessment

ES - Ecosystem Services

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Chapter 1: Introduction

1.1 General introduction

This report is part of the **TEEB Aruba research project**, which describes a **Total Economic Valuation (TEV)** assessment of the environmental goods and services in Aruba. The framework that is used to carry out this assessment is based on the valuation of ecosystem services. **Ecosystem services** are defined as goods and services that human beings derive from ecosystems and that contribute to human well-being (TEEB, 2010).

The ecosystem services are classified into four categories: 1) provisioning services which are the outputs obtained from ecosystems, 2) regulating services that are the services provided by the ecosystems' regulating processes, 3) cultural services which are the non-material benefits people obtain from ecosystems, and 4) habitat or supporting services that support the production of almost all other services (MEA, 2005 and TEEB, 2010).

Ecosystem services are important in small island developing states like those located in the Caribbean region because the economies of these nations depend mostly on ecosystem services like tourism, fisheries, and coastal protection (Waite et al., 2014). In spite of their importance, ecosystems have significantly degraded over the past years due to local drivers like coastal development, overfishing, and physical destruction and disturbance caused by recreational activities and tourism (Waite et al., 2014).

In this report we focus on the **Cultural Ecosystem Services (CES)** that are beneficial to the local community of Aruba. The TEEB Aruba project also consists of an umbrella report on the Total Economic Value (TEV) of nature on Aruba and a report specifically and more in depth on the Tourism value of nature on Aruba. There is a necessity for integrating the people perspective and needs into the understanding of the value of ecosystem services (Scholte, Van Teeffelen, & Verburg, 2015). It is important to understand the elements of ecosystems that are important to people as well as the landscape components that are tied to certain values (Scholte et al., 2015). These gaps reflect the necessity of having a better understanding of cultural ecosystem services. Cultural ecosystem services require different valuation methods depending on the scale and types of society (Milcu et al., 2013).

Aruba's national government has set as a goal to move towards a more sustainable development approach and is currently implementing and localizing the **UN Sustainable Development Goals (SDGs)**. The understanding of ecosystem services can support Aruba's decision-makers and enable them to move forward towards a sustainable island economy.

Furthermore, having a better understanding of ecosystem services contributes to making better decisions in terms of land use. "Policies that recognize the diversity

and complexity of the natural environment can target changes to different areas so as to radically improve land use in terms of agriculture and greenhouse gas emissions, recreation, and wild species habitat and diversity" (Bateman et al., 2013).

In that sense, the aim of this particular report is to provide a comprehensive and in depth image of the economic value of cultural ecosystem services for the local community on Aruba. This was done by quantifying the ecosystem services according to the TEV framework and spatially distributing these values. The willingness to pay for nature protection was inquired. These results are expressed in monetary values. The value maps were also elaborated to create thorough understanding of the economic value.

1.2 Aruba

Aruba is the most southeastern island of the Caribbean archipelago. As shown in Figure 1, Aruba is located 27 kilometers off the coast of the Venezuelan peninsula and 90 kilometers west of Curaçao. The island is 32 km long and 10 km wide (Encyclopedia Britannica, 2017). Aruba was formerly part of the Netherlands Antilles, but in 1986 became a separate self-governing part of the Kingdom of the Netherlands (Encyclopedia Britannica, 2017). The island has generally a low elevation, with igneous rocks, limestone and coral reefs (Encyclopedia Britannica, 2017). Unlike many other islands in the Caribbean, Aruba has a very dry and windy climate. Aruba's climate is classified as a tropical steppe, semiarid hot climate with the wind coming for more than 95% of the time from the northeast and the southeast direction over Aruba, with an average speed of 7.3 m s⁻¹ at 10-meter distance (1981-2010). On average Aruba's temperature is 27.9° Celsius, but the temperature can fluctuate between 19.0° Celsius to 36.5° Celsius. The average rainfall for Aruba for the period 1981-2010 is 471.1 mm (Oduber, Ridderstaat and Martens, 2015; Departamento Meteorologico Aruba, 2016). Even though Aruba has a dry and windy climate, the island still has still managed to become a popular tourist destination. The majority of Aruba's population is ethnically mixed and the official languages are Dutch and Papiamentu (Encyclopedia Britannica, 2017).



Figure 1: Map of study area (source: Google maps)

The beaches are found in the western coast of the island. Beaches like Palm beach (Figure 2) and Eagle beach are the closest to the hotels and are often visited by tourists. Visitors enjoy different types of marine recreational activities like swimming and sailing. Aruba also offers good snorkeling and diving spots from where coral reefs can be seen. In addition, the leeward side ensures calm and clear waters suitable for snorkeling.

Another of the main attractions on the coast is the sand dunes (Figure 2), which consist of lime sand and finely eroded coral debris. The sand dunes create a beautiful landscape based on subtle textures and gentle shades of greens and browns that compose Aruba's desert.



Figure 2: Palm beach (left) and sand dunes (right) (source: Aruba Tourism Authority, 2017)

Aruba also offers a highly attractive terrestrial environment like mountains and rock formations. The island has a few isolated steep-sided hills that make beautiful landscapes. One of the most popular mountains is Hooiberg. The island also has aesthetic rock formations like, for example, Casibari rock formation and Ayo rock

formation (Figure 3). In addition, Aruba has one national park called Arikok National Park (Figure 3) which has different geological varieties. One of the main attractions is the rough hills of the volcanic lava formations, the rock of the batholithic quartz-diorite/tonalite, and the limestone rocks formation from fossilized coral reefs (Arikok National Park Aruba, 2017). The park also has the two tallest hills on the island: Jamanota hill and Arikok hill. Another main attraction of the park is the Natural Pool (Figure 3).



Figure 3: Ayo rock formation (left), Arikok National Park (center) and Natural Pool (right) (source: Aruba Tourism Authority, 2017)

1.3 Ecosystems of Aruba

In an assessment carried out by Van der Perk (2002), Aruban ecosystems were broadly categorised into three groups, based on the level of human interaction,

- Natural ecosystems (e.g. mangroves, coral reefs, salinías);
- Semi-natural ecosystems (e.g. cunucu landscape); and
- Cultivated ecosystems (e.g. urban green).

As shown in Figure 4, the author distinguishes several natural and semi-natural ecosystems present in the terrestrial and marine environment of Aruba (Van der Perk, 2002). Aesthetic and recreational value have been recognized as important functions of six of the island's ecosystems.

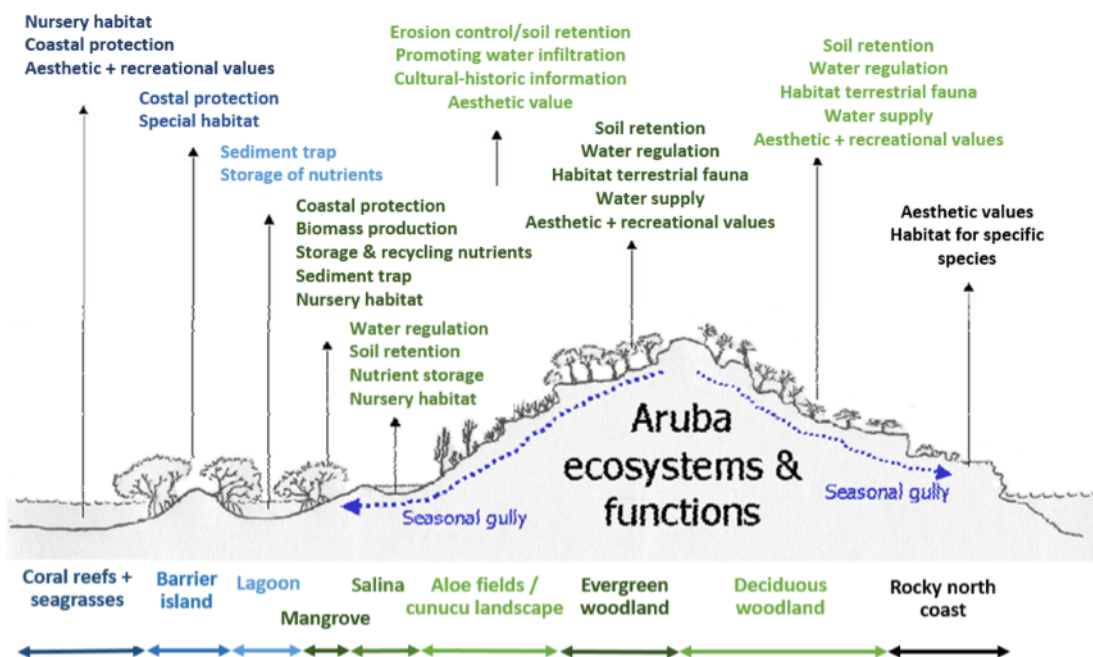


Figure 4: Schematic cross-section of Aruba's main ecosystems and its functions. Adapted from Van der Perk (2002)

1.5 Cultural Ecosystem Services (CES)

The Millenium Ecosystem Assessment (MEA) (2005) definition describes cultural ecosystem services (CES) as **“nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences”**. MEA (2005) identifies ten types of cultural ecosystem services, including cultural diversity, spiritual and religious values, knowledge systems, educational values, inspiration, aesthetic values, social relations, sense of place, cultural heritage values, and recreation and ecotourism (pp. 10–11). Some authors point out the importance of CES in fulfilling psychological needs such as belonging, esteem and self-actualization (Wu, 2013). Most cultural services are directly experienced and intuitively appreciated, often helping to raise public support for protecting ecosystems (Daniel et al., 2012; Tenerelli, 2016). Chan et al. (2012) highlight the importance of a systematic consideration of the cultural values associated with ecosystems which could “benefit many kinds of initiatives, including spatial planning, ecosystem-based management, integrated conservation and development schemes, and payments for ES (PES)” (p. 745).

Nonetheless, cultural ecosystem services have been overlooked in much ecosystem services (ES) research (Chan et al., 2012). The concept has been facing some methodological challenges associated with the quantification and mapping of cultural ecosystem services, and correspondingly their inclusion in ecosystem services assessments (Satz et al., 2013; de Groot, 2010). Cultural ecosystem services are often perceived as “intangible,” “subjective,” and difficult to quantify in biophysical or monetary terms (Daniel et al., 2012). As a study conducted by Feld et al. (2009) showed, CES – with the exception of recreation and tourism – are rarely considered in ecosystem services assessments. Only 6% of the 531 indicators examined in such study refer to cultural services (Feld et al., 2009). Likewise, Plieninger et al. (2013) point out that the focus of current research on ecosystem services is mostly set on “biophysical assessments, on the one hand, and on economic/monetary valuation exercises, on the other” (p. 119). The third and often neglected component of ecosystem services – the socio-cultural domain – requires alternative evaluation approaches, relying on a range of social science tools and methods (Daniel et al., 2012).

This research employs a multi-method approach to value the CES of Aruba. For the economic/monetary value we employ both Choice Experiment (CE) and Contingent Valuation (CV). To elicit information within the socio-cultural domain we employed Public Participation Geographic Information System (PPGIS) and Crowdsourcing for CES mapping. These are further elaborated within chapter 2 on data and methods.

The cultural ecosystem services analyzed more in depth through mapping in this research are ***aesthetic experience***, ***cultural heritage*** and ***recreation***. Landscape beauty and cultural heritage were identified and ranked as highly important

ecosystem services by local stakeholders at a workshop organized as a part of the TEEB Aruba Research Project². Considering the context of Aruba, all three services are beneficial for both the **local community** and **tourists** on the island. The TEEB Aruba research looked at how CES play an important role in the wellbeing of local community as well as tourists and this report focuses on the results of the local community. Information on the spatial distribution of these services provides valuable insight for the Aruban government which has set itself a goal to move towards sustainable development with a specific focus on “conservation, preservation and innovation of natural habitats, cultural expressions, and (land/marine) ecological systems” (The Green Gateway Policy, 2011-2013).

According to Daniel et al. (2012), natural or semi-natural features of the environment are often related to the identity of an individual, or a whole community for two reasons. First, experiences arising from the natural environment are shared across generations. Moreover, natural features provide “settings for communal interactions important to cultural ties” (Daniel et al., 2012, p. 8814). **Aesthetic experience** can be defined as the preference many people have for being in aesthetically pleasing environments (de Groot et al., 2002). **Recreation** represents an ecosystem service defined as “recreational pleasure people derive from natural or cultivated ecosystems” (MEA, 2005; TEEB, 2010). **Cultural heritage** can be defined as “the legacy of biophysical features, physical artifacts, and intangible attributes of a group or society” passed down from past generations, maintained by the present, and bequeathed for the benefit of future generations (Daniel et al., 2012, p. 8814).

² A two-day workshop held on Aruba (28th and 29th of April 2016) was organized with the purpose of building knowledge and sharing experiences between different stakeholders from public, private and citizens' organisations directly and indirectly involved in policy, management and investments in nature conservation in Aruba.

1.6 Research questions

The losses of ecosystem services are systematically underestimated. The true value of these services is usually not quantified and is consequently missing from indicators and market prices. Including natural capital in economic decision-making processes will result on wise and inclusive decisions on nature conservation and on a sustainable economic development of Aruba. In order to do that, the following questions will be addressed in this report.

- What is the perception of cultural ecosystem service (CES) value of Aruba's marine and terrestrial ecosystems to its local community?
- What is the willingness-to-pay towards management of Aruba's marine and terrestrial ecosystems to its local community?
- Where are the hotspots of cultural ecosystem services (CES) (aesthetic, recreational and cultural heritage) provision situated for Aruba's local community?

Chapter 2: Data and Methods

2.1 TEEB approach

The ecosystem service valuation conducted in this study is based on the Economics of Ecosystems and Biodiversity (TEEB). This approach follows the Millennium Ecosystem Assessment (MEA, 2005) and defines ecosystem services as the benefits people obtain from ecosystems and biodiversity (MEA, 2005; de Groot et al., 2010b).

Ecosystems and biodiversity therefore benefit societies through the provision of ecosystem services, which ultimately contribute to human wellbeing (Figure 5).

The capacity to provide ecosystem services is given by the biophysical components of ecosystems and their function in relation to the regulation of processes (de Groot et al., 2010b; Haines-Young and Potschin, 2013).

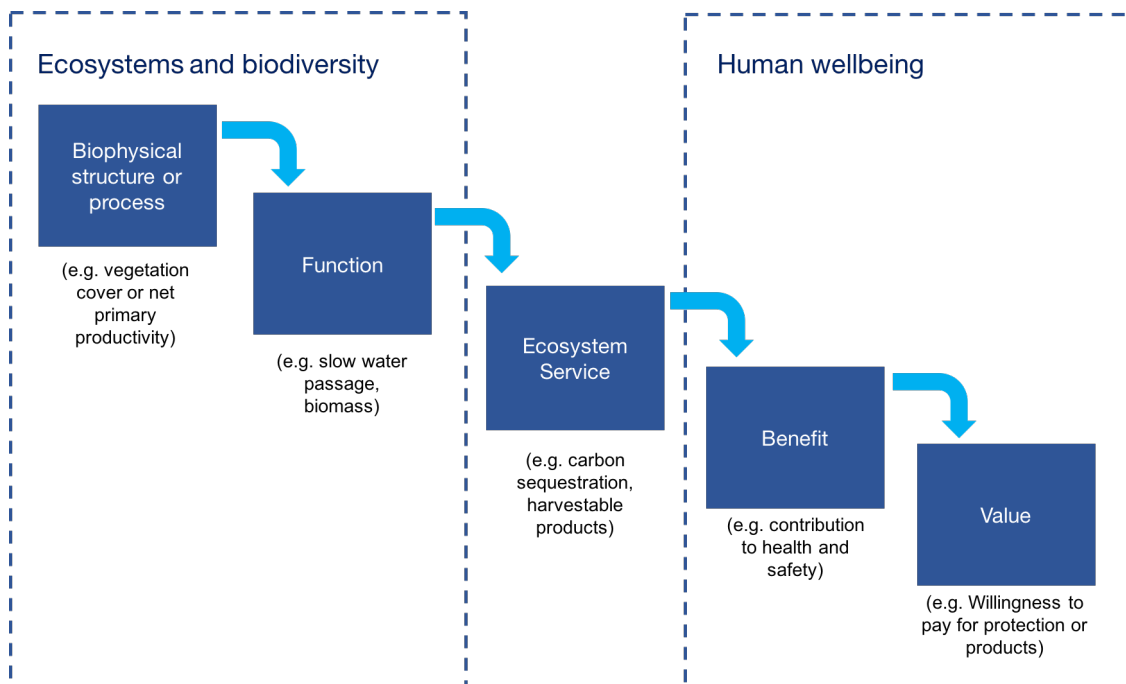


Figure 5: The ecosystem service cascade that depicts the pathway from ecosystem structure and processes to human well-being. Adapted from de Groot et al. (2010b) and Haines-Young and Potschin (2013)

According to this overarching framework, societies benefit from the following four categories of ecosystem services: provisioning, regulating, cultural and habitat/supporting services (MEA, 2005; de Groot et al., 2010b).

- **Provisioning services** (products obtained from ecosystems, such as food, freshwater and building materials).
- **Regulating services** (benefits obtained from regulation of ecosystem processes, such as climate regulation, erosion control and storm protection).
- **Cultural services** (nonmaterial benefits obtained from ecosystems, such as aesthetic, spiritual and religious values and recreation and ecotourism).
- **Habitat or supporting services** (such as nursery service and gene pool protection).

The importance of these services and the ecosystems providing them can be expressed through three value-domains: ecological, socio-cultural and economic (MEA, 2005; de Groot et al., 2010b). The ecological value of ecosystem services is associated with their contribution to the health state of a system, measured with ecological indicators such as diversity and resilience (de Groot et al., 2010b; Scholte et al., 2015). On the other hand, economic and socio-cultural values indicate the relative importance people give to a certain ecosystem service, with the main distinction being the use of monetary terms to express economic values (Oteros-Rozas et al., 2014).

The economic value of an ecosystem service can be classified in use or non-use value. Use values are divided into direct use and indirect use values (Figure 6). The first category corresponds to values derived from the direct harvesting or extraction of ecosystem products, such as food or water. Indirect use values, on the other hand, correspond to benefits obtained from the regulating capacity of ecosystems without entailing an active extraction of ecosystem products (Waite et al. 2014; van Beukering et al., 2007).

Non-use values include the existence value (i.e. the value humans place on the knowledge that a resource or species exists), bequest value (i.e. the value of guaranteeing the existence of a resource or ecosystem for the future generation), and option value of ecosystems (i.e. the value humans place on having the option to use or visit the resource or ecosystem in the future). Figure 6 presents the Total Economic Value (TEV) framework and the different use and non-use values that can be assigned to ecosystem services.

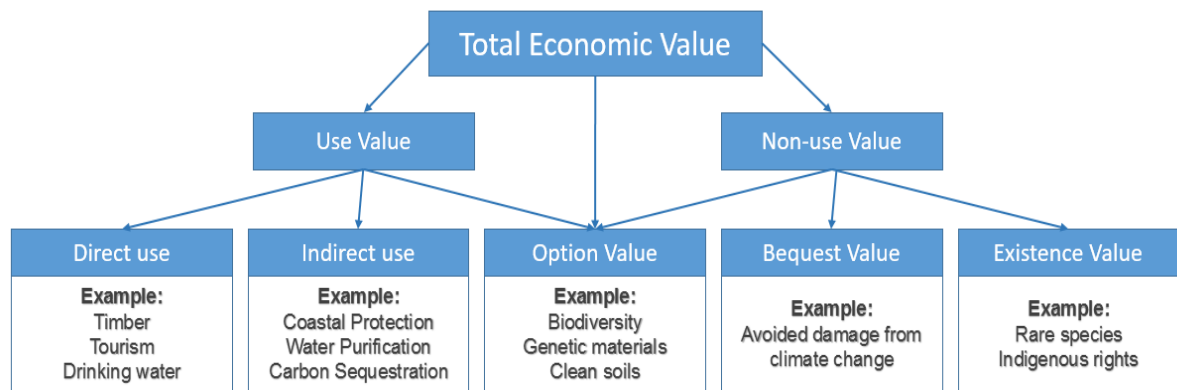


Figure 6: The Total Economic Value (TEV) framework for the valuation of ecosystems services. Adapted from Waite et al. (2014)

The different values of ecosystem services are quantified according to the TEV framework and expressed in monetary values. This type of analysis can be conducted through the application of different valuation techniques, which are classified in market-based techniques, non-market techniques and benefit transfer.

2.2 Methodology

To estimate the cultural value this research employs a multi-method approach to fill the described knowledge gap and value the CES of Aruba (Table 1). For the economic/monetary value we employ both the Contingent Valuation (CV) and the Choice Experiment (CE). CE is an extension of the CV. The main difference between the two is that CV is a *direct* stated preference method whilst CM is an *indirect* stated preference method (Tuan & Navrud, 2007). With CV respondents are asked directly for values for an ecosystem service. CM asks respondents to select between a set of alternative scenarios including different attributes to elicit the general trade-offs an individual is willing to make.

To include the socio-cultural domain, we perform a spatially explicit quantitative analysis. Several authors recognize mapping as an effective tool for capturing complex interactions between communities, regions, landscapes, and ecosystems (Ryan, 2011; Plieninger et al., 2013). Cartographic representation of perceptions and preferences allows to localize “hotspots” of cultural services (Bryan et al., 2010). In addition, we consider this study a methodological exploration of different mapping techniques since it employs a multi-method mapping approach.

In this study, each valuation technique is chosen according to its suitability to analyze specific ecosystem services, as well as on the availability of data and time.

Table 1: Valuation techniques used in this study (van Beukering et al., 2007; Waite et al., 2014)

Type of technique	Valuation technique	Description
Non-market technique	Contingent valuation	Survey-based technique in which respondents are asked directly about their willingness to pay for the supply of ecosystem services. Thus a direct stated preference method.
Non-market technique	Choice Experiment	Survey-based technique in which respondents are asked to select between a set of alternative scenarios including different attributes to elicit the general trade-offs an individual is willing to make. Thus an indirect stated preference method
Non-market technique	PPGIS	Spatially explicit data obtained through public participation geographic information system (PPGIS) where respondents participate in a mapping exercise for the identification and valuation of ecosystem services.
Non-market technique	Crowdsourcing - social media	Assessment of web-based geospatial information, such as data from social media platforms (e.g. instagram) as a source of spatially explicit information that can be utilized for mapping cultural ecosystem services

2.2.1 Estimating the willingness-to-pay (WTP) for management of Aruba's marine and terrestrial ecosystems

To calculate the range of WTP this study used both a *direct* (CV) and *indirect* (CE) stated preference methods. This in order to account for the hypothetical bias and "yea-saying" (respondents are asked to imagine a scenario and state their WTP) in the *direct* CV, which is less present in the *indirect* CE. Additionally, CE enables to elicit real life future trade-offs that would need to be made. Rather than stating a monetary amount directly, the respondent is asked to choose from a number of future scenarios with a set of environmental attributes at different levels. His or her willingness to pay is then derived from the choices that are made, since every scenario has a payment vehicle, which should be taken into account by the respondent when making the choices. Because the respondent needs to make a trade-off between these different attributes, CE allows for making a ranking of aspects considered important by respondents. By combining both methods a stronger analysis can be made as to the range of the WTP and the factors influencing this.

2.2.1.1 Contingent valuation

Stated preference techniques can be used when there is a lack of observable behavior on the market. Contingent Valuation (CV) studies ask questions that help to reveal the monetary trade-off each person would make concerning the value or good (Carson, 2012). This method therefore reveals the economic value people have for certain services generated by nature through their willingness-to-pay (WTP).

Most willingness-to-pay questions are open-ended questions. This gives respondents the opportunity to state their maximum willingness-to-pay amount freely (Armbrecht, 2014). One disadvantage of this method is that it tends to yield relatively large number of non-responses, as respondents find it difficult to put a monetary value on goods not usually on the market or made to be thought of in daily life.

To overcome this problem a payment card format was used, where suggestions of monthly payment is given. A payment card is a table or a list with suggestions (amounts) of a monthly payment. The table in this research ranged from 1.00 tot > 120.00 (Aruban florins = AWG). The steps and range for payment card were developed following the research of Rowe, Shulze and Breffle (1996). Furthermore it should be considered that open-ended questions may lead to strategic behavior and incorrect valuations, as do payment card format questions (Armbrecht, 2014). To overcome this, interviewers carefully explained and reiterate to the respondent that this is a personal opinion taking into account their ability and WTP given their current household income.

The CV questions provided to respondents are (See Annex A for household survey):

- *Are you in principle willing to pay for management of the marine and terrestrial natural environment on Aruba?*
- *What is your maximum amount of monthly contribution you are willing to pay for management of the marine and land natural environment on Aruba? In making a choice, carefully take into account whether you actually can and are willing to pay this amount given your current income level.*

The CV willingness-to-pay towards management of Aruba's marine and terrestrial environment is calculated by multiplying the total number households on Aruba by the percentage of households that are WTP. Then this number is multiplied by the households average WTP. In total there are 34,845 households in Aruba (CBS, 2015).

$$WTP = N^{\circ} \text{ of households} * \text{Households that are WTP (\%)} \\ * \text{Household average WTP}$$

2.2.1.2 Choice Experiment

The Choice Experiment (CE) is an extension of the Contingent Valuation (CV) method. The main difference between the two is that CV is a *direct* stated preference method whilst CM is an *indirect* stated preference method (Tuan & Navrud, 2007). CE is a recent innovation in stated preference methods. As is the case with the CV, stated preference methods are used for the elicitation of values that are not reflected in any observable behavior. CE was first applied to environmental management problems by Adamowicz, Louviere and Williams (1994), although it was applied in other fields (e.g. marketing, transport economics) since the 1980's. CE is a suitable approach to determine the willingness to pay or accept (WTP/WTa) and the utility derived from having an environmental service, either it be use or non-use value, and it performs better than other valuation methods (Boxall, et al., 1996; Adamowicz, et al., 1998; Hanley, Wright & Adamowicz, 1998; Tuan & Navrud, 2007).

The main theories that CE is based on are Lancaster's characteristics theory of value and the random utility theory (Hanley, Wright & Adamowicz, 1998). Lancaster's characteristics theory of value implies that consumer behavior is stipulated by the characteristics goods contain e.g. stories, distance to city, gated community etc. rather than the goods themselves e.g. house A or house B (Lancaster, 1966). Random utility theory implies that utilities should be treated as random variables to reflect that the observer lacks information on the goods characteristics and alternatives as well as not possessing complete information on respondents (Manski, 1977; Caussade, Ortuzar, Rizzi, & Hensher, 2005). CE illuminates the preferences (random utility theory) people have for environmental qualities (Lancaster's characteristics theory of value). The latter through its experimental design of providing multiple-choice tasks that allow the revelation of the environmental factors influencing choice.

These attributes are described as follows in the statistical design (Carson et al., 1994):

$$X_k = (k = 1, 2, \dots K)$$

$$X_{kl} = (l = 1, 2, \dots L)$$

The environmental service or good may potentially have a number (K) of attributes (X) and each attribute potentially has a number of levels (L)

The model which is used for the analysis of the CE is in accordance with the random utility theory. Utility of a respondent is explained by the following utility function:

$$U_{in} = V(X_{1l}, X_{2l}, \dots X_{kl}) + \varepsilon_{in}$$

A respondent (n)'s utility (U) derived from choosing a scenario (i) consists of a deterministic and in principle observable component $V(\bullet)$ and a random and unobservable component ε_{in} . The random and unobservable component represents the idiosyncrasy of respondent (n) that is unobservable to the observer. The observable component $V(\bullet)$ consists of the attributes and its corresponding levels

presented in scenario (i). The observable component $V(\bullet)$ can be further explained with the following equation:

$$V_{in} = ASC + \beta_{1l}X_{1l} + \beta_{2l}X_{2l} + \dots + \beta_{kl}X_{kl}$$

ASC is an abbreviation for the alternative specific constant which is an alternative (scenario) whose attributes and their corresponding levels are held constant from choice set to choice set. ASC is a dummy variable which equals zero when the ASC is chosen. The ASC allows for non-participation as well as for non-observable attributes to influence choice (Blamey, Gordon & Chapman, 1999; Hanley, Wright & Adamowicz, 1998; Carson et al., 1994). β_{kl} is a coefficient representing the utility derived from attribute X_{kl} (with (l) being the attribute level) within scenario (i). These utilities are derived through fitting the observed data to the statistical design plan and thereby making calculation of WTP possible.

Selection of one scenario over another implies that the utility (U_i) associated to that scenario is greater than the utility of the other (U_j). If for respondent (n) the probability of choosing scenario (i) is equal or greater than the utility derived from all other scenarios within a choice set the following equation applies:

$$Prob(i|I) = P(V_{in} + \varepsilon_{in} \geq V_{jn} + \varepsilon_{jn}; \forall j \in I)$$

I represents all the scenarios the respondent faces within the choice set. The usual assumption made is that the random error terms (ε) are Gumbel-distributed, it could also be type 1 extreme value distributed (McFadden, 1974). Given the utility function and the distributional assumption of the random error terms as Gumbel-distributed, the probability expression of the Multinomial Logit Model (MNL) is given by (McFadden, 1974):

$$Prob(i) = \frac{\exp^{\mu v_i}}{\sum_{j \in I} \exp^{\mu v_j}}$$

Thus the probability of choosing scenario (i) is expressed by the equation above with (μ) representing the scale parameter, which is usually assumed to be 1 implying a constant error variance (Hanley, Wright & Adamowicz, 1998).

The random parameters logit model (Koetse & Brouwer, 2015), was used to construct the most relevant choice cards. Each choice card presents a choice between three different future scenarios, which are depicted with different attributes as a future "package". This choice experiment consisted out of 6 different versions, where each version had 6 different choice cards. Each respondent was presented with one version, containing 6 different choice cards and thus makes 6 times a choice between scenarios A, B and C. In scenario A and B policy and management is applied, therefore a yearly contribution is required. In scenario C there is no management, which is the status quo (or opt-out option) and no contribution is required. In explaining the choice experiment to the respondent, the same example card was used for all respondents. The steps towards the final design of the choice experiment can be seen in Figure 7.

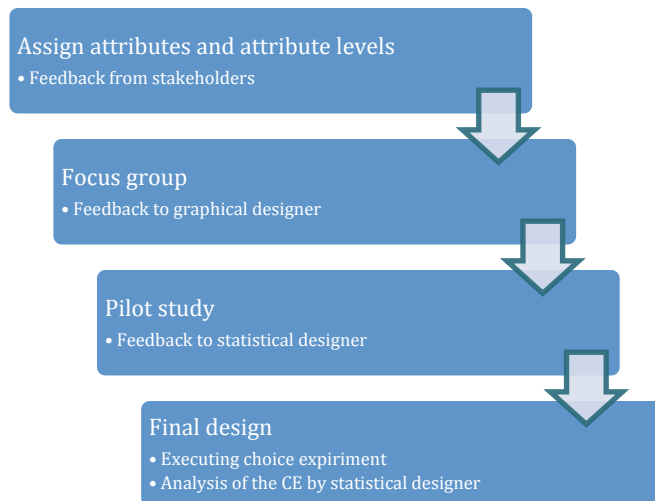


Figure 7: Steps in designing Choice Experiment

It is important that the attributes and levels chosen be policy-relevant and that ultimately the choice task represent a realistic choice situation. The development of the attribute levels is done in close consultation with multiple experts that have experience in designing CE, the local context and input provided at the two-day workshop held with local stakeholders from different sectors on the island. The complexity of the choice task must be taken into account and thus a trade-off must be made between quantity and quality. To portray all ecosystems an infinite number of attributes could have been chosen (quantity) but the choice task must be comprehensive for the respondents (quality). Thereafter the graphical designer develops pictograms that correspond with the different attributes and levels. These are then subsequently discussed within a focus group representative of several age groups, gender and multicultural backgrounds. The aim was to assess if the attributes and levels and the depiction of the pictograms were logical and intuitive. The results from the focus group are then reported to the graphical designer, after which the pictograms and levels were finalized. The next step in designing the choice experiment was coordinating the pilot study. The design of the pilot study as well as the final design was made by a statistical designer. The pilot CE study generated an orthogonal fractional factorial design with 36 choice cards (six versions with six choice cards each). In total 36 respondents were interviewed, who were randomly assigned to one of the six versions, providing 216 choices to fine-tune the final CE design. Pilot study model estimates, syntaxes used for generating the statistical designs, and statistical designs for the pilot and the main study are provided in Annex B. The choice cards were made using the software *Visio 2016* from Microsoft. See Table 2 for an overview of the attributes and their corresponding levels and Figure 8 for the example card used with each respondent as a warm-up choice set (identical for all six versions), which the interviewer used to explain the choice experiment. The latter avoids issues with learning-effects.

Table 2: Overview of attributes and corresponding levels of the Choice Experiment design

Level Attribute	1	2	3	4	5	6	Opt-out
Yearly contribution	0	24	60	120	600	1200	0
MPA establishment	0%	25%	50%	100%	-	-	0%
Fish catch per trip	50% less	Same	50% more	-	-	-	50% less
Beach width	30 meter	15 meter	0 meter	-	-	-	0 meter
Natural areas on land	90%	60%	40%	20%	-	-	20%
Tourist crowdedness	Current	Double	Triple	-	-	-	Triple

The attributes are described as follows:

- A **yearly contribution in florins (& displayed per month)** by all households on Aruba which would be used strictly for management of the natural environment of Aruba.
- **Marine Protected Area (MPA) establishment** refers to the amount of marine environment that will be managed. It would restrict access for fisherman and management of recreational activities (e.g. diving behavior and designated swimming areas) in the MPA with the purpose of recovery and protection for healthy fish populations and corals³.
- **Fish catch per trip** refers to how much fish can be caught for recreational purposes in the seas surrounding Aruba per fishing activity or trip. This can vary due to a change in fish abundance.
- **Beach width** refers to the width of the beach which is available for locals which can vary due to natural erosion and/or by expanding hotel 'palapas'.
- **Natural areas on land** refers to the natural habitat for flora and fauna of Aruba which can change due to increase of construction and infrastructure.
- **Tourist crowdedness** refers to the average number of tourists per day on the island of Aruba.

³ According to Aichi Biodiversity Targets of the Convention on Biological Diversity, Target 11, at least 10 percent of coastal and marine areas are conserved by 2020. www.cbd.int



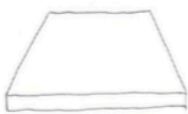
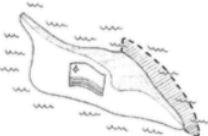


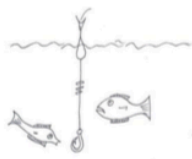

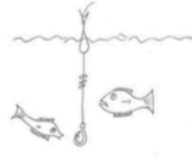









EXAMPLE choice	A	B	C
Yearly Contribution (in florins)	 1200 yearly (100 monthly)	 24 yearly (2 monthly)	 0 (no contribution)
Marine Park Establishment	 25% managed	 50% managed	 0% managed
Fish Catch	 50% less catch	 50% more catch	 50% less catch
Beach Width	 Stay at 30 meter	 Stay at 30 meter	 Decline to 0 meter
Natural areas on land	 40% nature left	 20% nature left	 20% nature left
Tourist crowdedness	 Current no. visitors	 Double no. visitors	 Triple no. visitors

Figure 8: Example Choice Card used in TEEB Aruba study

2.2.2 Public Participation Geographic Information System (PPGIS)

Another method used is Public Participation Geographic Information System (PPGIS) to establish the cultural value insights. PPGIS has been widely recognized as a valuable tool to capture spatial information on cultural values of landscape at local community level (Soini 2001; Brown 2005; Tyrväinen et al. 2007; Fagerholm & Käyhkö 2009). The main aim is to get an understanding of which locations on the island are perceived as the most valuable ones from the perspective of the local community. Participatory mapping can be conducted by using several techniques (Plieninger et al., 2013). Brown et al. (2012) define PPGIS as “the process of using GIS technologies to produce local knowledge with the goal of including and empowering marginalized populations” (p. 634). For this research we designed a paper-based mapping exercise. The 1:125,000 scale, greyscale map of the study area (see Annex C) was presented to the respondents as a part of the household survey questionnaire.

Respondents were asked to point out the most important location for a particular cultural ecosystem service, i.e. recreation, aesthetic value and cultural heritage. To do so, respondents used colour markers (2 mm) to draw symbols for different types of activities/values presented in the legend (see Annex C). Respondents were asked to use points since they are more suitable than polygons for large scale studies such as this household survey. Also, points tend to produce estimates of collective spatial significance (Brown & Pullar, 2012). Furthermore, it has been tested that respondents find the placement of points less ambiguous than identifying polygons and thus are more likely to complete the mapping activity (Brown & Pullar, 2012). The function of point density was used to determine the "hotspots" of aesthetic appreciation, recreation and cultural heritage value.

The exercise consisted of four questions in total (see Annex C). In the first two questions respondents were asked to indicate overall eight locations on the island where they engage in specific recreational activities. The first question asked to indicate two locations for each of two most often undertaken recreational activities in coastal and marine environment. Likewise, the second question asked to mark two locations for each of the two most often undertaken recreational activities in terrestrial environment. Locations marked for these activities were later used as indicators of recreational value. In the third question respondents were asked to map three locations on the island which they perceive as having high aesthetic value. Similarly, last question of the participatory mapping exercise asked respondents to map three locations on the island which they perceive as having high cultural heritage value. To familiarize respondents with the terms aesthetic and cultural heritage value, these were explained as shown in Table 3.

Table 3: Explanations of value types based on Brown (2005)

Type of value	Explanation
Aesthetic	<i>I value these locations because of the beautiful scenery.</i>
Cultural heritage	<i>I value these locations because they are important places of natural and human history.</i>

The following step consisted of creating a map of significant natural areas on Aruba to further depict the density of the aesthetic, recreational and cultural heritage points within these areas. The map of significant natural areas was based on different sources. Firstly, the insights from a focus group exercise to define the important natural sights and areas. Secondly, input was the Spatial Development Plan of Aruba (Directie Infrastructuur en Planning, 2009). Finally, based on the information of the Arikok National Park, the area of Arikok is represented in three distinct zones. The final map consisted out of thirteen natural areas around which a buffer of 200 m was designated. Subsequently, the areas were ranked according to the absolute number of points per square kilometer and their density in each one.

2.2.3 Crowdsourcing - social media

Another non-market technique employed in this research is the use of social media data through crowdsourcing. In the recent years crowdsourced data from social media has become a significant source of spatially explicit information that can be utilized for mapping cultural ecosystem services (Casalegno et al., 2013; Pastur et al., 2015; Tenerelli et al., 2016). However, the assessment of web-based geospatial information, such as data from social media compared with more traditional PPGIS tools, has not been widely thematised in scientific research (Rouse et al., 2009). Pastur et al. (2016) recognize the need of integrating data collection by using different techniques to develop a more comprehensive understanding of CES.

Data from the web-platform was acquired using Application Programming Interface (API). Generally, API is defined as a language and message format used to communicate with an operating system, control program, or communicational protocol (Figueroa Alfaro, 2015). In other words, an API is a programme which enables the retrieval of the data from another application such as Instagram, Flickr, and Panoramio.

Instagram images can be used to assess what different types of activities local people engage in on the island and how those are spatially distributed. To identify the home location of Instagram users we downloaded uploads of all users in the database of the week half a year prior to the last upload on Aruba. If these were on Aruba as well we classified the user as local. If the uploads of this week were not on

Aruba we classified the user as non-local. This selection allowed for the comparison of the results with the map derived from the PPGIS exercise.

In order to conduct the analysis of spatial distribution of photographs, they first must be categorized according to the landscape features they capture, on the one hand, and their semantic content on the other (see Table 4). Several studies measured aesthetic values of landscapes by analyzing the semantic content of images uploaded to websites such as Panoramio and Flickr (Casalegno et al. 2013; Pastur et al. 2016). In the case of this research, semantic content categorization clusters the photographs according to the landscape value that the photographer tries to highlight so they can be used as indicators of aesthetic appreciation or recreational activity.






Table 4: Main classification of photographs

Main categorization	Explanation
Excluded	Aerial, indoor, urban areas, people ⁴ as the main subject, cars, cruise ships as the main subject.
Coastal landscape	Photographs of the coastline; sub-category chosen according to the dominant feature on the photo.
Terrestrial landscape	All photos of terrestrial natural and semi-natural landscape; sub-category chosen according to the dominant feature on the photo.
Seascape	Photographs of the seascape (above water).
Underwater	Photographs taken underwater (used strictly as indicators of recreational activity – diving and snorkeling).
Flora and fauna	Close-up photographs of flora or fauna where specific landscape type/feature cannot be defined.

Next, each photograph, previously classified as coastal or terrestrial landscape, was assigned to one of the twelve sub-categories according to the dominant landscape feature captured (see Table 5).

⁴ In the case of Instagram, photographs which featured people as the main subject and natural environment as a background were included in the analysis.

Table 5: Classification by landscape feature

Landscape feature	Explanation	Example
Beaches	Photographs of beaches	 <p>(Source: Flickr)</p>
Rocky shores	Photographs of rocky shores	 <p>(Source: Panoramio)</p>
Dunes	Photographs of dunes	 <p>(Source: Panoramio)</p>
Other (coastline)	Coastline photographed from the distance; photographs of coastline including man-made structures on shore (e.g. docks, terraces, etc.)	 <p>(Source: Panoramio)</p>
Mangroves	Photographs of mangroves	 <p>(Source: Flickr)</p>

Wetlands and saltmarshes Photographs of wetlands and saltmarshes



(Source: Panoramio)

Cacti and dry vegetation landscapes Photographs of cacti and dry vegetation landscape



(Source: Instagram)

Rough rocky landscapes Photographs of rough rocky landscapes



(Source: Flickr)

Heterogeneous landscapes Photographs of terrestrial natural and semi-natural landscapes including more equally distributed features



(Source: Instagram)

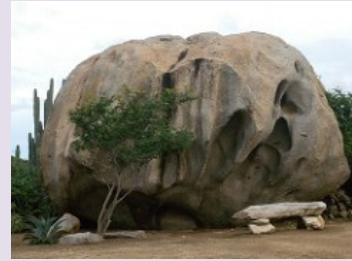
Caves (landmark) Photographs of caves (entrance or inside)



(Source: Flickr)

**Rock formations
(landmark)**

Photographs which include rock formations as the main feature



(Source: Flickr)

**Anthropogenic
landmarks**

Photographs of anthropogenic landmarks in the natural environment (e.g. lighthouse, gold mine ruins, chapel)



(Source: Flickr)

2.4 Data collection process

The study is based on both primary and secondary data sources. A wide variety of stakeholders were contacted in Aruba to support the research with existing data sources. Many government departments, public and private organizations support the TEEB Aruba project. Primary as well as secondary data sources have been used. Secondary data entails literature review, census and population data from the Central Bureau of Statistics of Aruba (CBS), available GIS maps from the department for Infrastructure Management and Planning (DIP). Additionally, the stakeholder's two-day workshop held in April of 2016 served as input for the study scope and development of the household survey as well as the tourism exit survey, which form part of this research⁵.

2.4.1 Primary data source - Household survey

The data is collected by executing a household survey on the island Aruba. The survey included the CV, CE and PPGIS methodologies as well as a background questionnaire to assess influencing factors for WTP as well as environmental topics. In order to draw statistically sound conclusions the target sample size (n) of the household survey was set at 400 households and had a Papiamentu and English version. The background questionnaire consisted of 41 questions divided over the 10 following sections:

- *General questions*
- *Environmental awareness*
- *Relation between well-being and natural environments*
- *Urban green space*
- *Choice experiment*
- *WTP for environmental management*
- *Recreation and participatory mapping*
- *Recreational fishing and agriculture*
- *Statements*
- *Demographics*

The general and demographic questions in the survey are based on the classification of Central Bureau of Statistics of Aruba (CBS) and the questionnaire was administered to a sample of random selected addresses provided by CBS. For the

⁵ A two-day workshop held on Aruba (28th and 29th of April 2016) was organized with the purpose of building knowledge and sharing experiences between different stakeholders from public, private and citizens' organisations directly and indirectly involved in policy, management and investments in nature conservation in Aruba.

sample CBS drew 600 addresses randomly from their database and divided the addresses in 10 different lists of 60 addresses each and provided maps in pdf format to find the right locations. In Figure 9 the distribution of conducted surveys is visualized. There is a higher density in Oranjestad, this area is also more densely populated. There are no points on the north coast and in a large area in the north-east, which is the Arikok National Park.

During the months April, May and June of 2016 surveys were conducted by an interview team. In total 13 interviewers were trained to conduct the survey, which included students from the University of Aruba and the network of CBS. All interviewers were proficient in Papiamentu, English, Spanish and Dutch.

The survey was digitalized and conducted with the use of tablets. The results are immediately uploaded into an online database for tracking progress as well as automatically being geo-tagged with GPS function. The tablets used were of the brand BLU with the in the program *Harvest your Data*⁶. Harvest your Data is a data collection software that allows conducting digital surveys off-line with a corresponding app *DroidSurvey*, which allows for geo-tagging. The cleaned data was imported into *SPSS 23.0* for further analysis.

A survey package was provided consisting of a tablet to conduct the interview and several tools; pens, colours, legend, and maps for the participatory mapping; a booklet with all the choice sets; an interview protocol; a list of addresses and appointment cards.

⁶ For more information about this program see: <https://www.harvestyourdata.com/>



Figure 9: Visualization of the spatial distribution of TEEB Aruba conducted household survey

In total 378 households were interviewed. For the CE, 35 respondents were excluded from the analysis because of one of the following reasons:

- Respondents did not answer the choice questions;
- Respondents indicated to have made random choices in the choice experiment;
- Respondents who systematically chose the status quo (or opt-out option) AND who indicated that the reason for this was that they were not confident that the money will be used as specified (protest response).

For the PPGIS, 353 maps were received of which 345 were correctly filled in and included in the analysis. Each respondent's map of values was digitized and coded using ArcGIS software. Overall, 907 points (2.6 per respondent) were used as indicators of aesthetic value and 816 points (2.4 per respondent) as indicators of cultural heritage value. For mapping the recreational value 1557 points were used.

Next step of data processing included the use of ArcGIS software in order to create density maps for each particular cultural ecosystem service studied. To calculate the density of point features the Point Density tool from ArcGIS Spatial Analyst toolbox

was used. This tool calculates a magnitude-per-unit area from point features that fall within a neighbourhood around each cell. The cell size used was 90 meters. The radius of circular neighbourhood was set to default of 783.95 m. Geographic Coordinate System used for this study was the World Geodetic System (WGS) of 1984, and as Projected Coordinate System we used the WGS_1984_UTM_Zone_19N as it is the best projection for Aruba. To set a geographic area of interest for analysis a 1000 m buffer around the island's coastline was used.

2.4.2 Primary data source - Crowdsourced social media

For the Crowdsourced - social media data, in total 4750 photographs from the social media platform Instagram was analyzed. Of this 1098 featuring the natural environment and mostly showing the coastal landscape (62%). Regarding the two studied values, photographs interpreted as indicators of aesthetic value account for 63% of the Instagram dataset. 603 points were used as indicators of aesthetic and 304 points as indicators of recreational value to produce density maps of Instagram data. Data processing the ArcGIS software and same settings were used as for the PPGIS exercise. In addition, longitude and latitude information from geo-tags was used to create a point shapefile for each of the three social media datasets. Correspondingly, other point shapefiles were derived for each of the social media sites and values measured.

Chapter 3: Results

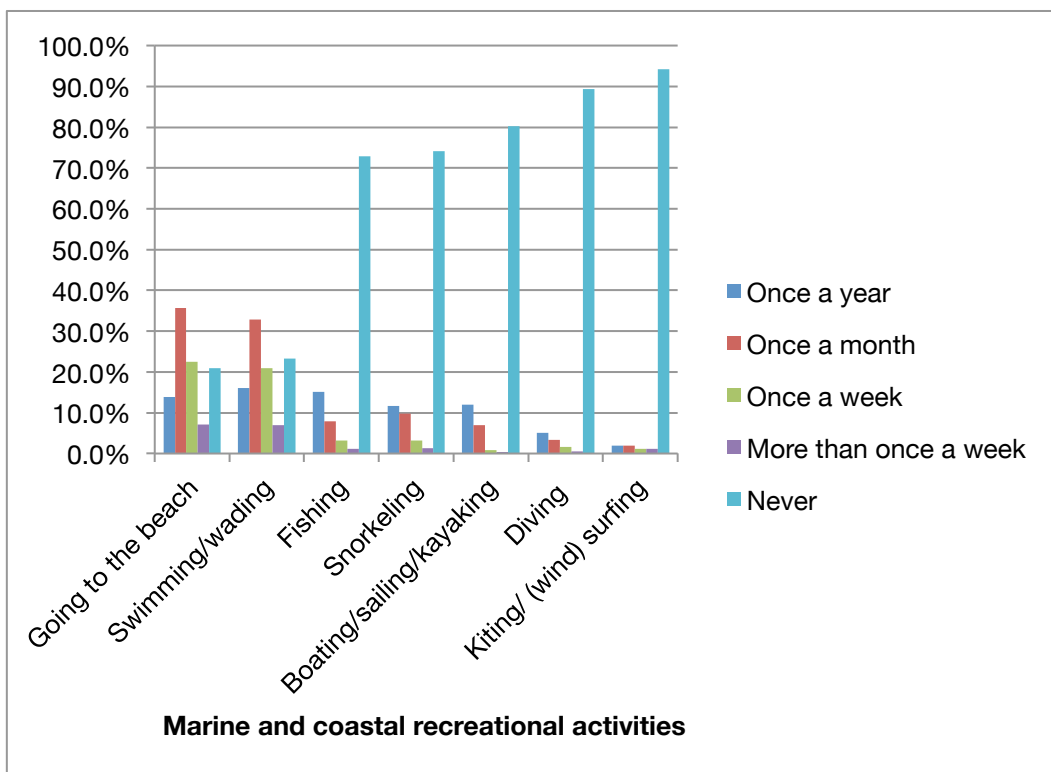
3.1 Characteristics of local community in Aruba

Descriptive statistics from the household survey⁷

3.1.1 Environmental activities

The household survey inquired on recreational environmental activities carried out by the local community both within the marine & coastal- and the terrestrial environment. Additionally, the survey inquired a bit more in depth on fishing and agricultural practices of the local community as these were of interest to stakeholders⁸.

3.1.1.1 Marine and coastal environment



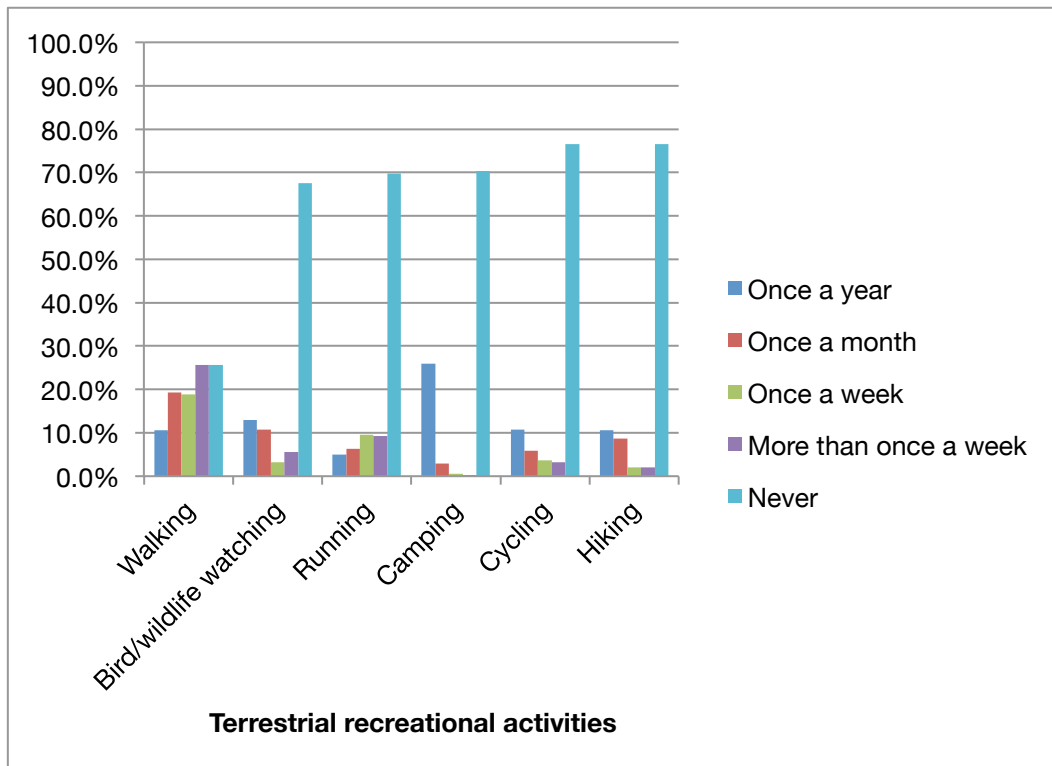
Graph 1: How often do you participate in the following activities in marine and coastal natural environment?

⁷ For representativeness of sample see Annex D

⁸ A two-day workshop held on Aruba (28th and 29th of April 2016) was organized with the purpose of building knowledge and sharing experiences between different stakeholders from public, private and citizens' organisations directly and indirectly involved in policy, management and investments in nature conservation in Aruba.

The two most popular local activities in the coastal environment are, going to the beach and swimming/wading of which around 80% of the population engages in. And around 60% do this at least once a month (Graph 1). The rest of the activities are engaged in by less than 30% of the population, activities such as fishing, snorkeling, diving, boating etc., all of which require more resources or preparation time to participate in. Additionally, the recreational activities mostly participated in the marine environment by the local community seems to be of a more passive nature, e.g. going to the beach to relax, rather than participating in an active sport. Given the importance of beaches for recreation, it is essential then to maintain public beach access for the local community. Increase in population and popularity of beaches as a tourism destination can create difficulties in providing public beach access e.g. noise, crowdedness, general access to the beach (Oh et al., 2010). Furthermore, coastal erosion is of concern here, the latter can be caused by sea level rise, changing currents, frequency and intensity of storms due to climate change, making coastal erosion risk mitigation strategies important (UNFCCC, 2005).

3.1.1.2 Terrestrial environment



Graph 2: How often do you participate in the following activities in terrestrial natural environment? (activities on land)

In the terrestrial environment the most popular recreational activity, engaged in by around 75% of the population, is walking in nature. Other recreational activities such as running, cycling, hiking, wildlife watching and camping are performed by around 30% of the population (Graph 2). When it comes to camping this is participated much less frequently, mostly once a year in the period of Easter weekend celebration in the spring. Especially the provision of trails in nature create healthy opportunities by providing the local community with accessible and low- or no-cost places for walking, running and cycling, and thus helping people incorporate exercise within their lifestyle. Developing walking trails and greenways⁹ can allow humans to experience nature with minimal environmental impact. In the case of bird or wildlife watching, greenways and trails can also be a useful tool for wetland preservation (a habitat for a range of water birds and migratory shorebirds) as well as contributing to the improvement of air and water quality in the area (Allen, 2012; Jim & Chen, 2008)¹⁰.

⁹ Greenways are corridors of protected open space managed for conservation and recreation purposes. Greenways often follow natural land and water features, and link nature preserves, parks, cultural heritage features with each other and with populated areas. They may incorporate trails or not and can be either publicly or privately owned.

¹⁰ Air quality is improved by protecting the plants that naturally create oxygen and filter out pollutants such as ozone, sulfur dioxide, carbon monoxide and airborne particulates of heavy metals. Water quality is improved by the greenway acting as natural buffer zones for lakes, streams and wetlands, from pollution that degrades waterways and threatens the health of water quality and aquatic species (also saving money on artificial water filtration systems).

3.1.1.3 Fisheries

This paragraph focuses a bit more in depth on fishing practices of the local community as these were of interest to stakeholders¹¹.

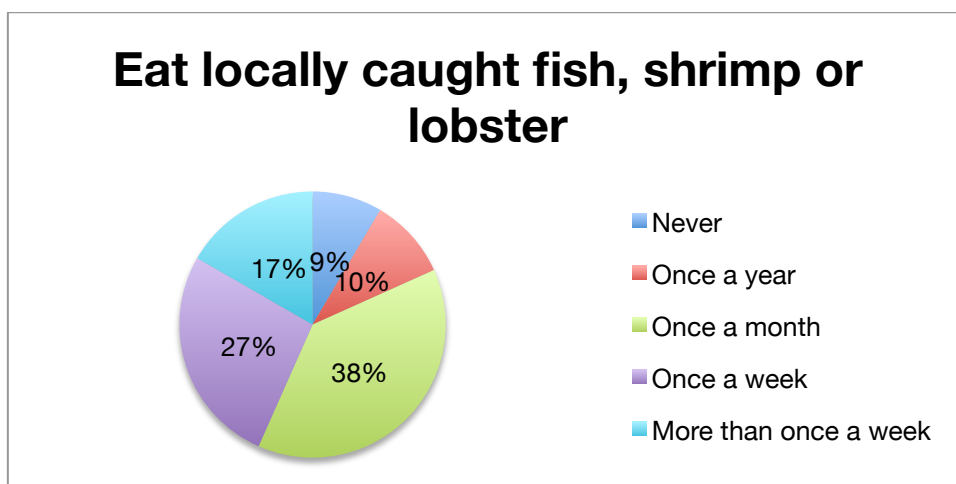


Figure 10: How often do you eat locally caught fish, shrimp or lobster?

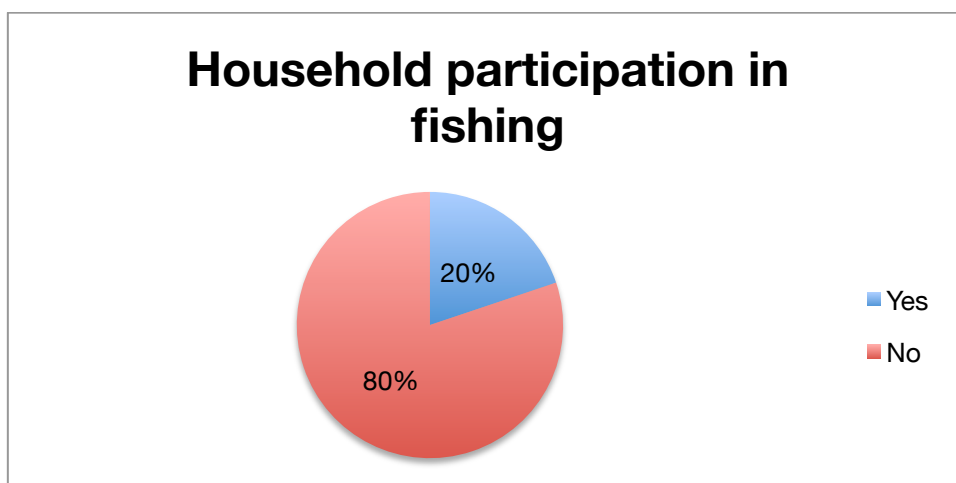
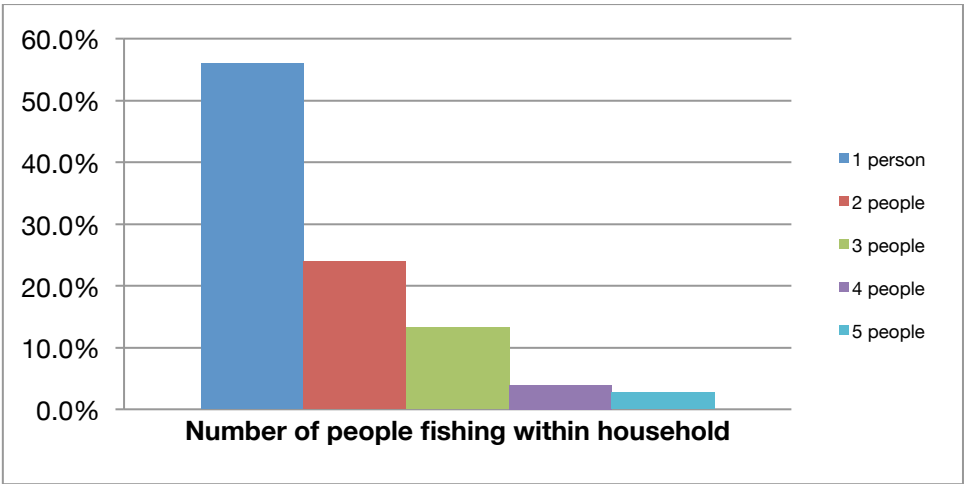


Figure 11: Do you or someone else in your household currently fish?

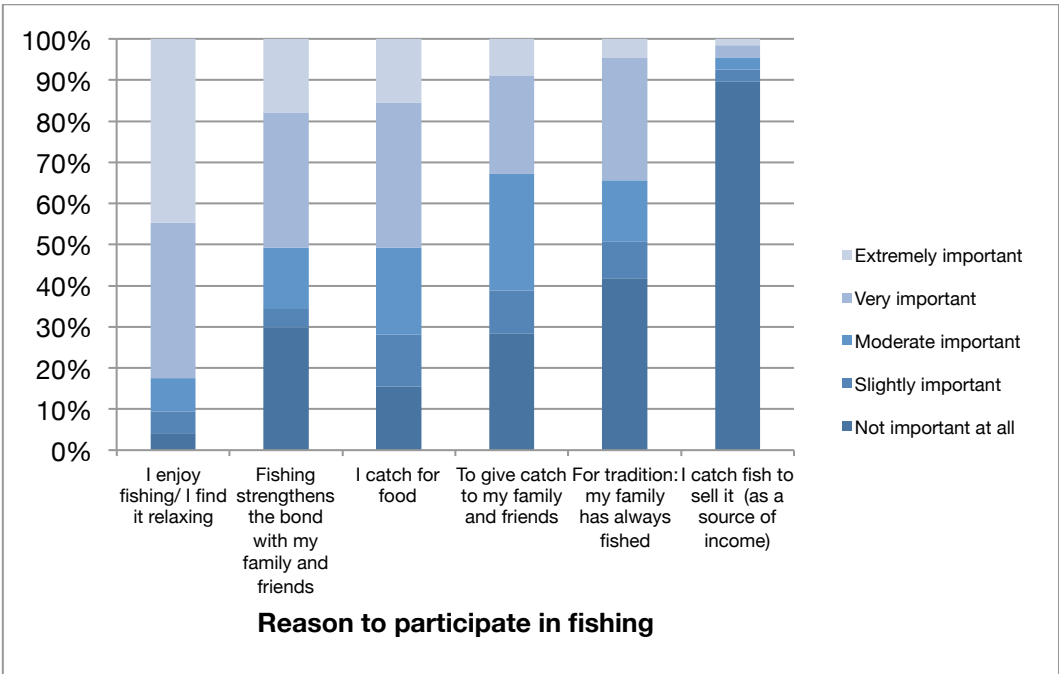
¹¹ A two-day workshop held on Aruba (28th and 29th of April 2016) was organized with the purpose of building knowledge and sharing experiences between different stakeholders from public, private and citizens' organisations directly and indirectly involved in policy, management and investments in nature conservation in Aruba.

Although only 20% of the respondents go on fishing trips (Figure 11), more than 80% of the respondents do eat locally caught fish (Figure 10) and some 45% at least once a week.



Graph 3: How many people currently fish for recreational purposes in your household?

Of the households that do participate in fishing, around 55% of the time it is one person within the household that does this and another 25% of the time households have two people participating (Graph 3).



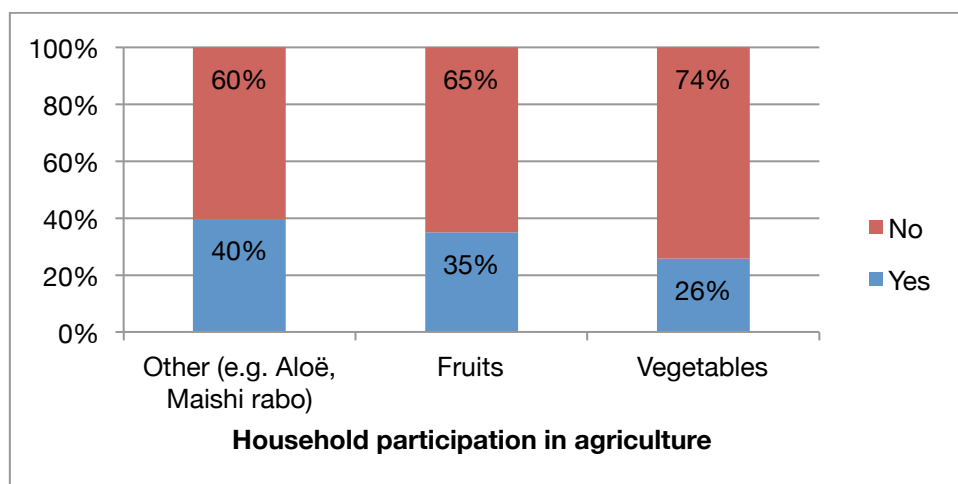
Graph 4: How important are the following reasons for you (or members of your household) to go fishing?

Respondents could express more than one reason to go fishing, thus one is not exclusive from another. Most respondents go fishing because they consider the enjoyment and relaxation of fishing a great motivator. Subsequently, as part of social cohesion by strengthening the bond with family and friends. Also, in general in order to catch fish for food. Around 35% of households find that tradition is a very or extremely important reason to participate in fishing. The least important reason was for income purposes (Graph 4).

There are considerable food resources in the surrounding waters of Aruba and given the importance of fish as a local food source, there is a clear demand and market present. Although fisheries in Aruba is not as developed as in other countries and occurs in the informal sector, sustainable management of the food resources in the surrounding waters of Aruba and mitigating possible impacts e.g. untreated waste water discharge in coastal areas or unsustainable fishing methods, becomes important to be able to have healthy fish populations.

3.1.1.5 Agriculture

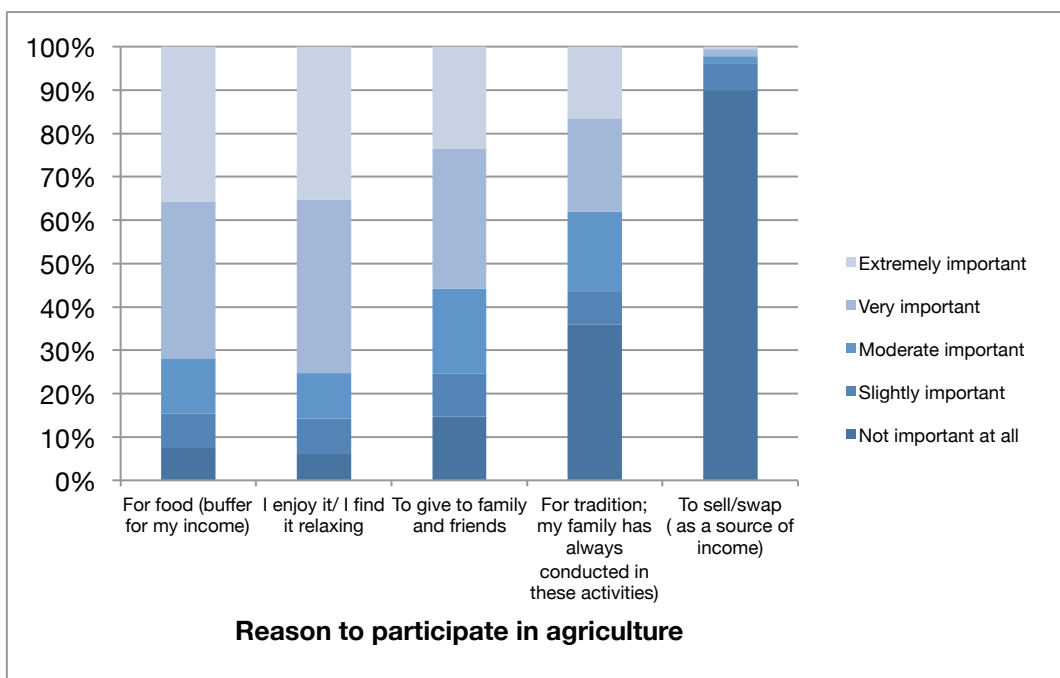
This paragraph focuses a bit more in depth on agricultural practices of the local community as these were of interest to stakeholders¹².



Graph 5: Does your household participate in harvesting fruits and vegetables?

Between 25% to 40% of households participate in some sort of agricultural harvesting of fruits, vegetables or other crops such as the Aloë or the local “Maishi rabo” (sorghum flour) (Graph 5).

¹² A two-day workshop held on Aruba (28th and 29th of April 2016) was organized with the purpose of building knowledge and sharing experiences between different stakeholders from public, private and citizens' organisations directly and indirectly involved in policy, management and investments in nature conservation in Aruba.



Graph 6: *How important are the following reasons for you to participate in harvesting fruits and/or vegetables?*

Respondents could express more than one reason for participating in harvesting, thus one is not exclusive from another (Graph 6). The two foremost important reasons for households to participate in harvesting of fruits, vegetables or other crops is in general for food or buffer for the household income as well as it being a source of enjoyment and relaxation. Subsequently, 55% of households find it very or extremely important being able to share their harvest with family and friends. The least important reason was to sell or swap as a source of income.

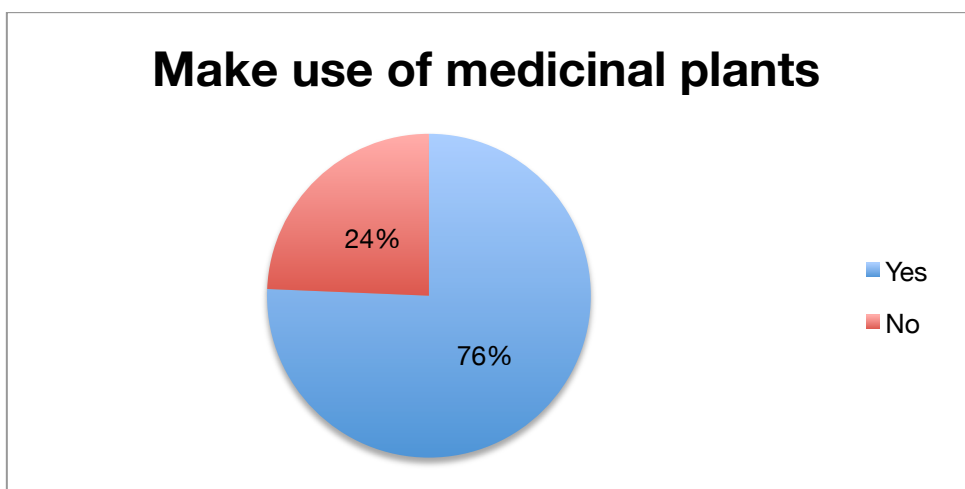


Figure 12: *Do you make use of medicinal plants grown on Aruba?*

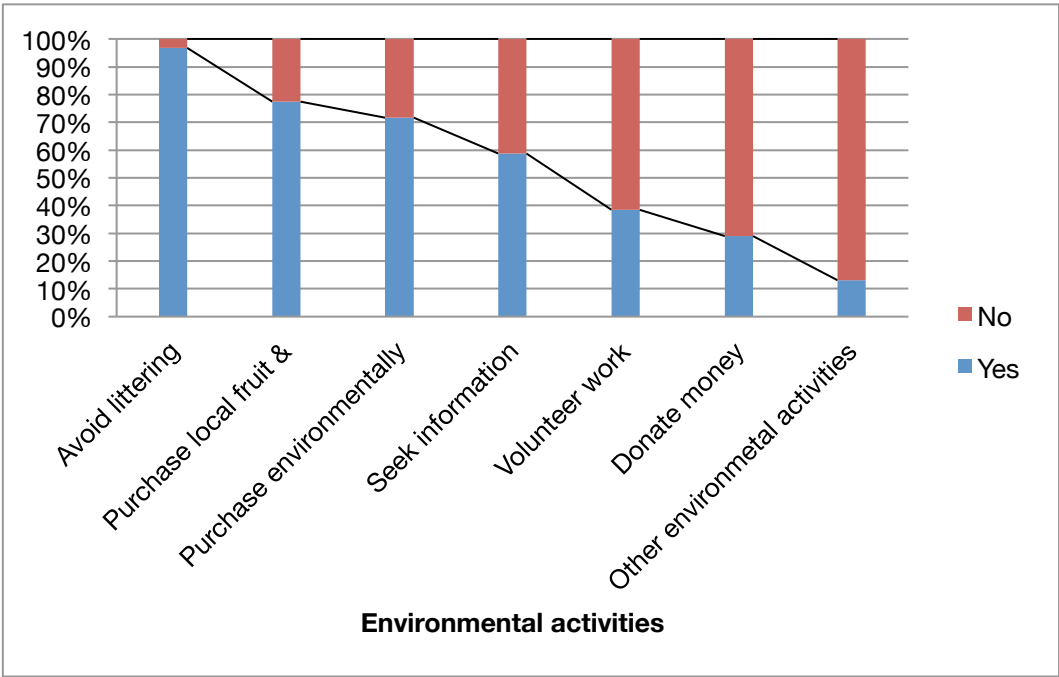
Additionally, the survey inquired on the use of medicinal plants on Aruba as an alternative to modern medicine or prescription drugs. An inquiry into the cultural aspect of using plants as medicine and to what extent it was still in play in current times as an ecosystem service. Medicinal plants are provided by the dry forest ecosystem. Around 76% of respondents, more than three quarters, make use of medicinal plants (Figure 12). Respondents were given the opportunity to mention three medicinal plants they use. From the plants that grow on Aruba some are considered plagues or an ecosystem disservice (e.g. neem tree), these were removed from the list (van der Burg et al, 2012)¹³. Popular reported medicinal plants are the “Aloë”, “Yerba di hole”, “Toronjil”, “Moringa”, “Seida cora”, “Shorshaka”, “Calbas” and “Noni”. Aloë (Aloë vera) is known all over the world for its medicinal qualities and the products derived from it, especially skin-care, and is also an export of the island. The “Yerba di hole” (*Ocimum americanum*), a type of basil where leaves are used for tea as well as nutritiously in soups (and for taste). Toronjil (*Melissa officinalis*) can have many purposes, tea from the leaves works calming, while crushed leaves can even work as an insect repellent. Knowledge on medicinal qualities of plants is mainly tacit and local/traditional knowledge, given its use on Aruba by the local community, it would be important to document this local knowledge as it can preserve cultural heritage and biological diversity (Das et al., 2016).

¹³ A distinction of indigenous and non-indigenous plants was not made

3.1.3 Environmental perspectives

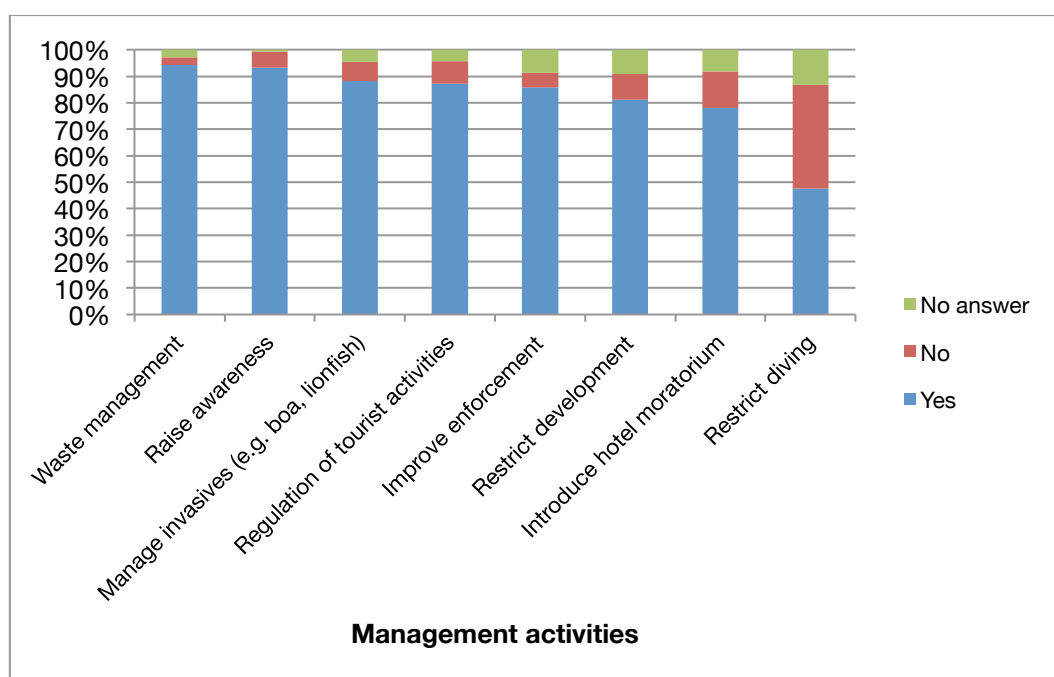
The household survey contained sections dedicated to evaluating environmental perspectives. The actions a respondent undertakes to improve the environment, the perception on management options as well as threats were assessed. Additionally, looking at the perception between well-being and nature. And finally also specifically on perceptions regarding urban green spaces.

3.1.3.1 Environmental awareness and management statements



Graph 7: Did you do any of the following activities in the past year?

Graph 7 describes the responses on participation in environmentally conscious activities by respondents during the past one year. The graph is ordered from right to left, from the most to the least percentage of participation. The participation rate of residents where highest for the following environmental activities “Avoid littering” (97% participation rate), “Purchase local fruit and vegetables” (78%) and “Purchase environmentally friendly products (reusable bags etc.)” (72%). The lowest participation rates are attributed to the following activities “Donate money to an environmental cause (e.g. a nature conservancy organization)” (29%) and “Do any voluntary environmental work (e.g. beach or mangrove clean-up)” (38%). Around 59% actively “Seek environmental information (on internet, TV, newspaper, radio etc.)”. Other activities mentioned was for example a schoolteacher that incorporated sustainability as part of the curricula and recycling.

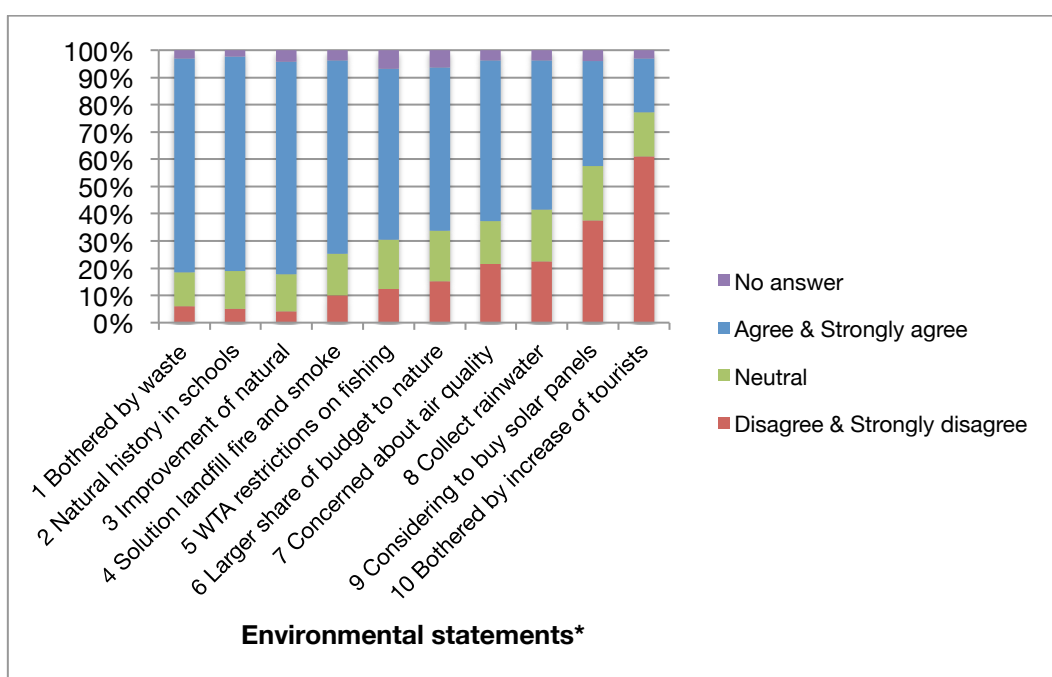


Graph 8: Are you in favour of the following management activities to improve the marine and land natural environment?

Eight different management activities were presented to respondents in order to assess the amount of support and perceived need assigned to them. From Graph 8 it can be concluded that there is in general a high support for most of the management activities proposed, “Improving solid waste management” (94%)¹⁴, “Environmental awareness raising (campaigning etc.)” (93%) “Management of invasive species (e.g. boa constrictor, lion fish)” (88%). It is the opinion of the local community that existing

¹⁴ This is in line with findings from the Department of Nature and Environment (DNM). In 2014, DNM worked on the development of its nature and environment policy and organised stakeholder consultations (DNM, 2014). These consultations report the same results as found in the TEEB Household survey; waste management is a priority.

rules are currently not optimally enforced with 86% agreeing to “Improve enforcement of environmental regulations (e.g. driving in the dunes with 4x4)”. When it comes to development there is a sentiment for restriction with 81% agreeing with “Restricting coastal and inland development (e.g. where building is allowed)” and 78% agreeing with “Introduce a moratorium on building hotels (moratorium = a temporary prohibition of an activity)”. When it comes to tourism activities that might affect the provision of ecosystem services the local community is in favour of regulation, “Regulation of tourist activities (e.g. tours)” (87%). However, “Restricting SCUBA diving/snorkelling” received much less support with 48% agreeing. The latter management option also had a higher frequency of “No answer”, this could be due to lack of more specific information on how this might be implemented, thus such an implementation would require more awareness raising and stakeholder engagement than other management options proposed.



Graph 9: Environmental statements

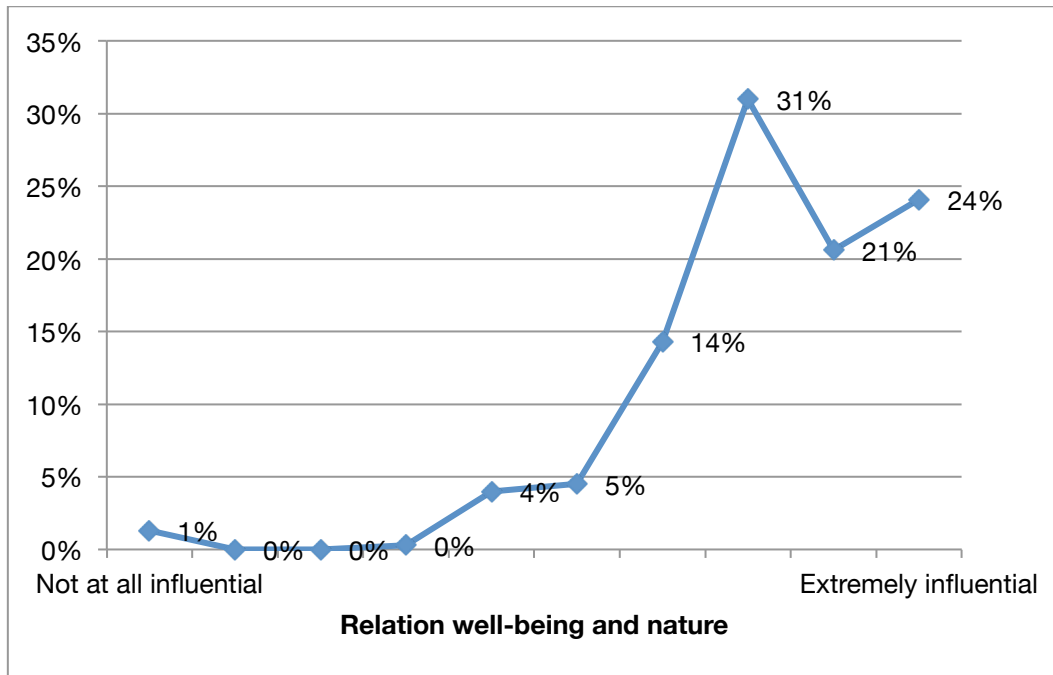
- 1= I am bothered by the increasing amount of waste and litter on Aruba
- 2= Aruba's natural history and cultural heritage should form part of education in schools
- 3= Improvement of the natural environment is very important to me
- 4= There should come a solution for the occasional fire and smoke at landfill Parkietenbos
- 5= I am willing to accept restrictions on fishing if that helps to protect the marine life of Aruba
- 6= A larger share of the budget of the government should go to the management of natural areas
- 7= I am concerned about air quality on Aruba
- 8= Inhabitants of Aruba should start collecting rain water (e.g. for cleaning your car and watering your garden)
- 9= I am considering to buy solar panels, or I already have them installed
- 10= I am bothered by the increasing number of tourists on Aruba

Respondents were presented with ten different environmental statements with which they could strongly agree to strongly disagree with (Graph 9). These statements were chosen based on input from stakeholders. Apparent from the results is that waste management is a high priority for the local community. This is also in line with the perception on management activities seen in Graph 8. Majority of the local community is bothered by the increasing amount of waste and litter and also agree that there should come a solution for the fire and smoke at landfill Parkietenbos. Another apparent result is that majority agrees to accept restrictions on fishing if this helps in the protection of the marine environment.

Around 60% of the local community wants a larger share of the governmental budget to go to management of natural areas. Around 38% of households on Aruba are considering to buy solar panels or already have them installed. When it comes to the statement least agreed with by 60%, "I am bothered by the increasing number of tourists on Aruba", respondents took the opportunity to express at the open comment at the end of the survey that it was not per se about the number of tourists but the type as well as the on-going development. The latter is seen from the fact that 78% of the respondents are in favour of a limit on the development of hotels (Graph 8).

3.1.3.3 Relation between well-being and natural environments

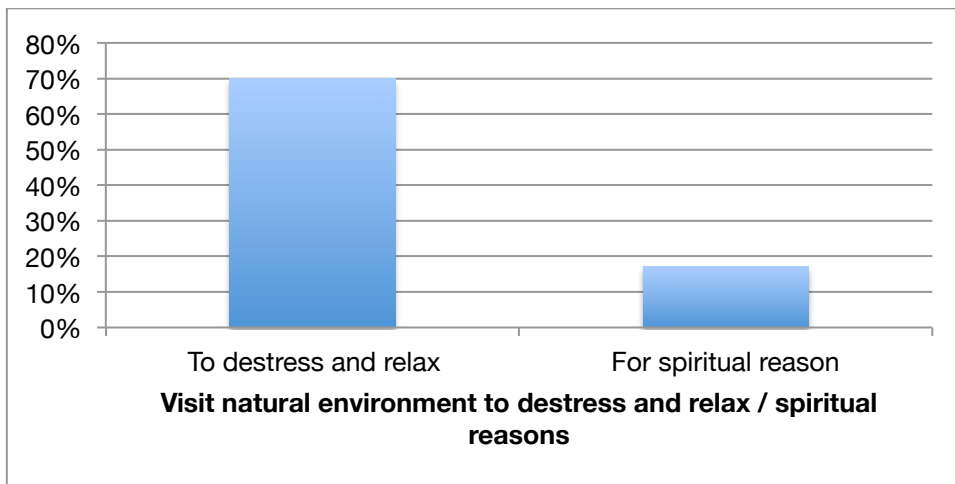
The focus of this section was to explore the perception of the local community on their well-being in relation to nature, as part of overall Quality of Life. It is focused on the subjective part of quality of life; human well-being¹⁵.



Graph 10: To what extent do you think the natural environment has an influence on your well-being?

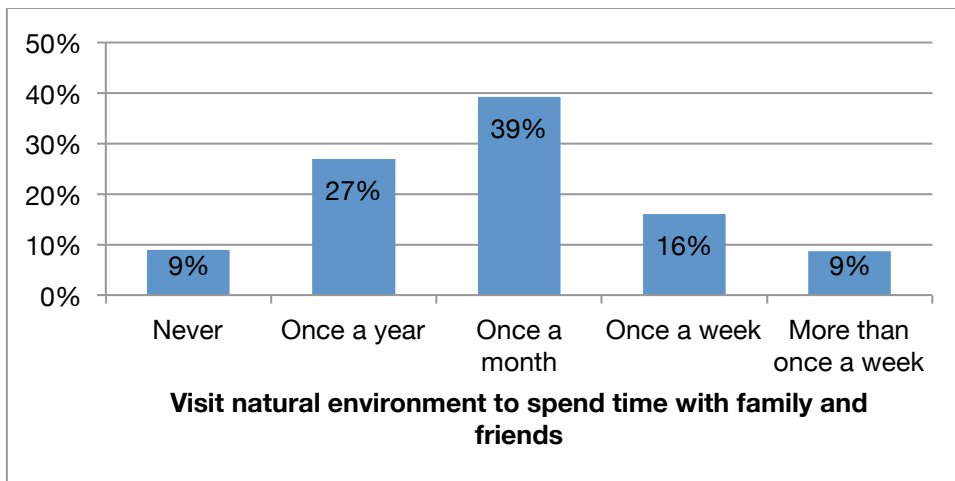
Respondents were asked to indicate how influential the natural environment is to their well-being (Graph 10). 95% of the local community has the perception that nature has an influence on their overall well-being and the majority finds it extremely influential.

¹⁵ Costanza et al. (2007) defined that Quality of Life is the extent to which objective human needs are fulfilled and in relation to personal (or group) perceptions of subjective human well-being. Quality of life consists of two parts, human needs and human well-being (Costanza, et al., 2007; Forgeard et al., 2011). Human needs can be measured with statistical data, such as mortality rate, income, diseases (e.g. depression), education rate, etc. human well-being is about perception and experience and it is measured subjectively.



Graph 11: Do you visit natural environments when you are stressed and want to relax / for spiritual reasons (e.g. areas of spiritual, religious, or other forms of exceptional personal meaning)

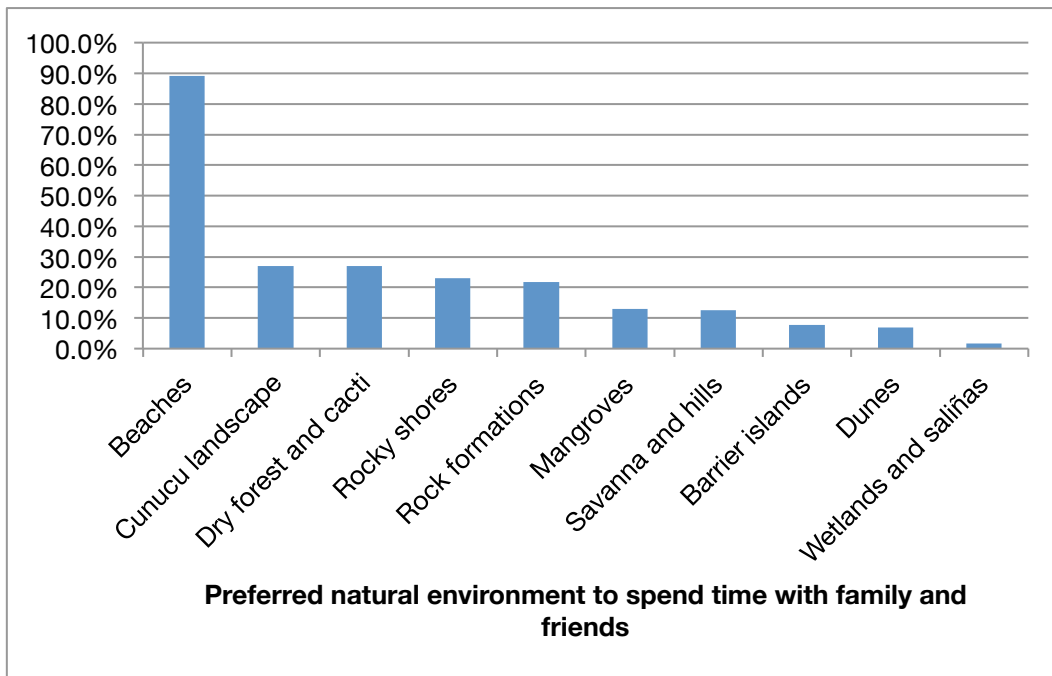
Around 70% visit natural environments to destress and relax¹⁶. Additionally, around 17% of the local community in Aruba would visit a natural area for spiritual reasons (see [Graph 11](#)).



Graph 12: How often do you visit a natural environment to spend time with family and friends?

Natural areas also serve as a bonding opportunity, around 25% of the local community on Aruba visit a natural environment to spend time with family and friends at least once a week and another 39% at least once a month (see [Graph 12](#)).

¹⁶ Research from the University of Minnesota (2014) found that natural environments can reduce stress, which is good for a person's health (by reversing elevated blood pressure, heart rate and muscle tension) and a study from Stanford (2015) found that people who walked for 90 minutes in a nature area showed decreased activity in a region of the brain associated with depression.

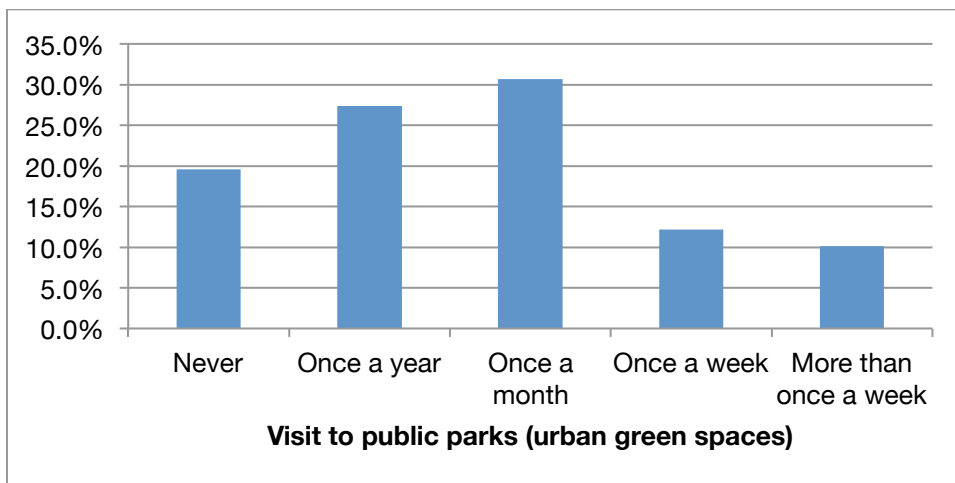


Graph 13: Which natural environment do you prefer when spending time with family and friends? (respondents could choose 3)

The most favored natural environment for social cohesion and bonding with family and friends is first and foremost the beach, making public access to beaches an important policy topic (see [Graph 13](#)).

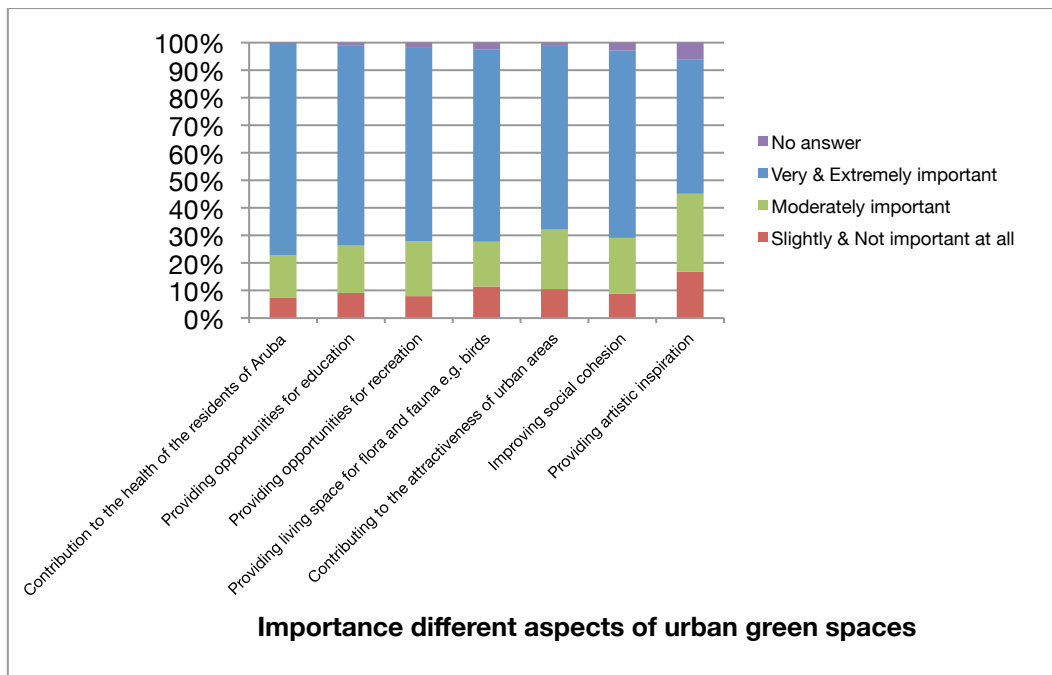
3.1.3.4 Urban green space

This section explores the perception on urban green space on Aruba, which is considered a cultivated (man-made) ecosystem.



Graph 14: How often do you visit public parks (e.g. Wilhelmina park, Linear Park)?

Inquiry into how many times the local community visit a public park (or urban green space) led to 22% visiting at least once a week, another 31% visit a public park once a month, 27% only once a year and 20% never visit a public park (Graph 14).



Graph 15: How important are the following aspects of urban green spaces for you (public parks, e.g. Wilhelmina park, Linear Park, but also the natural areas – such as gardens and wetlands – surrounding urban spaces)?

Inquiry into the importance of different aspects of urban green spaces reveals that 77% find it very or extremely important for the health of the residents of Aruba (Graph 15)¹⁷. This relates to recreational ecosystem services, the park invites one to walk, run and work out, but also regulation ecosystem services; filtering of air and the cooling effect of the trees. Majority also finds urban green spaces to contribute to provision of opportunities for education, recreation, living space for flora & fauna, attractiveness of urban areas and improving social cohesion¹⁸. Urban green space as a source of artistic inspiration is moderately important for around 28% of respondents and for 49% very or extremely important.

¹⁷ The question examines different ecosystem services; a) habitat service; b) aesthetic appreciation; c) recreation; d) health/regulating; e) social cohesion; f) artistic inspiration and g) education.

¹⁸ Urban green spaces, such as parks and gardens can improve cognitive development and buffer against the effects of health inequality. This relates to opportunities for children to develop mental skills such as discovery and creativity and when scientists examined associations between participants' level of financial stress and psychological well-being, results show that the difference in well-being scores among people experiencing the most and least financial difficulty diminished with greater access to green spaces, such that the health gap was 40 percent smaller among those with better access (Payam Dadvanda et al., 2015; Richard J. Mitchell et al., 2015).

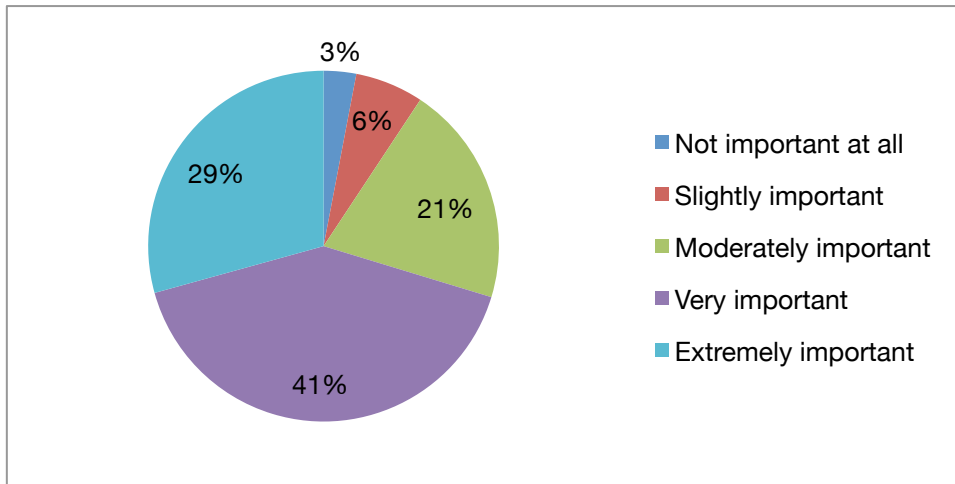


Figure 13: How important is the presence of native vegetation in urban public parks (e.g. Divi tree, Cacti and Aloë) to you?

An additional question was posed on the importance of native species in urban parks, such as the Divi tree and Cacti, to which 70% finding this very to extremely important (Figure 13)¹⁹.

¹⁹ The urban design's role in shaping cities is becoming more important to develop a multi-sensory experience and emphasizing biological complexity in design to enhance human well-being (Fuller et al., 2007).

3.2 The willingness-to-pay (WTP) of local community for nature protection

3.2.1 Contingent valuation

The CV willingness-to-pay (WTP) towards management of Aruba's marine and terrestrial environment is estimated by multiplying the total number households on Aruba by the percentage of households of the sample that are WTP. 62.7% of the respondents are in principle willing to pay for management of marine and terrestrial natural environment. Then this number is multiplied by the households average WTP. In total there are 34,845 households in Aruba (CBS, 2015). The household average WTP is 24.81 AWG per household per month (13.78 USD²⁰).

WTP monthly

$$= N^{\circ} \text{ of households} * \text{Households that are WTP (\%)} \\ * \text{Household average WTP}$$

$$542,044 \text{ AWG (301.136 USD)} = 34,845 * 62.7 (\%) * 24.81 \text{ AWG (13.78 USD)}$$

This leads to a **yearly willingness-to-pay towards management of Aruba's marine and terrestrial environment of 6.5 million AWG (3.6 million USD).**

Of the respondents that were not willing to pay, 40% are in favour of more management, however are of the opinion that this should be derived from existing tax revenues and 39% indicated not being able to financially afford a contribution as their main reason.

3.2.2 Choice experiment

The CE willingness-to-pay towards management of Aruba's marine and terrestrial environment is estimated with the most commonly used choice model; a conditional logit model (see Annex E for the conditional logit model).²¹

First, results show that maintaining current policy decreases welfare or in other words utility of the local community. The current policy constant is represented in the choice card as a situation in which there is no marine protected area, where recreational fish catch decreases by 50%, where there are no public beaches left for the local population, where only 20% of natural areas on land remain, and where the number of tourists triples compared to now.

²⁰ 1 USD = 1.80 AWG

²¹ All model estimations were done in NLOGIT 5.

In summary, the results pertaining to the relevant attributes included in the model are as follows:

- **Marine Protected Area (MPA) establishment:** increasing marine protected areas has a strong positive effect on utility. The effect is bigger for larger areas. The pattern in WTP is displayed in Figure 14. When exploring the existence and sources of preference heterogeneity (a model in which we incorporate people's background characteristics) having a medium or high level of education appears to have a positive effect on preferences for MPA establishment and MPA size, as does the perceived impact of nature on well-being and visiting natural areas when stressed. These effects are plausible when realizing that knowledge likely leads to increased environmental understanding and preferences towards nature protection, and when realizing that an increased supply of MPA's has more positive consequences for those who perceive nature to be good for them and even use it to recuperate.

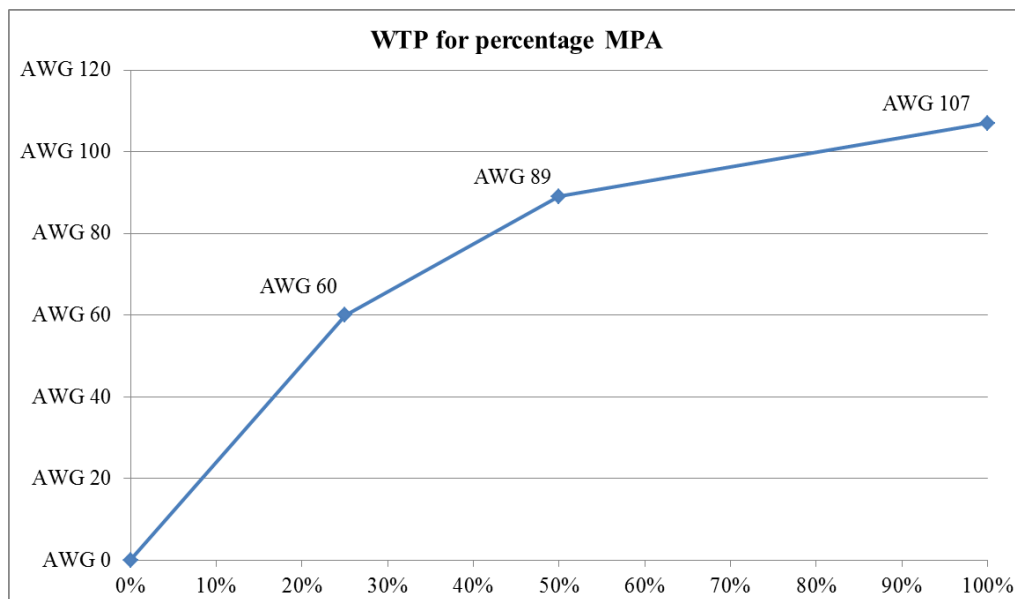


Figure 14: WTP for percentage of MPA (in AWG per household per month)

- **Fish catch per trip:** maintaining recreational fish catch at the current level (compared to a decrease of 50% under current policy) has a small and insignificant effect on utility. Increasing recreational fish catch by 50% (compared to a decrease of 50% under current policy) does have a positive effect on utility. People who perceive nature to be good for their well-being and people with a higher frequency of fishing activities are more positive (negative) about increases (decreases) in recreational fish catch, which seems plausible.
- **Beach width:** increasing beach width left for the local population has a strong positive effect on utility. Education and frequency of beach visits have positive effects on preferences for beach width left for the local population.
- **Natural areas on land:** protecting natural areas on land has positive effects on utility, but only when large parts are protected. Under current policy there will be only 20% left of these natural areas, and increasing this number to 40% does not affect utility much. Maintaining 60% and especially 90% has a strong positive effect on utility, and people appear to have a relatively high willingness to pay for natural area protection. The pattern in WTP is displayed in Figure 15.

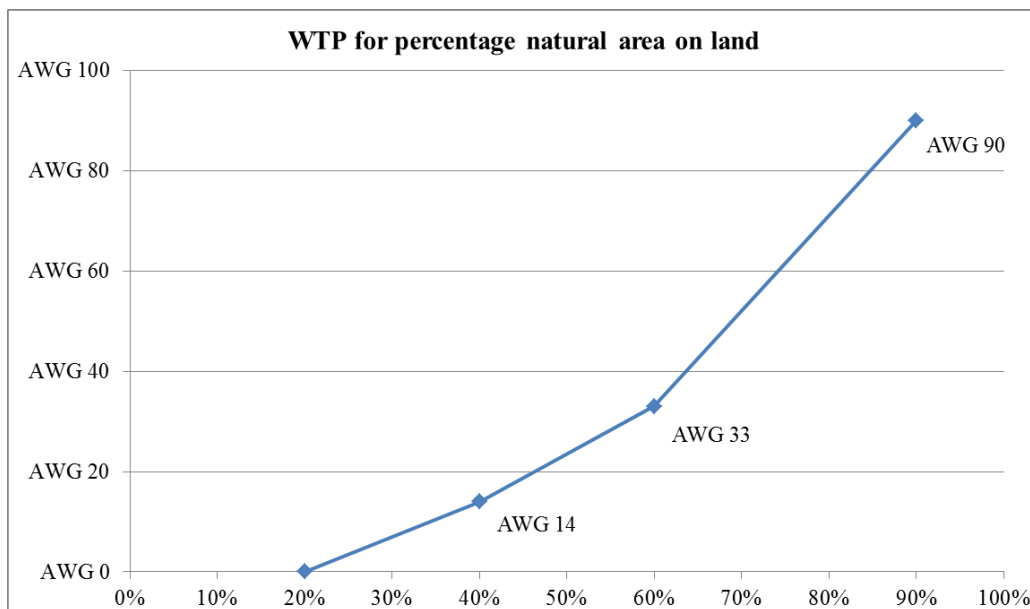


Figure 15: WTP for percentage of natural areas on land (in AWG per household per month)

- **Tourist crowdedness:** under current policy the number of tourists will increase by a factor 3. Average preferences for changes in the number of tourists were neutral, i.e., changes in tourism numbers did not affect average utility and average WTP was low. Further analysis shows that this average disguises widely varying opinions and preferences on this topic. People who are employed in the hotel/restaurant or retail sector are more in favour of more tourists. People who perceive nature to be beneficial for their well-being, households with people that fish and people with a higher frequency of beach visits are less positive or more negative about an increase in number of tourists. This set of results likely reflects that these groups will experience a decrease in use values from nature when tourism increases.

Although the CE has benefits as both envisioning and learning effects take place, the model is also suspected to suffer from a hypothetical bias, which can cause WTP estimates that are relatively high, therefore to present the CE monthly WTP the conservative option is used. As with the CV calculation, 62.7% of the respondents are in principle willing to pay for management of marine and terrestrial natural environment. Hereafter this number is multiplied by the household CE monthly WTP of 64 AWG (35.69 USD²²). In total there are 34,845 households in Aruba (CBS, 2015).

$$1,398,260 \text{ AWG (776,811 USD)} = 34,845 * 62.7 (\%) * 64 \text{ AWG (35,69 USD)}$$

This leads to a **yearly willingness-to-pay towards management of Aruba's marine and terrestrial environment of 17 million AWG (9.3 million USD).**

3.2.2.1 Current policy scenario and two alternative management strategies

To show how this value function can be used, we calculate average WTP per household per month for the current policy strategy and for two alternative management strategies. The first strategy is a strategy that can be defined as the most optimal. The second strategy can be characterized as a strategy that is just better than the current policy. The chosen 20% for Marine Protected Area (MPA) is based on the Caribbean Challenge Initiative which has as aim: "Protecting and sustainably managing 20% of the Caribbean's marine and coastal ecosystems by 2020". The Government of Aruba has signed a Memorandum of Understanding for the Caribbean Challenge Initiative²³. These strategies are presented in Table 6.

²² 1 USD = 1.80 AWG

²³ . See: <http://www.caribbeanchallengeinitiative.org/> for more information.

Table 6: Management strategies used in WTP simulation

		Attribute				
		MPA	Recreational fish catch	Beach width	Natural area	# tourists
Current policy		0%	-50%	0 meter	20%	Triple
Scenario 1 (optimal)	1	100%	+50%	30 meter	90%	Current number
Scenario 2 (conservative)	2	20%	Stays the same	15 meter	40%	Double

The WTP values for these strategies are presented in Figure 16²⁴. As discussed before, current policy scenario generates negative welfare benefits. The figure clearly demonstrates that the two management strategies generate positive welfare benefits, and that scenario 1 generates the largest welfare benefits by far, WTP of 331 AWG (183.88 USD) per household per month. Scenario 2 generates a WTP 64 AWG (35.69 USD) per household per month. Of course, whether scenarios 1 or 2 are economically viable from a broader welfare perspective, and whether scenario 1 is still the more preferable of the two, depends to a large extent on the costs of implementing the management strategies. Thus the WTP levels give an indication of the utility (welfare) derived by the local community in the differing scenarios relevant to each other.

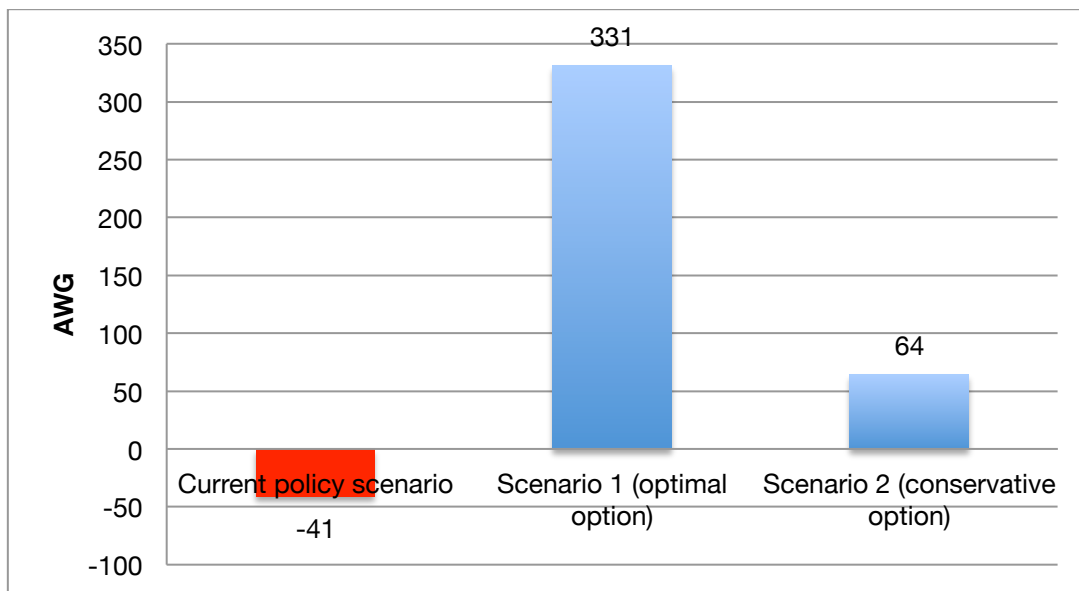


Figure 16: WTP for the current policy and two alternative management strategies (in AWG per household per month)

²⁴ The MPA 20% in management strategy 2 was not an attribute level in the choice experiment, so we derived its value by interpolation.

Chapter 4: Hotspot mapping

4.1 Public Participatory Geographic Information System (PPGIS)

Spatially explicit data can be obtained through public participation geographic information system (PPGIS). PPGIS has been widely recognized as a valuable tool to capture spatial information on cultural values of landscape at the local community level. Three values were researched: **Aesthetic**, **Cultural Heritage** and **Recreational**. The main aim is to get an understanding of which locations on the island are perceived as the most valuable ones by the local community by identifying hot spots.

4.1.1 Aesthetic value

Analysis of PPGIS data revealed three locations on Aruba perceived as having the highest aesthetic value for local residents. First is the area of **Seroe Colorado and the Baby Beach Lagoon** on the southern tip of the island, followed by the western tip of the island with **California Lighthouse and the dunes** (see Figure 17). Third hotspot appears inland in the area of **Arikok National Park**. Here, according to the shape and the size of the hotspot, we can make an assumption that respondents had difficulties to map the exact location within the park area, but rather they allocated the points right next to the name (*Arikok*) that was featured on the map. This may imply that Arikok as a whole has a high aesthetic value for the local community.

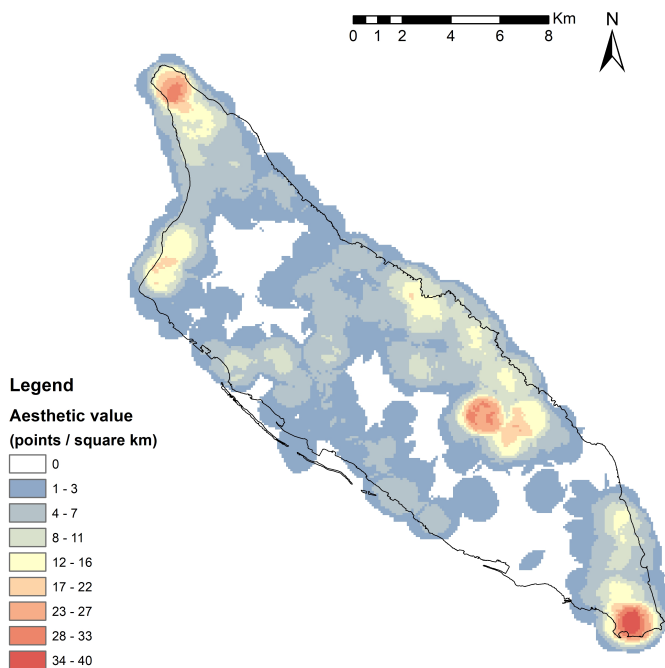


Figure 17: Density of aesthetic value points

These aesthetic hotspot locations in the natural environment of Aruba, two within coastal areas with seascape views (*California Lighthouse and the dunes & Seroe Colorado and the Baby Beach Lagoon*) and one terrestrial (*Arikok National Park*), have a value for the local community because of the beautiful scenery. These ecosystem areas, because of their beauty, can serve as an experiential cultural benefit, e.g. people feeling touched by the beautiful scenery, which might include feelings of calm or spiritual enrichment arising from encountering physical attributes in the ecosystem area. The areas can also serve as inspiration for drawing, painting, photography, poetry and storytelling that draw upon the natural environment. It's important to notice that the hotspots for aesthetic value are within less developed areas on the island, especially the conservation area Arikok National Park and the area of the California Lighthouse dunes. The area of the Baby Beach Lagoon is situated close-by to a residential area, however the beach and lagoon is not surrounded by large infrastructure such as other beach areas on the island.

4.1.2 Cultural heritage

Regarding the cultural heritage, another CES examined through participatory mapping, one big hotspot emerged followed by three hotspots of lesser intensity. As Figure 18 illustrates a major hotspot is located in the area of **California Lighthouse and the dunes** on the North of the island. Another hotspot occurred in the area of **Arikok National Park**. Similar as in the case of aesthetic value, the location of this hotspot (i.e., in the place where the name was on the map respondents had to fill in) suggest that the majority of respondents consider Arikok National Park as a whole to be an area of special importance for the cultural heritage of the island. Another hotspot of cultural heritage value emerging in the natural environment is the area of **Seroe Colorado and the Baby Beach Lagoon** situated on the southern tip of the island. Lastly, even though it is an urban area, the respondents often recognized **Oranjestad** – the capital city, as an important sight of the island's cultural heritage.

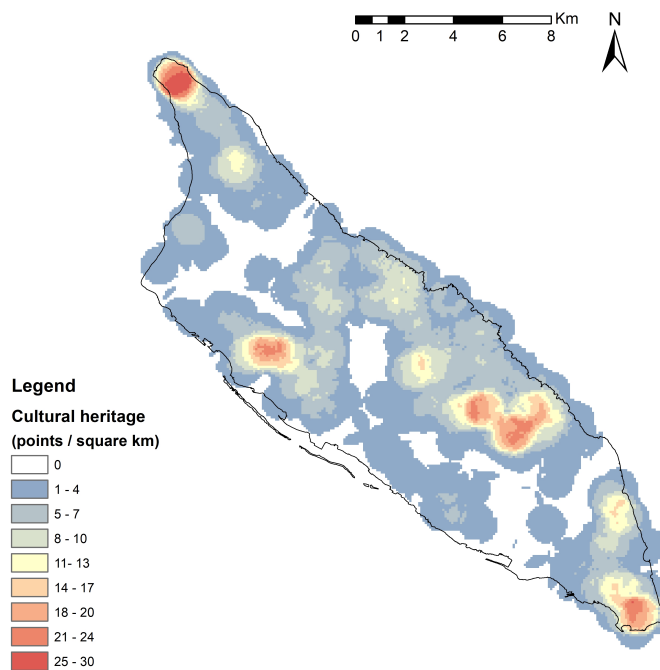


Figure 18: Density of cultural heritage value points

These cultural heritage hotspot locations (*California Lighthouse and the dunes, Seroe Colorado and the Baby Beach Lagoon, Arikok National Park and Oranjestad*), are valued by the local community as important places of both natural and human history. These areas serve as a place of identity and continuity with past. People thus feel a sense of belonging to these areas, having memorable experiences or might miss these sites when having been away from them for a long time. Most cultural heritage hotspots identified on Aruba are also considered an aesthetic hotspot with

only the exception of Oranjestad being a cultural heritage valued hotspot but not an aesthetic valued hotspot. This might then suggest that areas considered for pure aesthetic value are areas where there is less infrastructure development.

4.1.3 Recreational value

To map the recreational value of natural environment in Aruba, we asked the respondents to point out the location where they engage in certain recreational activities, both marine and terrestrial. Respondents were asked to point out on the map up to two locations for each of the two activities, from the question on recreational activities in marine & coastal and similar for the terrestrial natural environment, that they undertake most often. These activities were then used as indicators of recreational value. As Figure 19 shows, several hotspots occurred mostly in the coastal areas of the island. Location with the highest recreational value for the residents of Aruba is the **Eagle Beach** located on the southern part of the island's western coast. Additionally, the area of **Arashi, Boca Catalina and Malmok** – the strip of beaches in the northern part of the western coastline also has the high importance for the recreation of local residents. Likewise, another beach being the hotspot of recreational value is the **Baby Beach Lagoon** in the south, followed by the area of **Surfside Beach** and in the area of the urban park **Linear Park in Oranjestad**.

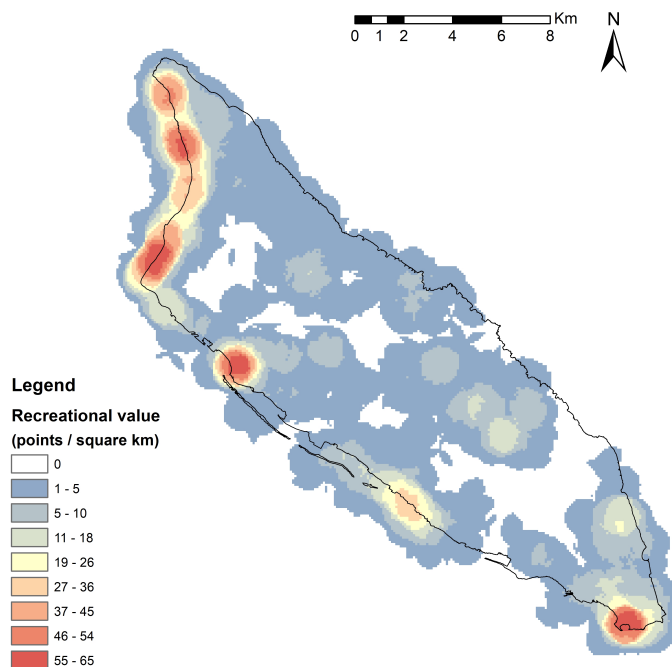


Figure 19: Density of recreational value points

Coastal and marine recreational activities

Figure 20 illustrates the locations for each of the six specific recreational activities in the coastal and marine natural environment. **Going to the beach** (Figure 20a) and **swimming/wading** (Figure 20b) are the two recreational activities in coastal environment in which the local community of Aruba engage the most. The most popular locations for these activities are mainly located on **beaches of the western coast**. One other location important for these two activities is the **Baby Beach Lagoon on the southern tip** of the island.

Two locations (Figure 20c & d) being the most important for underwater activities such as **snorkelling and diving** are the area of **Malmok Beach on the west**, and the **mangrove area of Mangel Halto on the southern coast** of the island.

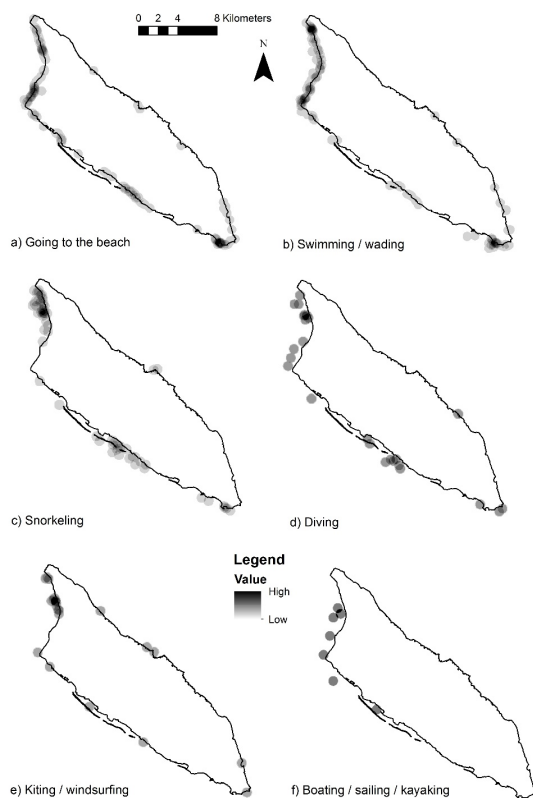


Figure 20: Recreational activities in coastal and marine environment

Terrestrial recreational activities

Regarding the recreational activities in the terrestrial environment, the most popular among the local residents on Aruba is **walking** in nature. As Figure 21 a & b shows that this activity occurs almost on the entire island, but one specific hotspot emerges in the area of Oranjestad, specifically on the location of **recently built urban Linear Park**²⁵. The latter also being the prominent hotspot for **running**. Prominent **cycling** hotspot appears on the **western tip of the island near California Lighthouse and the dunes**. Location most popular for **camping** is the **Eagle Beach**. As for the **hiking**, the most popular location for this activity is the **Hooiberg hill**, followed by **several locations in the Arikok National Park area**. **Bird and wildlife watching** occurs the most around the **Bubali wetland**, but also in the **Arikok National Park area**.

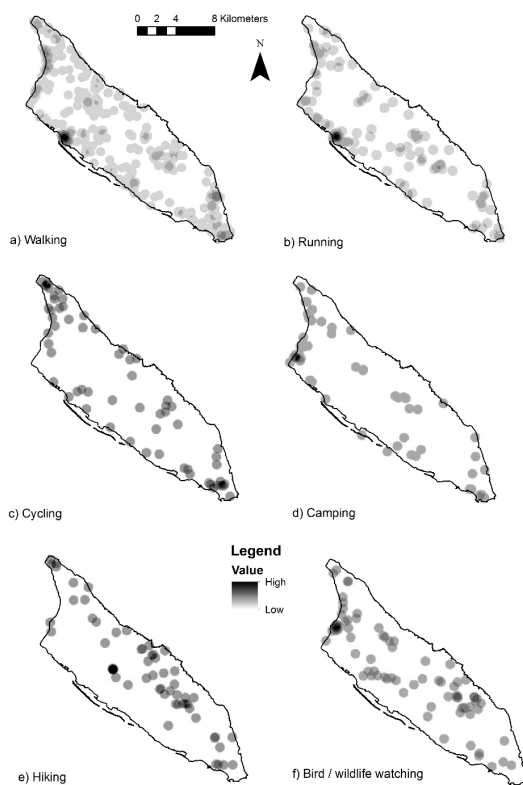


Figure 21: Recreational activities in terrestrial natural environment

²⁵ The Linear Park is a recent built park in 2012 as part of governmental tourism policy programmes aimed at enhancing visitor's experience while also benefiting the local community. The park is situated in an urban area providing ocean vista, bike and jogging paths and plazas as spaces for recreation and relaxation (Ministry of Tourism, Transportation and Labour Government of Aruba, Tourism Policy - Two steps ahead , 2012)

These recreational hotspot locations (*Arashi, Boca Catalina and Malmok, California Lighthouse and the dunes, Bubali wetland, Eagle Beach, Surfside Beach, mangrove area of Mangel Halto, Hooiberg Hill, Arikok National Park, Baby Beach Lagoon and the urban park Linear Park in Oranjestad*) are valued by the local community as important places for non-work leisure time involving physical interactions between people and the natural environment. The natural capital of these locations comprises land cover, the stability and resilience of biodiversity and its plant communities and watchable wildlife. Contributing to the value for recreation are for example ecosystems' regulatory services, such as maintaining water quality at beaches, as well as provisioning services in providing harvestable stocks for extractive recreation like fishing. Research shows that nature-based recreation has a positive influence on well-being by increasing physical activity, restorative, stress-alleviating experiences and increasing social interaction and cohesion (Korpela et al., 2013; Wolsko & Lindberg, 2013). These activities may have a passive nature such as going to the beach (not swimming), wading, quiet birdlife or wildlife watching or an active one such as walking, cycling and hiking in nature, and is done social or solitary. Due to these benefits nature-based recreation is associated with health cost savings and information on outdoor recreation can aid policymakers in decision making regarding investments in public health (Rosenberger et al., 2009; Dustin et al., 2010).

4.2 Crowdsourcing - Social Media - Instagram

As an additional analysis, Instagram data was filtered to represent the local population. Accordingly, the results presented in this section consider only local social media users. In the context of this research, visual analysis including the categorization of images, which was the first step of analyzing social media data, allowed the detection of landscape features perceived as the most valuable. To be able to define the photographs as indicators of studied values, we developed a set of criteria to support the objectivity of visual analysis. In total 88% of the photographs posted were taken in coastal and marine environment rather than in the terrestrial environment. The landscape features posted the most are beaches, rocky shores, rough rocky landscapes, cacti and dry vegetation and anthropogenic landmarks (e.g. Alto Vista Chapel, Bushiribana and California Lighthouse). It is important to note that specific types of recreation can be less represented as abilities and motivation to take photographs change with engaging in different recreation activities (Wood et al., 2013; Tenerelli et al., 2015). For example, people engaging in windsurfing may take fewer photographs than families and friends spending leisure time on the beach. An additional challenge when conducting visual analysis of the images is the fact that aesthetic enjoyment is often closely related with engaging in recreational activities (Daniel et al., 2012). Hence, making these two values mutually exclusive. For example, a scenic photograph of rocky shores could be taken during a hike in the

nature. Still, for operationalization and based on the categorization we applied in this research, that photograph would be used only as an indicator of aesthetic value²⁶.

4.2.1 Aesthetic & Recreational value - Instagram

Aesthetic value hotspots based on Instagram photographs are situated in the areas of **Arashi Beach, California Lighthouse and the dunes** on the western side of the island and the area of **Renaissance and Surfside beach**. Hotspots of smaller intensity appear in the area of **Alto Vista Chapel** in the north-west part of the island, the **Divi Beach** as well as in the **mangrove area of Mangel Halto** on the southern coast.

The biggest recreational activity hotspot according to Instagram photographs occurs in the west, in the areas of **Arashi Beach and Boca Catalina**. This part of the coastline is prominent windsurfing spot on the island. Furthermore, Boca Catalina is a popular snorkelling and diving sight. Additionally, the areas of **Renaissance and Surfside beach** as well as the **urban Linear Park** (see Figure 22).

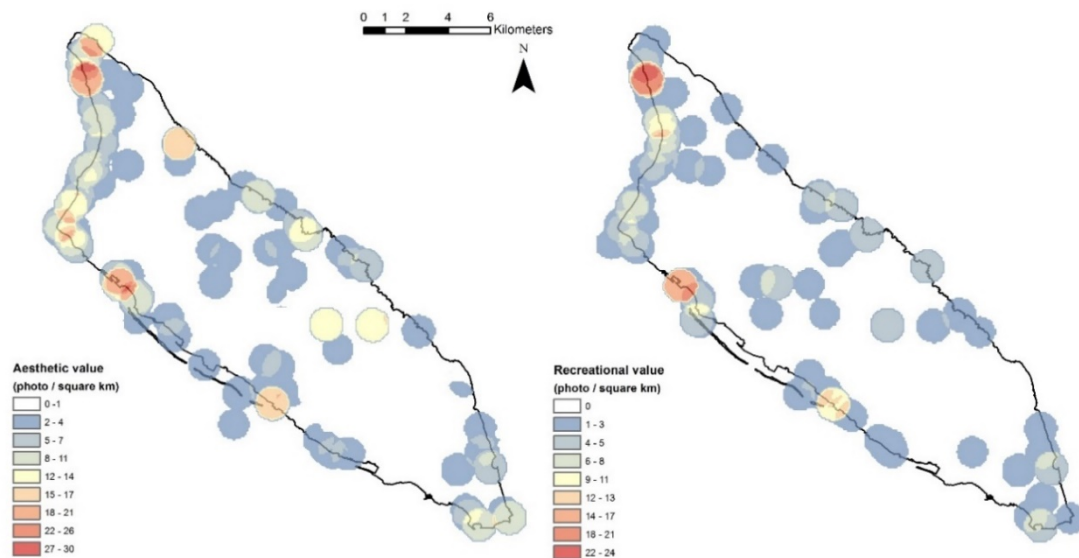
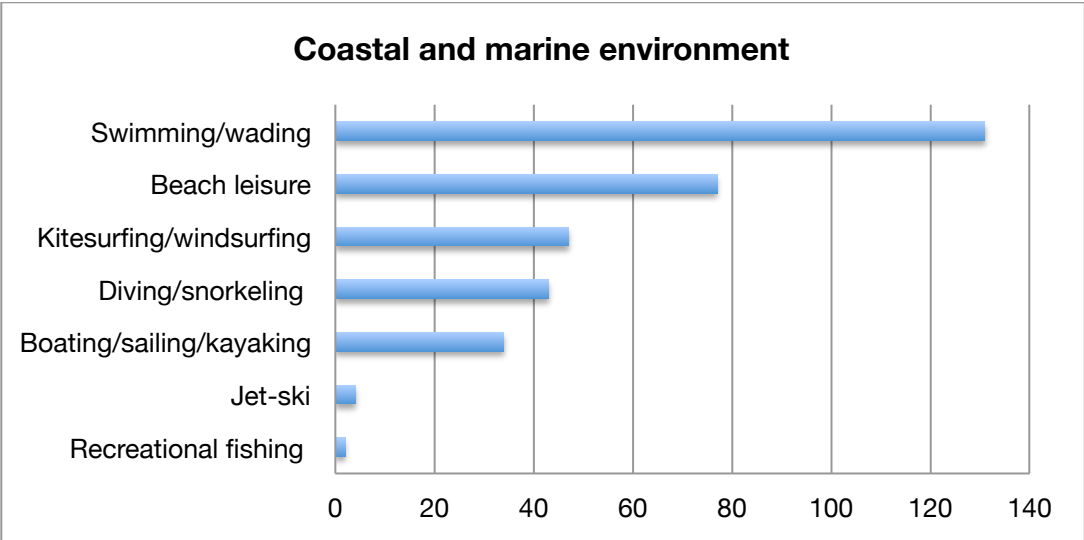


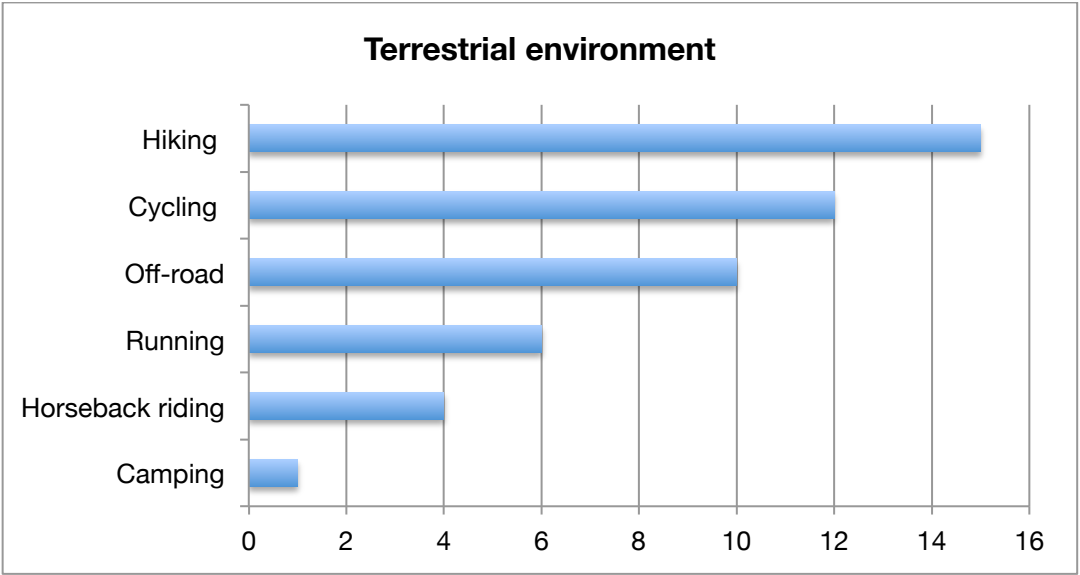
Figure 22: Density of aesthetic value (left) and recreational value (right) - Instagram

²⁶ One possible way to overcome this in the future assessments would be to conduct an additional semantic analysis of the tags users often attach to the photographs they post on social media. According to Sigurbjörnsson & Van Zwol (2008), these tags are used to “describe the content of the photo or provide additional contextual and semantical information” (p. 327). Thus, they represent a valuable insight that could help in further distinguishing different types of values highlighted on the images.

Graph 16 and Graph 17 show the recreational activities posted by local Instagram users. **Swimming and wading**, followed by spending **leisure time on the beach** are the two types of activities being reported the most.



Graph 16: Recreational activities by local community on Instagram in coastal and marine environment



Graph 17: Recreational activities by local community on Instagram in terrestrial environment

4.2.3 Extra analysis comparison social media - Instagram & PPGIS

By simultaneously employing two methodologies to assess two different cultural ecosystems services (i.e. aesthetic value and recreation), this study contributes to current literature on mapping CES (Daniel et al., 2012; Plieninger et al., 2013). It is important to note the differences in the data pool assessed; since PPGIS was a representative sample of local community households and the social media Instagram data is pooled from locals as well but whom are engaged in social media and these might thus have different demographics (e.g. age groups making use of Instagram). Nonetheless, in the recent years, social media has been emerging as an important source of information being utilized in the cultural ecosystem services research (Casalegno et al. 2013; Pastur et al. 2016; Tenerelli et al., 2016).

Area of agreed high densities for aesthetic values appears on the location of **California Lighthouse and the dunes**. In the case of recreation highest density of both social media and PPGIS points is located in the **Arashi beach** area on the western coast. Although PPGIS method (public pinpointing on a map of Aruba) identifies *Arikok National Park* and *Seroe Colorado and the Baby Beach Lagoon* as having high aesthetic value with the highest density points, the social media Instagram method (photographs taken by public and published on Instagram) does not identify these with the highest density points. This might suggest that locals do have a high aesthetic value for these areas, however might visit them less often to actually take photographs at these areas. The social media Instagram as a method identifies further other areas for aesthetic value such as the *Alto Vista Chapel*, the *Divi Beach*, the *Renaissance and Surfside beach* as well as in the *mangrove area of Mangel Halto*. When it comes to comparing the recreational value hotspots between the two methods the areas are similar, however activities most engaged in and reported through photographs are hiking, cycling and off-roading. Of course here one must note that categorizing the photographs for aesthetic value by virtue means the photograph might have been taken while for example walking, which is a limit of the use of Instagram for identification of recreational value in comparison to PPGIS.

4.4 Extra analysis 13 Natural areas

To put the provision of cultural ecosystem services in the context of specific natural areas on the island, a map of thirteen significant areas was developed based on information from various sources. Firstly, insights from a focus group exercise to define the important natural sights and areas was used. Second input were zones designated as nature zones in the Spatial Development Plan of Aruba (Ruimtelijke Ontwikkelings Plan or ROP) (Directie Infrastructuur en planning, 2009)²⁷. The vision of the spatial plan is described as "*The realization of an integrated sustainable and balanced development of Aruba*" with goals from three main angles;

Economic:	"Developing a good spatially functional structure that enables realization of social and economic goals and improving spatial quality"
Social:	"Achieving an adequate level of facilities tailored to the well-being and need of the society"
Spatial:	"Developing a spatially functional structure that enables realization of social and economic goals and improving spatial quality"

Further social sub-goals for culture and recreation are the "*Conservation of cultural and natural elements*" and "*Realizing adequate recreational opportunities tailored to population growth, tourism development and the wishes of the population*" and sub-goals for spatial quality relating to the bottom layer²⁸ are "*Basic protection of nature areas based on ecological principles (corridor function) and/or landscape (experience) values (including Parke Nacional Arikok, Northern Conservation Area, Spanish Lagoon, Marine Park)*", "*Basic protection of the remaining suitable agricultural land and the reserving of land around tanks and dams for agriculture*", "*Avoid erosion processes*" and "*Protect reef-islands and coral reefs*". The spatial plan describes that within the nature zones the preservation and where necessary the recovery of the natural values is a priority²⁹. Based on both the focus group and spatial plan input a final map consisting of thirteen significant natural areas around which a buffer of 200 m was created. Subsequently, the areas were ranked according to the absolute number of points and their density per km² in each one. Results of the analysis by pre-designated locations showed that 70% of the PPGIS points were located in one of the thirteen natural areas listed (see **Error! Reference source not found.**). Indicating the relevance of the pre-designated areas.

²⁷ The spatial development plan is up for revision in 2018

²⁸ The bottom layer consists of the cohesive living system of water, soil and the life found within it. The bottom layer houses a historical archive and "carries" the landscape identity (Directie Infrastructuur en Planning, 2009).

²⁹ According to the spatial development plan the nature zones are considered the "green crown jewels" of Aruba.

Table 7: Value points in 13 natural areas

Natural area	Aesthetic	Cultural heritage	Recreational	SUM	Area (km ²)	Per km ²
Conservation Zone (North)	200	180	184	564	33,24	17
White Beaches (West)	79	16	444	539	11,36	47
Arikok Central Activity Zone	142	156	85	383	17,64	22
Conservation Zone (South-east)	82	56	164	302	12,64	24
Arikok South Nature Zone	49	68	36	153	21,51	7
Arikok North Nature Zone	73	47	22	142	9,84	14
Mangroves	9	2	71	82	1,62	50
Spanish Lagoon and Franse Pas	11	5	12	28	4,71	6
Bubali Wetland	9	4	14	27	0,58	47
Hooiberg	6	7	7	20	0,68	29
Palm and Renaissance Islands (reef-islands)	3	0	13	16	3,32	5
Ayo Rock Formation	3	5	0	8	0,39	20
Casibari Rock Formation	0	4	0	4	0,26	15

In terms of absolute number of points, the **Northern conservation zone including the rocky shores**, an area where salt spray provides a unique flora and fauna as well as the California Lighthouse and the dunes are ranked first with similar number of points for all three studied CES; *aesthetic, cultural heritage and recreational value*. Second by the absolute number of points is **the strip of White Beaches**, with majority of points indicating recreational value. **Arikok National Park**, its Central Activity Zone is ranked third in terms of the absolute number of points. As for the whole of the **Arikok National Park**, *cultural heritage value* was recognized the most (271 points), closely followed by *aesthetic value* (264) and then *recreational value* (143 points) which were allocated in all three zones of the national park. Arikok National Park's Southern zone has lower both absolute number of points overall and point density per km² compared with its other two zones. This can be explained by the lack of hiking trails in that area. However, the southern zone has a lot to offer in terms of interesting sights such as dry river beds, and Masiduri area, a former agricultural landscape with dominant cacti vegetation. Thus, expanding the hiking trails in the southern part of Arikok could be a part of the strategy to induce ecotourism practices on the island within the park. Locations with the highest density of points per km², see resulting density map Figure 23, are **the mangrove area of Mangel Halto**, followed by **the strip of White Beaches** and **Bubali wetland** on the west. Pieces of land in km² where high density occurs are lands with high cultural value and where it is important to conserve or restore for its ecosystem service and functionality provided if deemed necessary.

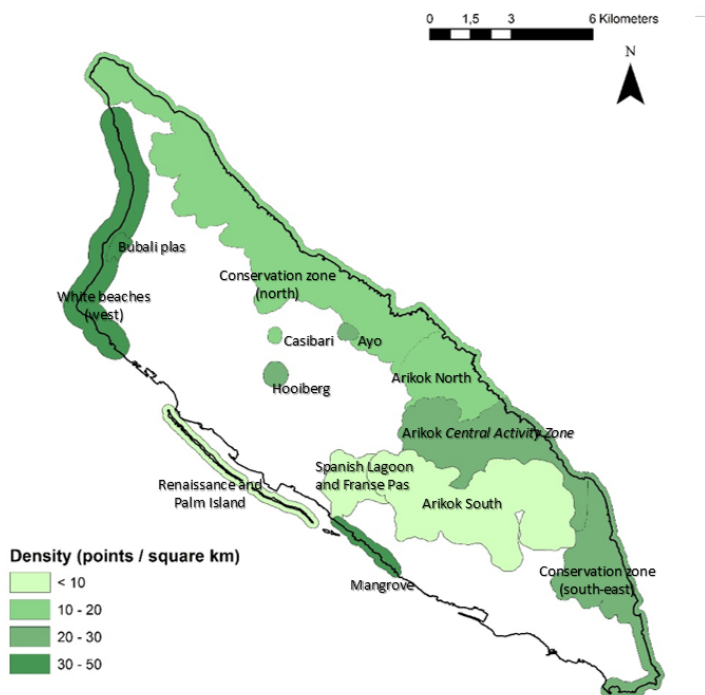


Figure 23: Density points in 13 natural areas

Chapter 5: Results and Environmental policy

5.1 Results

There is **economic potential in safeguarding and maintaining ecosystems and biodiversity** towards building a more resource efficient economy. The success of efforts to be able to tackle current unsustainable use of irreplaceable natural capital and heritage, requires comprehensive and relevant policy options, as well as committed and well-informed decision makers. Including natural capital in the economic decision-making processes will result in wise and inclusive decisions on nature conservation and thereby on sustainable green economic development of Aruba. The TEEB Aruba research set out to create insight in the value of cultural ecosystem services.

Research on various ecosystem services valuing and mapping has increased significantly in recent years. However, compared to provisioning and regulating services, cultural ecosystem services have not yet been fully integrated into operational frameworks. One reason for this is that transdisciplinarity is required, since by definition cultural services, encompassing physical, intellectual, spiritual interactions with biota, need to be analyzed from multiple perspectives i.e. ecological, social, behavioral. A second reason is the lack of data for large-scale assessments, as detailed surveys are a main source of information. The TEEB Aruba research contributed to a first analysis of the cultural ecosystem services of Aruba by taking a multi-method approach, including a large-scale household survey and different mapping methods in order to assess the economic and socio-cultural value of cultural ecosystem services on Aruba.

The TEEB Aruba research shows that nature plays an important role in the lives of the local population, 95% of the local community has the perception that nature has an influence on their overall well-being and the majority finds it extremely influential. Around 70% visit natural environments to destress and relax and natural areas also serve as a bonding opportunity with around 25% of the local community on Aruba visiting a natural environment to spend time with family and friends at least once a week and another 39% at least once a month. The average amount that households are willing to pay per month towards management of Aruba's marine and terrestrial environment can be ranged between 25 AWG (14 USD) (CV) and 64 AWG (36 USD³⁰) (CE). Taking the conservative side of the range leads to **a yearly willingness-to-pay towards management of Aruba's marine and terrestrial environment of 6.5 million AWG (3.6 million USD) by the local community.**

³⁰ 1 USD = 1.80 AWG

There is a general sentiment on **overdevelopment** with 81% agreeing with restricting coastal and inland development. The CE results of the attribute *Natural areas on land* show that utility (welfare) is increased by protecting natural areas on land, but only when large parts are protected. When it comes to infrastructural development, specifically related to the main economic pillar of the island, **Tourism**, there is a sentiment for restriction with 78% agreeing to introduce a moratorium on building hotels. With regards to perceptions on tourist numbers, 60% disagreed with the statement that they are bothered by the increasing number of tourists on Aruba and CE results on attribute *Tourist crowdedness* indicate that average preferences for changes in the number of tourists were neutral and did not affect average utility (welfare). However, further analysis showed that this average disguises widely varying opinions and preferences on this topic. People who are employed in the hotel/restaurant or retail sector are more in favour of more tourists, whilst people who perceive nature to be beneficial for their well-being, households with people that fish and people with a higher frequency of beach visits are more negative about an increase in number of tourists. The latter groups will experience a decrease in use values from nature when tourist numbers increase. There is a critical struggle observed between tourism and environmental and cultural heritage conservation, as it is also considered the bread and butter. However, overall 87% of the local community is in favour of regulating tourism activities (e.g. tours) and 86% is of the opinion that existing regulation are currently not optimally enforced and want to see improved enforcement of environmental regulations (e.g. driving in the dunes with 4x4).

5.2 Environmental policy

To further encapsulate the TEEB Aruba research results, the following roles of cultural ecosystem services in different policy categories are highlighted below; *"Spatial planning and environmental assessments", "Protected Areas", "Payment schemes and market-based instruments", "Better links to Macro-economic and societal indicators and national accounts" & "Restoration of degraded ecosystems".*

5.2.1 Spatial planning and environmental assessments

Planning frameworks and environmental impact assessments can include ecosystem services as a decision-making tool.

Aruba has a Ordinance for Spatial Planning (Landsverordening Ruimtelijke Ontwikkeling (LRO), AB 2006 no. 38.) and a draft Environmental Protection Ordinance (Ontwerp Landsverordening milieubeheer). The latter of which includes regulations on Environmental Impact Assessments (EIA), however to date has not entered into effect legally.

Maintaining public beach access

In terms of recreational value, the activity performed the most by the local community in the coastal and marine natural environment of Aruba is going to the beach, swimming and wading. Additionally, the most favored natural environment for social cohesion and bonding with family and friends is first and foremost the beach, making public access to beaches an important policy topic. Especially identified favorite current beach areas **Arashi Beach, Boca Catalina and Malmok, Eagle Beach³¹, Surfside Beach, Mangrove area of Mangel Halto and Seroe Colorado and Baby Beach Lagoon**. Increase in population and popularity of beaches as a tourism destination can create difficulties in providing public beach access (e.g. noise, crowdedness, palapas³² and coastal development). According to CE results on attribute Beach width increasing the beach width left for the local population has a strong positive effect on utility (welfare). Especially in view that besides recreational value there is a the strong cultural heritage and aesthetic value identified for **Seroe Colorado and Baby beach lagoon in the east coast**, the integration with tourism development in this specific area would need to be carefully elaborated. This is an assignment for the further elaboration of the Spatial Development Plan (Ruimtelijke Ontwikkelings Plan) (ROP) into the level of the (ROPV)³³. In the process of setting up one or more ROPVs further indication of purposes within the zones of the ROP can be specified on which regulation can be applied. The specification of regulation within the ROPV has several forms which can include; standards and key figures (e.g. density of development), an area-based policy review ³⁴ (e.g. the "Richtlijnen Ruimtelijk Beleid Rifzones" - a guideline for the spatial policy on the reef islands, or planning principles, e.g. the elaboration of criteria for the evaluation of landscape as heritage) (Government of Aruba, 2017). Thus for areas where extra protection is requested or where government wants to guide development, the regulations could

³¹ Eagle beach is also relevant for camping traditionally during the Easter weekend.

³² Palapas are structures of wood covered with dried woven palm leaves build on beaches with the purpose of providing shading and a place to sit. The beaches on Aruba according to law are to remain accessible to the public without charge, however with increase in tourism followed by construction of more palapas (by hotels, watersports and beach chair rental companies) has led to less beach width space and diminished view of the beach landscape.

³³ The structure of the legislation for spatial planning is based on the Landsverordening Ruimtelijke Ontwikkeling (LRO), AB 2006 no. 38 (Ordinance for Spatial Planning). The Ruimtelijke Ontwikkelings Plan (ROP) (Spatial Development Plan) outlines the purposes of specific zones (i.e. nature, commercial or living, also defining quantitative ranges such as population density per area). The ROP is an integral policy plan of the Aruba government, however in itself does not comprise binding provisions for the use of the space. It is intended to be used for drafting zoning plan(s), with the LRO indicating that regulations of designations be described through the instrument of the "Ruimtelijk Ontwikkelingsplan met Voorschriften" (ROPV) (Spatial Development Plan with Regulations). The ROPV, once approved, will be binding for government as well as citizens. The ROPV will contain instructions regarding the destination, the layout, building and use of land and may impose restrictions on it of construction, other work and buildings. Currently the formalization of the ROPV with binding regulations that would integrate judicial support and measures of control has not taken place.

³⁴ In dutch "beleidsverkenning" of which the purpose is to bring insight into the use and possible options (with pros and cons, opportunities and threats) for future policy and management of a specified area. With the main question whether this should lead to adjustments to current policies.

be made more stringent. According to the ROP (2009), The Sunrise Coast, which is the east coast area of the island and includes Seroe Colorado and Baby beach lagoon, has a development policy proposal outlining hotels and golf-courses to convert this into a touristic area, however also emphasizes the need to tune policies further and take into account the effect on the value of nature as well as harmonization with other touristic development plans in the west coast part of the island. Especially taking into account the effects this can have on vegetation as was seen for the case in the west coast part of the island (Oduber, Ridderstaat and Martens, 2015). As specific regulation (ROPV) still needs to be finalized and approved, in this respect it is necessary to attain a careful weighing of the different demands and develop a set of criteria by which plans can be judged. In light of the aesthetic, recreational and cultural heritage value expressed for the Seroe Colorado and Baby beach lagoon area, decisions on the height of buildings, large-scale hotels, maintaining landscape features that may be strongly related to the nature cultural values such as beach landscape view would be important to maintain the local communities connection with the sea.

Provision of urban green space

The most popular and participated in recreational activity in the terrestrial natural environment among the local community on Aruba is clearly walking in nature. This occurs almost on the entire island, however specific hotspot emerges in the area of Oranjestad, specifically on the location of newly built urban Linear Park. Indicating the value of cultivated (man-made) ecosystems and maintaining **urban green spaces** as opportunity for recreation. The provision of trails in urban green spaces create healthy opportunities by providing the local community with accessible and low- or no-cost places for walking, running and cycling, and thus helping people incorporate exercise within their lifestyle. Around 77% find it very or extremely important for the health of the residents of Aruba as well as contributing to social cohesion. Research has shown that nature-based recreation is associated with health cost savings and information on outdoor recreation can aid policymakers in investments in public health. Besides Oranjestad, the ROP designates two other zones as urban areas, **Noord and Sanicolas**, based amongst others on the number of inhabitants, presence of shop facilities and where provision of adequate housing for the community but also corresponding facilities need to be provided. These are zones where urban green spaces, cultivated (man-made) ecosystems, which contribute to health and social cohesion are beneficial to develop for the local community in harmonization with other development plans for the area.

The Bubali wetland

Besides the protected nature reserve Arikok National Park, the most popular sight for bird and wildlife watching for the local community is the **Bubali wetland, also called Bubali plas**. Additionally, according to the analysis the Bubali Wetland area is a location with one of the highest density of points per km², pieces of land in km² where high density occurs are lands with high cultural value and where it is important to conserve or restore for its ecosystem service and functionality. The Bubali Wetlands is state-owned and one of the four Important Bird Area (IBA)³⁵ for Aruba under the Birdlife International protocol of important bird areas in the Caribbean³⁶. It functions as a feeding and resting place for many migratory birds. The area falls within the green buffer zone between Oranjestad and Noord and is included in the ROP as a spatial buffer and a water drainage area (not to be developed). However, concrete and binding regulations (ROPV) have not yet been enacted and this has made the area vulnerable to tourism development. Moreover, the area has not been designated as nature reserve, equally like the Arikok National Park. In the case of bird or wildlife watching, greenways and trails have been useful for wetland preservation, providing recreation and contributing to the maintenance of reed invasion and the improvement of air and water quality within the area. Beside the cultural ecosystem service provision it is important to note that, especially for small island states, wetlands also function as natural buffers that help reduce the impact of disasters by collecting and holding water during floods and protecting coastal communities against storm surges (Kumar et. al., 2017).

California Lighthouse and the dunes

A major hotspot identified for all three cultural ecosystem services, recreational, aesthetic as well as cultural heritage value is the area of the California Lighthouse and the dunes, situated on the north of the island. In terms of recreation for the local community, the California Lighthouse is a landmark popularly used as a starting point for cycling on the north coast of the island. The California white sand dunes is a unique and fragile ecosystem on Aruba (Van der Perk, 2002). Its state is being threatened by recreational activity such as off-road driving damaging the morphology of sand structures, as well as habitats for specific dune flora and fauna. The ROP has assigned the area as conservation zone (natuurgebied), within the Salt Spray Park³⁷,

³⁵ the other three IBA's; two state-owned Oranjestad Reef Islands IBA (AW003), and San Nicolas Bay Reef Islands IBA (AW004) and one private-owned Tierra del Sol Salina IBA (AW002)

³⁶ On February 6th, 2013, the Parliament of Aruba voted unanimously in favor of a motion to protect 16 areas, which include the Bubali wetlands, and have them declared as nature protected areas and to incorporate these into Arikok National Park. To date only one of the 16 areas, the Spanish Lagoon a Ramsar site, has received the legal protective status and placed under Arikok National Park.

³⁷ Salt spray denoting the seawater that strikes the "rough" north coast

and specifically identifies within the zone the California dunes as heritage based purely on its landscape value. This analysis furthermore shows that the area has a cultural heritage value for the local community, the area serves as a place of identity and people thus feel a sense of belonging to this area. However, concrete and binding regulations (ROPV) have not yet been enacted which leaves this important area currently legally unprotected.

Mangrove area of Mangel Halto

The mangrove area of Mangel Halto on the southern coast of the island is a location with one of the highest density of points per km², pieces of land in km² where high density occurs are lands with high cultural value and where it is important to conserve or restore nature for its ecosystem service and functionality. The area is also one of the two most important locations for underwater activities such as snorkelling and diving, the other being Malmok beach on the west. Additionally according to crowdsourced social media analysis a hotspot for aesthetic value of local users. The mangrove forest, evergreen, dense and lush vegetation differs greatly from the inland mostly deciduous vegetation. It forms crucial ecological functions such as a nursery for coral reef fish, rest and nesting ground for seabirds as well as erosion controller, sediment catcher and nutrient filters. Currently the ROP assigns this area as conservation zone (natuurgebied) and further specifies the policy for the mangrove forests as having the highest degree of protection, given their value for tourism and ecological function. However, the concrete and binding regulations (ROPV) have not yet been enacted which leaves this important area currently legally unprotected. Specific regulation to be developed under to ROPV can ensure that developments occurring in the surrounding area take the value into account in order to protect the forests survival.

5.2.2 Protected Areas

For a locally integrated protected area management, including ecosystem services is instrumental in order to secure local community benefits of conservation³⁸.

Aruba has the Nature Conservation Ordinance (AB 1995 no. 2, update: AB 1997 no. 34) (Natuurbeschermingsverordening) a framework act aiming to protect local flora and fauna as well as internationally protected flora and fauna. Under this Ordinance nature reserves can be designated and be established. It is supplemented by a number of implementing decrees of which the designation of the terrestrial Arikok National Park as a nature reserve is one (AB 2000, no 59). To date Aruba has no marine park established under law³⁹.

³⁸ Locally integrated means taking into account the perspectives of all beneficiaries of ecosystem services provided by a national park.

³⁹ Aruba does have the Marine Environment Ordinance of Aruba (Marien Milieuverordening, AB 1980, No. 18). This ordinance was scheduled to be withdrawn upon the enactment of the Nature Conservation Ordinance. However, to

Terrestrial Arikok National Park

The Arikok National Park has demonstrated to have high cultural ecosystem service value for the local community of Aruba. As a major hotspot for all three cultural ecosystem services evaluated; recreational, aesthetic as well as cultural heritage value. In terms of recreational activities for the local community, Arikok National Park is considered especially an important hotspot for hiking and bird and wildlife watching. However according to a recent landscape-ecological survey conducted in 2016, main drivers of vegetation degradation are the impact of off-road driving causing water and wind erosion for healthy vegetation and the free-roaming of goats overgrazing the land (Oosterhuis, 2016). In order to protect the **high cultural ecosystem service value for the local community provided by the Arikok National Park** - the indigenous vegetation, habitats of indigenous fauna such as the Brown-throated Parakeet (Prikichi), recently declared national bird, and beaches & dunes - a locally integrated protected area management by balancing and coordinating the use of different ecosystem services among goat owners and tourism operators is thus vital.

Marine Protected Area (MPA)

Currently Aruba does not have an established marine protected area. According to CE results **establishing and increasing the marine protected area (MPA) size along the coastline of Aruba has a positive effect on utility (welfare) of the local community**. The local community is much in support of introducing a MPA which would restrict access for fisherman and management of recreational activities (e.g. diving behavior and designated swimming areas) with the purpose of recovery and protection of marine ecosystems for healthy fish populations and corals. Maintaining recreational fish catch at the current levels does not have a significant effect on utility (welfare), however increasing the amount of fish catch does. Around 20% of the respondents participate in recreational fishing and more than 80% of the respondents eat locally caught fish and 45% at least once a week. Although fisheries in Aruba is not as developed as in other countries and occurs in the informal sector, sustainable management of the food resources in the surrounding waters of Aruba and mitigating possible impacts, e.g. untreated waste water discharge in coastal areas or unsustainable fishing methods, becomes important to have healthy fish populations. Additionally, the marine environment is important for snorkeling and diving, providing

date the ordinance is still effective together with a number of implementing decrees. On the basis of this legislation it is prohibited to take specified species of turtles, calco, and reef fish from Aruban waters.

thriving coral reefs linked to other marine ecosystems such as seagrass beds for turtles and mangroves as fish nursery areas. The main hotspots for snorkeling and diving for the local community are the area of **Malmok Beach on the west**, and the **mangrove area of Mangel Halto on the southern coast** of the island. When it comes to proposed management options “Restricting SCUBA diving/snorkeling” received a support of 48% agreeing, the latter management option also had a higher frequency of “No answer”, this could be due to lack of more specific information on how this might be implemented. Such an implementation would **require awareness raising and stakeholder engagement**. Taking a locally integrated protected area and ecosystem services approach to improve the environment, requires balancing and coordinating the use of different ecosystem services among beneficiaries, such as conservationists, fishers and tourism operators.

5.2.3 Payment schemes and market-based instruments

Payment mechanisms developed through insight of ecosystem service beneficiaries and as well as providing incentives that reward good stewardship of natural capital.

Given the WTP of the local community, starting with the conservative yearly willingness-to-pay towards management of Aruba's marine and terrestrial environment of 6,5 million AWG (3,6 million USD), it would be beneficial to assess the current **governmental budget on environmental management related expenditures**. Around 60% of the local community want a larger share of the governmental budget to go to management of natural areas. Additionally, market-based instruments to maintain or restore ecosystem services identified such as the value of mangrove forest can be applied in Aruba e.g. **blue carbon markets for the mangrove area of Mangel Halto and the Bubali wetland**. Carbon emissions, CO₂, is captured by mangroves, seagrass beds and wetlands and sequestered as organic carbon stock in the soil and seabed (NOAA, 2017). Blue carbon markets work by quantifying the positive impact of blue carbon ecosystem conservation on CO₂ emission reduction and monetizing this ecosystem service through carbon credits, generating funding for the conservation of these ecosystems⁴⁰. Another market-based instrument is the opportunity for **ecolabelling certified tour operator** which helps in conservation efforts in fragile ecosystems such as the **the area of California Lighthouse and the dunes**. In this way promoting a balance between ecology and economy.

5.2.4 Better links to Macro-economic and societal indicators and national accounts

⁴⁰ Article 5 of the Paris Agreement states “Parties should take action to conserve and enhance, as appropriate, sinks and reservoirs of greenhouse gases.” Furthermore, the Paris agreement explicitly mentions the role of the ocean as an ecosystem vital for the climate.

Most services provided by the natural environment to human society are not captured by GDP or other conventional macro-economic indicators.

Aruba is currently implementing the 2030 Agenda for the Sustainable Development Goals (SDG), which requires data and monitoring as a base to enable efficient governmental steering for sustainable development. The market currently ignores a whole series of ecosystem services, without prices, these services go unmeasured in conventional accounting procedures such as the universal System of Standard National Accounts (SNA) which is used to generate a country's gross domestic product (GDP)⁴¹. A System of Economic Environmental Accounting (SEEA) has been developed, covering environmental expenditures and social issues in monetary and physical terms, moving beyond the GDP to measure sustainability and human well-being. The UN Statistical Commission in 2015 recognized the SEEA as an important framework for the SDG indicators. In 2013 the Central Bureau of Statistics (CBS) established the Environmental Statistics department, where the vision is to follow the international community (UN, OECD, World Bank etc.) and the aspiration is to complement the current System of National Accounts (SNA) with System of Environmental Accounts (SEA), the SEEA and TEEB⁴². The TEEB Aruba research project results in the economic value of the natural resources of Aruba, which can feed into a future SEEA account of CBS⁴³ and contributing to localization of the SDGs.

5.2.5 Restoration of degraded ecosystems

Several ecosystems and areas have shown to be of important cultural value for the local community of Aruba. Currently there is a lack of **ecological indicators on Aruba** to be able to assess what the current quality and state are of these ecosystems and how they can keep providing these services for future generations. Some ecosystems might thus currently be in need of restoration efforts. In order to keep the cultural heritage of the natural environment for the local community insight and investments will be needed. On a first basis in order to strengthen institutional capacities to provide ecological data and secondly on the restoration efforts itself.

⁴¹ "The SNA measures what takes place in the economy, between which agents, and for what purpose. At the heart of the SNA is the production of goods and services. These may be used for consumption in the period to which the accounts relate or may be accumulated for use in a later period. In simple terms, the amount of value added generated by production represents GDP" (EC, IMF, OECD, UN & World Bank. (2009). System of National Accounts 2008)

⁴² See here for the opportunities described for nature and environmental statistics by CBS Aruba, which includes the SEEA and TEEB framework: <http://cbs.aw/wp/index.php/2012/11/16/opportunities-and-challenges-for-environmental-statistics-in-aruba/>

⁴³ It should be noted that currently there is a lack of data on ecological indicators on Aruba that would support in monitoring the provision of these ecosystem services. Next to this, existing data is fragmented, outdated or unknown and not centralised. Increasing institutional capacities in this respect is needed for establishment of data and monitoring of the SDGs.

Most ecological infrastructure projects require significant up-front investment and may take time to materialise, making the role of governments support and coordination of stakeholders important for restoration. In this way protecting Aruba's key ecosystems and key iconic species such as the national symbol the "Shoko" (Aruban Burrowing Owl - *Athene cunicularia arubensis*) and the national bird the "Prikichi" (Aruban Parakeet - *Aratinga pertinax arubensis*), found nowhere else in the world, as well as lesser known ones such as the native "Raton di anochi" (Bats - *Leptonycteris curasoae* & *Glossophaga longirostris*) whom are pollinators for Aruba's scenic dry-forest cacti landscape.

References

- Adamowicz, W., Boxall, P., Williams, M. & Louviere, J. (1998). Stated Preference Approaches for Measuring Passive Use Values: Choice Experiments and Contingent Valuation. *American Journal of Agricultural Economics*, 80 (1), 64-75.
- Allen, Will. (2012). Advancing Green Infrastructure at All Scales: From Landscape to Site. *Environmental Practice*. 14. 1.
- Arikok National Park Aruba. (2017). Retrieved from <https://www.arubanationalpark.org/main/park-information/>
- Armbrecht, J. (2014). Use value of cultural experiences: A comparison of contingent valuation and travel cost. *Tourism Management*, 42, 141-148.
- Aruba Tourism Authority. (2017). Retrieved from www.aruba.com
- Bateman, I. J., Harwood, A. R., Mace, G. M.; Watson, R. T.; Abson, D.J.; Andrews, B.; Binner, A.; Crowe, A.; Day, B. H.; Dugdale, S.; Fezzi, C.; Foden, J.; Hadley, D.; Haines-Young, R.; Hulme, M.; Kontoleon, A.; Lovett, A. A.; Munday, P.; Pascual, U.; Paterson, J.; Perino, G.; Sen, A.; Siriwardena, G.; van Soest, D.; Termansen, M. (2013). Bringing Ecosystem Services into Economic Decision-Making: Land Use in the United Kingdom. *Science*, 341, 45 -50
- Blamey, R., Gordon, J. & Chapman, R. (1999). Choice modelling: assessing the environmental values of water supply options. *Australian Journal of Agriculture and Resource Economics*, 43(3), 337-357.
- Boxall, P., Adamowicz, W., Swait, J., Williams, M., & Louviere, J. (1996). A comparison of stated preference methods for environmental valuation. *Ecological Economics*, 18, 243-253.
- Bryan, B. A., Raymond, C. M., Crossman, N. D., & Macdonald, D. H. (2010). Targeting the management of ecosystem services based on social values: Where, what, and how?. *Landscape and Urban Planning*, 97(2), 111-122.
- Carson, Richard T., Jennifer Wright, Anna Alberini, Nancy Carson, and Nicholas Flores (1994), A Bibliography of Contingent Valuation Studies and Papers. Unpublished Paper, National Resource Damage Assessment Inc., La Jolla, CA.
- Carson, R. (2012). Contingent Valuation: A practical alternative when prices aren't available. *Journal of Economic Perspectives*, 26(4), 27-42.
- Caussade, S., Ortuzar, J.de D., Rizzi, L.I. & Hensher, D.A. (2005). Assessing the influence of design dimensions on stated choice experiment estimates. *Transportation Research*, 39, 621-640.
- CBS (2015). Housing. In *Statistical Yearbook 2015* (p 100).
- Chan, K. M., Guerry, A. D., Balvanera, P., Klain, S., Satterfield, T., Basurto, X., ... & Hannahs, N. (2012). Where are cultural and social in ecosystem services? A framework for constructive engagement. *BioScience*, 62(8), 744-756.

- Daniel, T. C., Muhar, A., Arnberger, A., Aznar, O., Boyd, J. W., Chan, K. M., & Grêt-Regamey, A. (2012). Contributions of cultural services to the ecosystem services agenda. *Proceedings of the National Academy of Sciences*, 109(23), 8812-8819.
- Das, Piyali & Juran, Krishna & Sarkhel, Juran. (2016). Documentation of Tacit Indigenous Medicinal Knowledge (TIMK): Issues and perspective in present era. *Imperial Journal of Interdisciplinary Research*. 2.
- de Groot, R. S., Wilson, M. A., & Boumans, R. M. (2002). A typology for the classification, description and valuation of ecosystem functions, goods and services. *Ecological economics*, 41 (3), 393-408.
- de Groot, R. S., Alkemade, R., Braat, L., Hein, L., & Willemen, L. (2010). Challenges in integrating the concept of ecosystem services and values in landscape planning, management and decision making. *Ecological Complexity*, 7(3), 260-272.
- de Groot, R., Fisher, B., Cristie, M., Aronson, J., Braat, L., Haines-Young, R., Maltby, E., Neuville, A., Polasky, S., Portela, R. and Ring, I. (2010b). Integrating the ecological and economic dimensions in biodiversity and ecosystem service valuation. In: *The Economics of Ecosystems and Biodiversity (TEEB): Ecological and Economic Foundations*. Earthscan, London
- Departamento Meteorologico Aruba. (2016). Climatological summary 2016.
- Dustin, Daniel & Bricker, Kelly & Schwab, Keri. (2010). People and Nature: Toward an Ecological Model of Health Promotion. *Leisure Sciences*. 32. 3-14. 10.1080/01490400903430772.
- EC, IMF, OECD, UN & World Bank (2009). *System of National Accounts 2008*.
- Encyclopedia Britannica (2017) Aruba. Retrieved from <http://www.britannica.com/place/Aruba>
- Feld, C. K., Martins da Silva, P., Paulo Sousa, J., De Bello, F., Bugter, R., Grandin, U., & Pärtel, M. (2009). Indicators of biodiversity and ecosystem services: a synthesis across ecosystems and spatial scales. *Oikos*, 118(12), 1862-1871.
- Fuller RA, Irvine KN, Devine-Wright P, Warren PH, Gaston KJ. (2007) Psychological benefits of greenspace increase with biodiversity. *The Royal Society Biology Letters*, 3, 390-39
- Government of Aruba. (2017). Ruimtelijke Ordening Voorschriften. Retrieved from: http://www.overheid.aw/informatie-dienstverlening/ruimtelijke-ordening_3339/item/voorschriften_6898.html
- Haines-Young, R., and Potschin, M. (2013). *Common International Classification of Ecosystem Services (CICES): Consultation on Version 4*, August-December 2012. EEA Framework Contract No EEA/IEA/09/003. Nottingham: Centre for Environmental Management, University of Nottingham. 19 pp.
- Hanley, N., Wright, R.E. & Adamowicz, V. (1998). Using Choice Experiments to Value the Environment. *Environmental and Resource Economics*, 11 (3-4), 413-428.
- Jim, C.Y. & Chen, Wendy. (2008). Assessing the ecosystem service of air pollutant removal by urban trees in Guangzhou (China). *Journal of environmental management*. 88. 665-76. 10.1016/j.jenvman.2007.03.035.

Koetse MJ, R Brouwer, 2015, Reference Dependence Effects on WTA and WTP Value Functions and Their Disparity, *Environmental and Resource Economics*, available online, doi: 10.1007/s10640-015-9920-2.

Korpela, Kalevi & Borodulin, Katja & Neuvonen, Marjo & Paronen, O & Tyrväinen, Liisa. (2013). Analyzing the mediators between nature-based outdoor recreation and emotional well-being. *Journal of Environmental Psychology*. 37. . 10.1016/j.jenvp.2013.11.003.

Kumar, R., Tol, S., McInnes, R. J., Everard, M. and Kulindwa, A.A. (2017). Wetlands for disaster risk reduction: Effective choices for resilient communities. Ramsar Policy Brief No. 1. Gland, Switzerland: Ramsar Convention Secretariat.

Lancaster, K. (1966). A New Approach to Consumer Theory. *Journal of Political Economy*, 74, 132-157.

Louviere JJ, DA Hensher, JD Swait, 2003, *Stated Choice Methods: Analysis and Applications*, Cambridge University Press, Cambridge.

Manski, C.F. (1977). The structure of random utility models. *Theory and Decision*, 8 (3), 229-254.

McFadden D (1974) Conditional logit analysis of qualitative choice behaviour. In: *Frontiers of Econometrics*. New York, NY: Academic Press. pp. 105–142.

Milcu, A.I. & Hanspach, Jan & Abson, David & Fischer, Joern. (2013). Cultural ecosystem services – a literature review and prospects for future research. *Ecol. Soc.* 18. .

Millennium Ecosystem Assessment (MEA) (2005). *Ecosystems and Human Well-being. A Framework for Assessment*. Millennium Ecosystem Assessment. Washington, DC, Island Press.

NOAA. (2017). Coastal Blue Carbon. Retrieved from <http://www.habitat.noaa.gov/coastalbluecarbon.html>

Oduber, M., Ridderstaat, J., & Martens, P. (2015). The Connection of Vegetation with Tourism Development and Economic Growth: A Case Study for Aruba. *Journal of Environmental Science and Engineering A* , 420-431.

Oh, Chi-Ok & Draper, Jason & Dixon, Anthony. (2010). Comparing resident and tourist preferences for public beach access and related amenities. *Ocean & Coastal Management*. 53. 245-251. 10.1016/j.ocecoaman.2010.04.007.

Oosterhuis, H. J. (2016). Landscape-ecological survey of Arikok National Park, Aruba. MSc minor thesis. Soil Physics and Land Management Group. Wageningen University.

Oteros-Rozas, E., Martín-López, B., González, J. A., Plieninger, T., López, C. A., & Montes, C. (2014). Socio-cultural valuation of ecosystem services in a transhumance social-ecological network. *Regional environmental change*, 14 (4), 1269-1289.

Payam Dadvanda, Mark J. Nieuwenhuijsen, Mikel Esnaola, Joan Forn, Xavier Basagaña, Mar Alvarez-Pedrerola, Ioar Rivas,a,b,c,e, Mónica López-Vicente, Montserrat De Castro Pascuala, Jason Suf, Michael Jerrettg, Xavier Querole, and Jordi Sunyer (2015) Green spaces and cognitive development in primary schoolchildren. *Proceedings of the National Academy of Sciences USA*, 112, 26.

Plieninger, T., Dijks, S., Oteros-Rozas, E., & Bieling, C. (2013). Assessing, mapping, and quantifying cultural ecosystem services at community level. *Land use policy*, 33, 118-129.

Richard J.Mitchell, Elizabeth A.Richardson, Niamh K.Shortt, Jamie R.Pearce,. (2015) Neighborhood Environments and Socioeconomic Inequalities in Mental Well-Being. *American Journal of Preventive Medicine*, 49, 1, 80-84

Rosenberger, Randall & R Bergerson, Terry & D Kline, Jeffrey. (2009). Macro-linkages between health and outdoor recreation: The role of parks and recreation providers. *Journal of Park and Recreation Administration* Fall. 27. 8-20.

Rowe, R., Schulze, W., & Breffle, W. (1996). A test for payment card biases. *Journal of environmental economics and management*, 31, 178-185.

Ryan, R. L. (2011). The social landscape of planning: Integrating social and perceptual research with spatial planning information. *Landscape and Urban Planning*, 100(4), 361-363.

Satz, D., Gould, R. K., Chan, K. M., Guerry, A., Norton, B., Satterfield, T., ... & Basurto, X. (2013). The challenges of incorporating cultural ecosystem

Scholte, S. S., van Teeffelen, A. J., & Verburg, P. H. (2015). Integrating socio-cultural perspectives into ecosystem service valuation: A review of concepts and methods. *Ecological Economics*, 114, 67-78.

TEEB (2010). *The Economics of Ecosystems and Biodiversity: Ecological and Economic Foundations*, ed. Kumar P. (Earthscan, Oxford, UK).

Tenerelli, P., Demšar, U., & Luque, S. (2016). Crowdsourcing indicators for cultural ecosystem services: A geographically weighted approach for mountain landscapes. *Ecological Indicators*, 64, 237-248.

The Green Gateway Policy 2011-2013 (2010). The Government of Aruba Ministry of Economic Affairs, Social Affairs and Culture.

Tuan, T. & Navrud, S. (2007). Valuing Cultural Heritage in Developing Countries: Comparing and Pooling Valuation and Choice Modelling Estimates. *Environmental and Resource Economics*. 38(1), 51-69.

UNFCCC (2005) *Climate Change - Small Island Developing States*.

US Department of State. (2016, October 31). U.S. Relations With Aruba. Retrieved August 01, 2017, from <https://www.state.gov/r/pa/ei/bgn/22491.htm>

van Beukering, P., Brander, L., Tompkins, E. and McKenzie, E. (2007). Valuing the Environment in Small Islands: an environmental economics toolkit. JNCC. Retrieved from <http://jncc.defra.gov.uk/page-4065>

van der Burg, W.J., de Freitas, J., Debrot, A.O., Lotz, L.A.P. (2012) Naturalised and invasive alien plant species in the Caribbean Netherlands: status, distribution, threats, priorities and recommendations. Wageningen UR

Waite, R., Burke, L., Gray, E., van Beukering, P., Brander, L., McKenzie, E., et al. (2014). Coastal Capital: Ecosystem valuation for decision making in the Caribbean. World Resource Institute.

Wolsko, Christopher & Lindberg, Kreg. (2013). Experiencing Connection With Nature: The Matrix of Psychological Well-Being, Mindfulness, and Outdoor Recreation. *Ecopsychology*. 5. 80-91. 10.1089/eco.2013.0008.

Wu, J. (2013). Landscape sustainability science: ecosystem services and human wellbeing in changing landscapes. *Landscape Ecology*, 28(6), 999-1023.

Annex A: Household survey

I. Interview ID code:			(See interview protocol)
II. Name interviewer:			
III. Location of Interview (District):			
IV. Date of interview:			
V. Time of interview:	From:	Until:	

Introduction

Hello my name is.....I am a student of the UA. I am helping out with a project called “The Economics of Ecosystem Services and Biodiversity of Aruba” or “Kiko ta e valor di nos Naturalesa?”. It is supported by our government. Maybe you have read about it in the newspaper? We are conducting a survey on the importance of Aruba’s marine and terrestrial landscape for the local residents of the island. We would like to hear your opinion about this. **Everything that you tell us will be kept strictly confidential.**

Would you be willing to participate?

[No], thank you for your time and have good day. *(Continue to next address)*

[Yes], Thank you very much for cooperating. I will tell you more about the study. The research takes places the coming year, and one of the components of the research is this household survey. Your help is very appreciated.

I. General Questions

1. Where were you born?

a. Aruba (continue to Q3)		e. Sint Eustatius		i. North America / Canada	
b. Bonaire		f. Saba		j. Elsewhere in the Caribbean	
c. Curacao		g. The Netherlands		k. Elsewhere, specify ...	
d. Sint Maarten		h. South America			

2. For how many years have you been living on Aruba? *(If less than one year, please indicate the months)*

a. Number of Years		b. Number of months	
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3. How many persons live in your household?

a. Number of Adults		b. Number of children under 18	
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II. Environmental Awareness

4. To what extent do you consider yourself environmentally aware? (1 is not environmental aware at all, 10 is very much environmental aware).

Not aware at all										Very much aware
1	2	3	4	5	6	7	8	9	10	

5. Did you do any of the following activities in the past year?

Activity	Yes	No
a. Seek environmental information (<i>on internet, TV, newspaper, radio etc.</i>)		
b. Avoid littering		
c. Buy locally grown fruit and vegetables		
d. Purchase environmentally friendly products (<i>reusable bags etc.</i>)		
e. Donate money to an environmental cause (<i>e.g. a nature conservancy organization</i>)		
f. Do any voluntary environmental work (<i>e.g. beach or mangrove clean-up</i>)		
g. Other environmentally friendly activities, please specify:		

6. Are you in favor of the following management activities to improve the marine and land natural environment? (**Read out loud**)

Management activity	Yes	No	Don't know/ no answer
a. Regulation of tourist activities (e.g. tours)			
b. Restricting coastal and inland development (e.g. where building is allowed)			
c. Improving solid waste management			
d. Improve enforcement of environmental regulations (e.g. driving in the dunes with 4x4)			
e. Restricting SCUBA diving/snorkeling			
f. Environmental awareness raising (campaigning etc.)			
g. management of invasive species (e.g. boa constrictor, lion fish)			
h. Introduce a moratorium on building hotels (moratorium = a temporary prohibition of an activity)			
k. Other, specify ...			

III. Relation between Well-Being and natural environments

Now some questions will follow regarding the relation between well-being and the natural environment on Aruba.

7. To what extent do you think the natural environment has an influence on your well-being?

Not at all influential									Extremely influential
1	2	3	4	5	6	7	8	9	10

8. Do you visit natural environments on Aruba when you are stressed and want to relax?

a. Yes		b. No	
--------	--	-------	--

9. Which natural environment would you prefer to visit if you are stressed and want to relax?
(Choose maximum three).

a. Dry forest and cacti landscape		f. Mangroves	
b. Rock formations		g. Beaches and dunes	
c. Cunucu landscape		h. Barrier islands	
d. Wetlands and saltmarshes (Saliña)		i. Dunes	
e. Rocky shores		j. Savanna and hills (e.g. Hooiberg, Jamanota)	

10. Do you prefer to spend time with family and friends in natural environments above urban environments? (e.g. areas serving as meeting points with family and friends)

a. Yes		b. No		c. I don't have a preference	
--------	--	-------	--	------------------------------	--

11. Which natural environment do you prefer when spending time with family and friends?
(choose maximum three)

a. Dry forest and cacti landscape		f. Mangroves	
b. Rock formations		g. Beaches and dunes	
c. Cunucu landscape		h. Barrier islands	
d. Wetlands and saltmarshes (Saliña)		i. Dunes	
e. Rocky shores		j. Savanna and hills (e.g. Hooiberg, Jamanota)	

12. How often do you visit a natural environment to spend time with family and friends?

a. Never	
b. Once a year	
c. Once a month	
d. Once a week	
e. More than once a week	
f. Don't know/don't want to answer	

13. Do you visit natural environments for spiritual reasons? (e.g. areas of spiritual, religious, or other forms of exceptional personal meaning)

a. Yes		b. No	
--------	--	-------	--

14. Which natural environment do you prefer to visit for spiritual reasons?

a. Dry forest and cacti landscape		f. Mangroves	
b. Rock formations		g. Beaches and dunes	
c. Cunucu landscape		h. Barrier islands	
d. Wetlands and saltmarshes (Saliña)		i. Dunes	
e. Rocky shores		j. Savanna and hills (e.g. Hooiberg, Jamanota)	

IV. Urban green space

15. How important are the following aspects of urban green spaces for you (public parks, e.g. Wilhelmina park, Linear Park, but also the natural areas – such as gardens and wetlands – surrounding urban spaces)?

	Not important at all	Slightly important	Moderately important	Very important	Extremely important	Don't know/no answer
a. Providing living space for flora and fauna e.g. birds						
b. Contributing to the attractiveness of urban areas						
c. Providing opportunities for recreation						
d. Contribution to the health of the residents of Aruba						
e. Improving social cohesion						
f. Providing artistic inspiration						
h. Providing opportunities for education						

16. How often do you visit public parks (e.g. Wilhelmina park, Linear Park)?

a. Never	
b. Once a year	
c. Once a month	
d. Once a week	
e. More than once a week	
f. Don't know/don't want to answer	

17. How important is the presence of native vegetation in urban public parks (e.g. Divi tree, Cacti and Aloë) to you?

a. Not important at all	
-------------------------	--

b. Slightly important	
c. Moderately important	
d. Very important	
e. Extremely important	
f. Don't know/don't want to answer	

V. Choice Experiment

Now a Choice Experiment will follow.

Refer to the interview protocol.

Version number:	
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(Remind the respondent that this is an anonymous questionnaire and that this experiment is hypothetical and that they should choose the scenarios regardless of who is managing the funds)

SHOW THE EXAMPLE CHOICE CARD HERE

We are now at another section of the survey. There are certain threats to nature on Aruba; these may lead to loss of certain species, habitats and places used for recreational purposes and places of cultural value for local inhabitants.

The following questions ask you to make a choice between three scenarios for the future state of different attributes because of managing them. The scenarios are described in terms of the following aspects:

1. A yearly contribution in florins (**& displayed per month**) by **all households on Aruba** which would be used strictly for management of the natural environment of Aruba
2. Marine Protected Area establishment refers to the amount of marine environment that will be managed. It would restrict access for fisherman and management of recreational activities (e.g. diving behavior and designated swimming areas) in the MPA with the purpose of recovery and protection for healthy fish populations and corals.
3. Fish catch per trip refers to how much fish can be caught for recreational purposes in the seas surrounding Aruba per fishing activity or trip. This can vary due to a change in fish abundance.
4. Beach width refers to the width of the beach which is available for locals which can vary due to natural erosion and/or by expanding hotel 'palapas'
5. Natural areas on land refers to the natural habitat for flora and fauna of Aruba which can change due to increase of construction and infrastructure
6. Tourist crowdedness refers to the average number of tourists per day on the island of Aruba

You will be asked to make a choice **six times**. In each question, the options on offer will be different. Try to imagine in which situation you would prefer to be, taking into account the payment, and then choose that option. (**Show on the example choice card that the items for one scenario belong together and indicate that he/she should choose one of the three scenarios.**) Be aware that none of the choices has a clear-cut best scenario and that you will need to make trade-offs between the different aspects. There are no wrong answers - we are only interested in your opinion!

Please look at the 3 options shown in the example card. To make a choice between the 3 options you should look at all of the items that shape the option (beach width ,fish catch, contribution per year, etc.).

- In **Option A** will 25% of the coastal waters of Aruba be part of a marine park. The fish catch per trip will reduce with 50%. The width of the beach stays at 30 meters. There will be 40% of natural areas left. The amount of tourist will stay at the current number of visitors. You pay 1200 florins per year (100 per month).
- In **Option B** will 50% of the coastal water of Aruba be part of a marine park. The fish catch per trip will increase with 50%. The width of the beach stays at 30 meters. There will be 90% of natural area left. The amount of tourist will double. You pay 24 florins per year (2 per month)
- In **Option C** will be no marine park established. The fish catch per trip will reduce with 50%. The width of the beach will decline to 0 meters. There will be 20% of natural area left. The amount of tourist will triple. You do not have to pay an additional contribution. This option will remain the same in all 6 choice questions that you will be asked.

Options A and B are different in each question. Please note that none of the options will be perfect from your point of view and that some decisions may be difficult. Every card represents a new choice and has nothing to do with the previous choice.

(For the first choice card try not to help the respondent too much, unless he really doesn't understand. Just briefly point out the differences between the options if necessary but try to give a balanced presentation. Do not let your values and preferences influence the respondent's choice!! After all choices are made, ask the respondent the follow up questions. If the respondent refuses to make a choice, try to find out why.)

18. Record the respondent's answers to each choice question and the certainty of the choice in the table below. *(Check only one box per row).*

Choice Set	a. Option A	b. Option B	c. Option C	d. Declined to answer
Choice card 1				
Choice card 2				
Choice card 3				
Choice card 4				
Choice card 5				
Choice card 6				

19. Please indicate on a scale from 1 to 10 how certain you are about the choices you just made

Very uncertain	←→								Very certain
1	2	3	4	5	6	7	8	9	10

(Only ask the following question if the respondent has chosen option C 5 or 6 times or declined to answer, otherwise skip to question 21)

20. You have chosen option C in each card or declined to answer. Can you explain why? (**Check only one**).

a. I am not responsible for the damage to the environment		f. Don't need another contribution no matter what it is used for	
b. I am not confident that the money will be used as specified		g. I couldn't understand the questions/ Too hard to make the choices	
c. I do not believe there are serious threats to the environment		h. The choices weren't relevant to me / Didn't describe what matters to me	
d. The issues are more complex than these questions suggest		i. Other, specify...	
e. I cannot afford it /The costs were too high		j. Don't know/ no answer	

21. In making your choices, how important were the following attributes to you? (1 being not important and 5 being very important).

Attribute	Not important at all	Slightly important	Moderately important	Very important	Extremely important	Don't know / no answer
a. Yearly contribution in AWG.						
b. MPA establishment						
c. Fish Catch						
d. Beach width						
e. Natural areas on land						
f. Crowdedness						

22. How did you make your choices? Did you:

a. Consider all aspects simultaneously		d. Use your intuition	
b. Consider a few specific aspects		e. Make a random choice	
c. Only consider one specific aspect		f. Don't know	

VI. WTP for environmental management

23. Are you in principle willing to pay for management of the marine and terrestrial natural environment on Aruba?

a. Yes (continue with question 19)	
b. No (Continue with question 18)	

24. What is the main reason you are **not willing to pay** for management of the marine and land natural environment on Aruba? (**tick only one reason**) (**After this question, continue to the next section, Q27**)

a. I do not care enough about the environment	
b. I am in favour of more protection, but this should be paid from existing tax revenues	
c. I can't financially afford to contribute	
d. I doubt the effectiveness of nature protection	
e. Other social problems are more urgent	
f. I do not cause nature problems and therefore I am not responsible for solving them	
a. g. Other, specify...	

25. What is your maximum amount of monthly contribution you are willing to pay for management of the marine and land natural environment on Aruba? In making a choice, carefully take into account whether you actually can and are willing to pay this amount given your current income level.

(Show table with amounts to let the respondent choose or any other amount they come up with themselves)

AWG per month
---------------	-------

AWG. 0.00	AWG. 2.00	AWG. 4.00	AWG. 8.00	AWG. 15.00	AWG. 30.00	AWG. 65.00	AWG. 125.00
AWG. 1.00	AWG. 2.50	AWG. 5.00	AWG. 10.00	AWG. 20.00	AWG. 40.00	AWG. 80.00	More than AWG. 125.00
AWG. 1.50	AWG. 3.00	AWG. 6.00	AWG. 12.50	AWG. 25.00	AWG. 50.00	AWG. 100.00	Don't want to say

26. Please indicate on a scale from 1 to 10 how certain you are about the choice you just made.

Very uncertain	←→								Very certain
1	2	3	4	5	6	7	8	9	10

VII. Recreation & Participatory mapping

The next part of the survey consists out of six questions. The first two questions are about recreational activities, followed by four questions in which you will be asked to carry out a simple mapping exercise. This exercise is meant to help us identify locations in both marine and terrestrial natural environment that are the most important for the inhabitants of Aruba.

27. How often do you participate in the following activities in marine and coastal natural environment?

Activity	Never	Once a year	Once a month	Once a week	More than once a week
a. Fishing					
b. Going to the beach					

c. Swimming/wading					
d. Diving					
e. Snorkeling					
f. Boating/ sailing/ kayaking					
g. Kiting/windsurfing/ golf surfing					

28. How often do you participate in the following activities in terrestrial natural environment?
(**activities on land**)

Activity	Never	Once a year	Once a month	Once a week	More than once a week
a. Cycling					
b. Walking					
c. Running					
d. Hiking					
e. Camping					
f. Bird/wildlife watching					

Participatory mapping

Now we will continue with the mapping exercise. It consists out of four questions in which you will be asked to use this map (**show the map**) to point out the locations that have the most importance for you. Locations indicated on the map are just for your own orientation, and you can map any other location on the island.

29. Can you please point out on this map up to two locations for each of the two activities from question 27 (marine environment) that you undertake most often? (**in total 4 locations, for symbols please refer to the legend**)

30. Can you please point out on this map up to two locations for each of the two activities from question 28 (land environment) that you undertake most often? (**in total 4 locations, for symbols please refer to the legend**)

We will now use the same map to mark locations that have the highest value for you.

31. Can you please point out up to three locations that have the highest aesthetic value for you by using red dots? (**for symbols please refer to the legend**)
Aesthetic value means: *I value these natural areas because of the beautiful scenery.*

32. Can you please point out up to three locations that have the highest cultural heritage value for you by using black dots? (**for symbols please refer to the legend**)
Cultural heritage value means: *I value these natural areas because they are places of natural and human history.*

VIII. Recreational Fishing & Agriculture

33. How often do you eat locally caught fish, shrimp or lobster?

a. Never	
b. Once a year	
c. Once a month	
d. Once a week	
e. More than once a week	
f. Don't know/don't want to answer	

34. Do you or someone else in your household currently fish?

note: fishing includes any method of harvesting marine food from the sea; hook and line, spearing, netting, gathering lobster, etc.

a. Yes		b. No (continue to Q 37)	
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35. How many people currently fish for recreational purposes in your household?

36. How important are the following reasons for you (or members of your household) to go fishing?

Reason	Not important at all	Slightly important	Moderately important	Very important	Extremely important
a. I enjoy fishing/ I find it relaxing					
b. I catch for food					
c. To give catch to my family and friends					
d. I catch fish to sell it (as a source of income)					
e. For tradition: my family has always fished					
f. Fishing strengthens the bond with my family and friends					

37. Does your household participate in harvesting fruits and vegetables? *(If no is checked 3 times, than continue to Q 39)*

Activity	Yes	No
a. Harvesting fruits		
b. Harvesting vegetables (incl. potatoes)		
c. Harvesting other (e.g. Aloe Maishi rabo, herbs, etc.)		

38. How important are the following reason for you to participate in harvesting fruits and/or vegetables?

Reason	Not important at all	Slightly important	Moderately important	Very important	Extremely important
a. I enjoy it/ I find it relaxing					
b. For food (buffer for my income)					
c. To give to family and friends					
d. To sell/swap (as a source of income)					
e. For tradition; my family has always conducted in these activities)					
g. Other, specify ...					

39. Do **you** make use of medicinal plants grown on Aruba?

a. Yes		b. No (continue to next section Q 41)	
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40. Please name up to three medicinal plant grown on Aruba that use the most.

1.
2.
3.

IX. Statements

We are almost at the end of the survey. Thank you a lot for your time. I have a few more questions to finish the survey.

41. Please indicate to what extent you agree or disagree with the following statements.

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Don't know / no answer
a. I am concerned about air quality on Aruba						
b. I am willing to accept restrictions on fishing if that helps to protect the marine life of Aruba						
c. I am bothered by the increasing amount of waste and litter on Aruba						
d. I am considering to buy solar panels, or I already have them installed						
e. Improvement of the natural environment if very important for me						
f. A larger share of the budget of the government should go to the management of natural areas						
g. Aruba's natural history and cultural heritage should form part of education on schools						
h. I am bothered by the increasing						

number of tourist on Aruba						
i. Inhabitants of Aruba should start collecting rain water (e.g. for cleaning your car and watering your garden)						
j. There should come a solution for the occasional fire and smoke at landfill Parkietenbos						

X. Demographics

42. Gender

a. Female	
b. Male	

43. In what age category do you fall?

a. 15-19		c. 30-39		e. 50-59		g. 70+	
b. 20-29		d. 40-49		f. 60-69			

44. What is the highest level of education you have completed?

a. Less than primary/ no education		g. VWO	
b. Primary (special) education		h. Vocational Education, intermediate (Associate) level (MBO)	
c. Lower vocational education (EPB)		i. Higher education (Bachelor, HBO)	
d. MAVO		j. Higher education (WO, Master)	
e. HAVO/ High School / Bachillerato		k. Higher education (WO, PhD)	

45. In which sector or field are you employed?

a. Agriculture		k. Real Estate	
b. Fishing		l. Public Administration	
c. Mining and Quarrying		m. Education	
d. Manufacturing		n. Health and Social work	
e. Electricity, gas and water		o. Other service activities	
f. Construction		p. Private households	
g. Wholesale and retail trade		q. External territorial organizations	
h. Hotels and restaurants		r. Other, specify,	
i. Transport		s. Not employed	
j. Financial intermediations		t. Don't want to say/ no answer	

46. May I ask your bruto household income in florins the last month?

a. < 249	1	e. 7000 – 10,999	5
b. 250 - 1499	2	f. 11,000 – 14,999	6
c. 1500 - 3499	3	g. 15,000 -19,999	7
d. 3500 - 6999	4	h. > 20,000	8
i. Don't know / no answer	9		

End

Thank you for your time and conducting this survey. The outcome of this research helps the Government of Aruba in making sustainable decisions in the future regarding nature management. Do you have any remarks?

Room for remarks: