*Designing*

# SUSTAINABLE TOURISM

DCNAnature.org

Dutch Caribbean Nature Alliance
Safeguarding nature in the Dutch Caribbean

DCNA

Designing
Sustainable Tourism


3 **Tourism in the Dutch Caribbean**
3 *Overview*
3 *Mass Tourism vs. Ecotourism*
4 *Value of Caribbean Ecosystem Services*

5 **Current State**

6 **Issues Impacting State of Nature**
6 *Increase in Human Pressures*
7 *Consumption of Natural Resource*
7 *Infrastructure*
7 *Climate Change*

8 **Sustainable Tourism**
8 *Overview*
8 *Implementation*
8 *Example of Solutions*

9 **Sustainable Tourism Indicators**
9 *Environmental Indicators*
9 *Societal Indicators*
9 *Economic Indicators*

10 **Recommendations**

11 **Members and Contact**


# Editor's Letter

Dutch Caribbean, 2020

Prior to the Corona virus pandemic, the trends for tourism in the Caribbean were pressing for cheaper and more varied options. There was a pressure to offer visitors prime experiences at a discounted price which often created tension between nature management and conservation within the tourism industry. Tourism is important to the lifeblood of the Caribbean, being a significant economic driver for most islands. This is especially true within the Dutch Caribbean. It is important, however, to remember why tourists visit these islands in the first place; often to take advantage of the pristine nature, crystal clear waters and diverse ecosystems they have to offer. This then begs the question:

**How can we design the future of tourism to balance nature, economy and culture in a way that benefits everyone?**

Although it's easy to focus on all the negatives from the ongoing Corona virus pandemic, one positive aspect is that it gives each of the islands a unique opportunity to reevaluate and redesign tourism. As tourism slowly begins to rebuild, it gives the islands the opportunity to maximize the visitor experience through focusing on increasing quality over quantity. Allowing visitors to fully immerse in the culture and natural environment will not only increase the benefits to the island but also to the visitors' overall experience.

Already, islands are beginning to explore these options. Public forums such as *Bonaire's Future Forum: Opportunity from Crisis* on Facebook has given island residents a venue to express concerns and share ideas for the future of the island. It will be this sort of creative thinking that drives these islands into a sustainable and prosperous future.

# Tourism in the Dutch Caribbean

## Overview

The world is continuously getting smaller as globe trotting gets easier with each passing year. In fact, tourism is one of the fastest growing industries [33]. One study by the World Travel and Tourism Counsel found, that in 2015, 1 in 11 jobs was related to tourism [35]. This is especially true in the Caribbean, where tourism has grown at a rate of 7%, nearly double the global average of 4% [3, 13]. Although tourism has continued to increase, natural disasters, such as Hurricanes Irma and Maria in 2017 proved to be devasting to local tourism [19]. Fortunately, 2018 and 2019 saw a rebound of these numbers, yet this was completely undone by the Corona virus halting all travel in 2020. These various incidents prove the fragility of the entire tourism sector, and show how important it is to design a tourism plan which can help weather these dips.

At first glance it may appear that the demands of increasing tourism are at direct odds with conservation efforts, but this does not have to be the case. Designing a sustainable tourism plan will not only work to protect the environmental richness that inspired tourists to visit the islands in the first place, but actually enhance their overall experience. This special edition BioNews will work to introduce the idea of Sustainable Tourism and provide examples and objectives to help drive these efforts into the future. It is paramount that the development and growth of the tourism industry within the Dutch Caribbean take into account the fragility of its natural resources and work to ensure that these environments are protected for everyone to enjoy for years to come.

## Mass Tourism vs. Ecotourism

As international travel has become increasingly common and has become a significant economic driver within the Caribbean, these islands have seen unparalleled changes to their environment within a single generation [33]. All tourists cannot be lumped together, as there are a variety of different types of tourism, from extended stay tourists who may choose to spend the winter months beachside to cruise boat tourists who spend a few hours soaking in what each island has to offer. In general, tourism in the Caribbean is predominately focused on marine activities such as swimming, snorkeling, diving, sport fishing, and yachting [33]. Mass tourism (low-cost packages) makes up a large portion of the tourist market [15]. This is especially true as the airline industry continues to press for cheaper flight options, making mass tourism packages increasingly common and affordable.

However, there is another side of tourism. Consumers are learning that their choices are contributing to the overall health of these environments, and increasingly "quality" is defined by environmental and ethical components [15]. Ecotourism has seen a rise in recent years, evident by Bonaire's push to become the world's first blue destination, for example. Ecotourism could highlight some of the islands' best natural features while still allowing tourists the opportunity to come and explore.

It is still unclear how the effects of the Corona virus pandemic will affect world travel once it's is behind us. It is now more important than ever for islands to diversify their interests to allow their economies to withstand and rebound after a disaster. Low budget, high volume tourism has developed at a great cost to each of the islands, but as these islands begin to rebuild, a focus on sustainable tourism options could help stabilize the local economies and increase their economic resilience in the future.

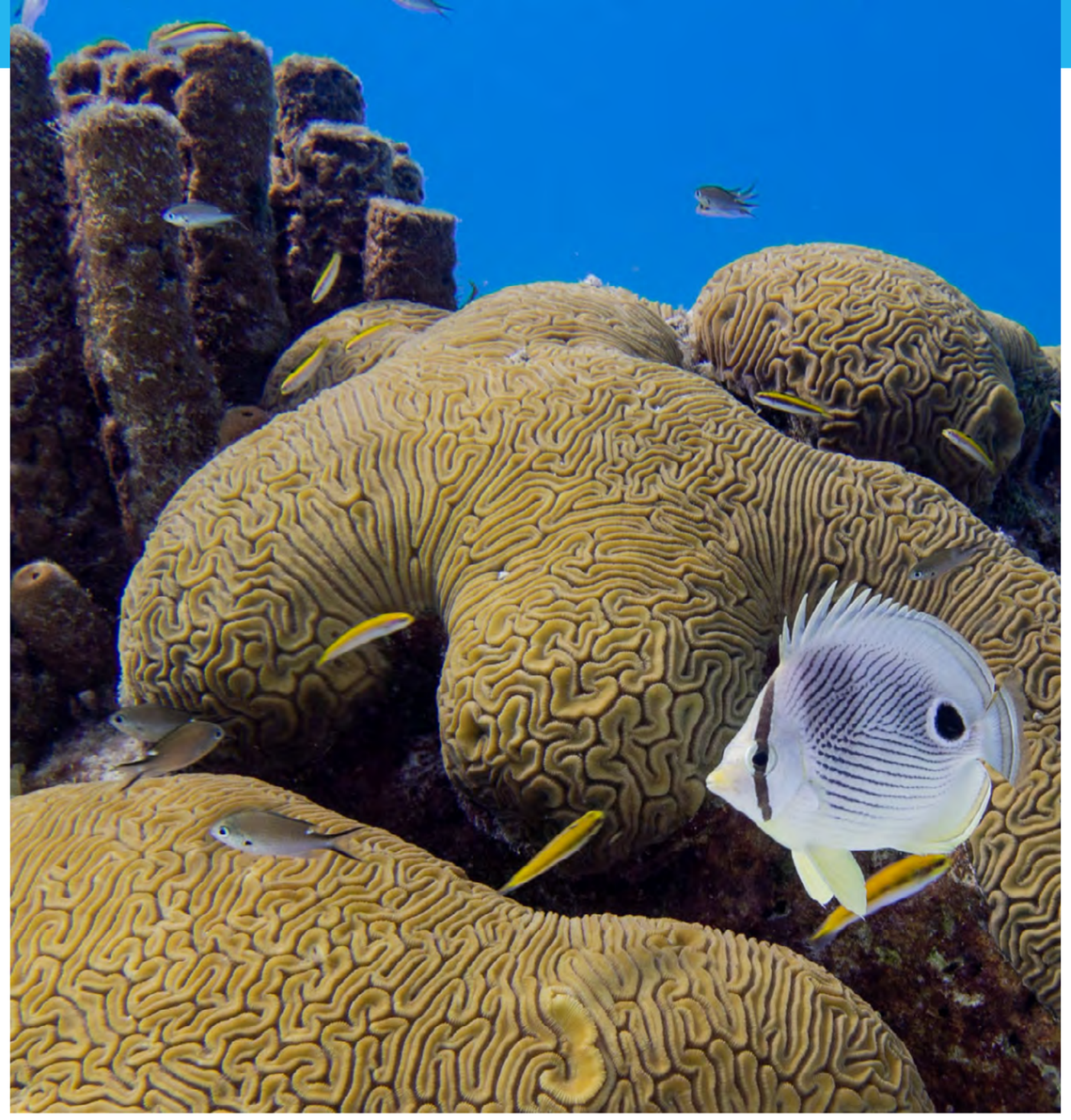


*Photo by: © Casper Douma Photography*

## Value of Caribbean Ecosystem Services

The Caribbean is an important biodiversity hotspot both above and below water. This region is home to 2.6% of the world's plant species and 3.5% of its vertebrate species [33]. In addition, nearly 7% of the world's reef ecosystems are found within the Caribbean [33]. Recent studies have identified, within the Caribbean, 755 species, both plant and animal, that are at risk of extinction. The 2011 Island Conservation report highlighted 121 critically endangered and 111 endangered mammals, reptiles, amphibians and birds, along with 13 bird species which have already become extinct [33].

Crystal blue waters, healthy coral reefs and stunning terrestrial landscapes are just a few reasons tourists flock to these islands each year. Recent TEEB (The Economics of Ecosystems and Biodiversity) research found that nature/ecosystem services of Bonaire, Saba and St Eustatius represent 31%, 27% and 24% of the island's gross domestic product (GDP) in 2013 [5, 6]. Similar TEEB information for Aruba found that that revenue generated from the ecosystem services was valued at an estimated US$ 269 million per year, and a poll found that around 50% of current visitors would not return if current environmental conditions deteriorated [36].

On St. Maarten, of the 500,000 stay-over visitors, 80% were found to have engaged in coral reef related activities (such as using the beaches, diving or snorkeling) [2]. On Curaçao, marine-associated tourism (excluding cruise boats) represented 38% of the total economic value of tourism in 2014. Restoring and conserving these environments is going to prove instrumental in keeping tourists returning year after year. Building a sustainable tourism plan will help ensure these environments are around for tourists to enjoy for many years to come.

# Current State

Each of the six Dutch Caribbean islands have their own unique draw, enticing visitors from around the world each year. From environments ranging from lush tropical habitats, cloud and dry tropical forests to rich coral reefs, each island has something unique to offer. Unfortunately, recent research has highlighted areas in which these environments have become gravely threatened, and if no action is taken soon, these environments could disappear completely.

The recent State of Nature report published by Wageningen University has brought a lot of attention to a number of environmental issues faced by the islands of Bonaire, Saba and St. Eustatius. In this report, all 33 experts concluded that the "*Conservation status*[1] *of the biodiversity in the Caribbean Netherlands is assessed as moderately unfavorable to very unfavorable*".

Another report brought attention to significant issues within Bonaire's reef, noting shallow areas are hardly growing, and some show signs of erosion. In fact, they found a low or negative growth rate for most of the shallow water reefs and noted that only a small portion of the reef will be able to withstand the pressures of sea level rise [1]. Additionally, there is widespread perception that these reefs are healthy, however this is now being attributed to what researchers are calling 'shifting baseline syndrome', and these reefs are actually losing important calcifiers and there is an overall decrease in coral cover [1, 14, 16; 21]. Similar trends have also been seen on Saba, where coral cover has steeply declined since the 1990s. In the 90s, coral cover was at nearly 30%, however a recent survey found coral cover to be closer to 8%, where most of the bottom cover is attributed to macro-algae, dead coral or rocks [17]. St. Eustatius had a similar reduction, going from 30% to 5% since 2005 [17].

For each of the six islands, their natural assets are under significant threat from a variety of local pressures. These pressures include land degradation due to coastal development, erosion and sedimentation, along with eutrophication caused by inadequate water treatment, biodiversity threats such as overfishing, disease and invasive species [17]. Furthermore, an increase in unexpected events such as Sargassum blooms or the effects of the Corona virus pandemic adds an additional burden for these islands to manage.

*Photo by: © Henkjan Kevit*

[1] The Conservation Status is used in the European Union for reporting on the status of species and habitats protected under the European Habitat Directive (see *http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm*).

# Issues Impacting State of Nature

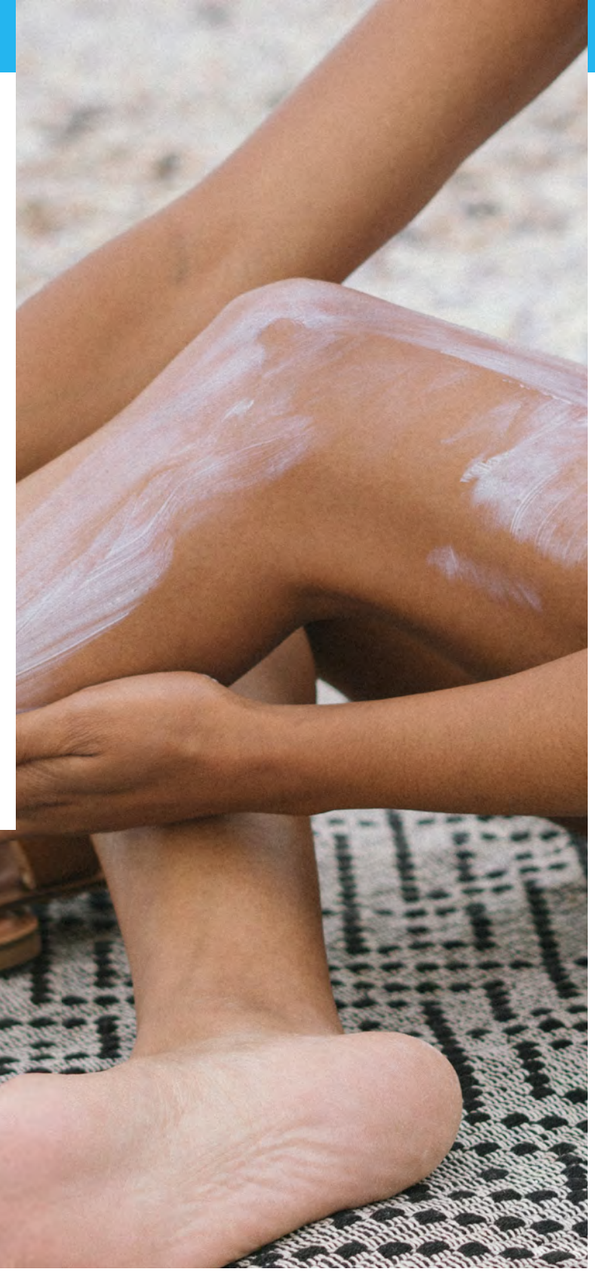
Although tourism drives local economies on these islands, it is not without a cost. The strain on local infrastructure, environment and supply needs ripples throughout the economy. As the needs of tourists continues to increase, the islands will be expected to give more and more of itself to meet these demands. It is impossible to understand and manage each of these environments in a vacuum, instead, an integrated, holistic approach must be undertaken to link these environments to their users. Understanding the limitations of the islands can help craft a plan to help support this increase in demand while still meeting the needs of the locals.

## Increase in Human Pressures

The type of tourist plays an important role in what they expect and require from the island. Stay over tourists tend to spend more money each day by staying in local accommodations and eating in restaurants. These tourists are also more likely to book tours or take advantage of the various entertainment options the island has to offer. On the other hand, cruise boat tourists also generate revenue through port fees and day trips booked from onboard. These tourists can often be found in and around port and tend to purchase drinks or souvenirs.

One reason why tourism can often be so damaging, is that users are often concentrated within a particular area, typically in the most fragile environments such as beaches, reefs or mangroves [15]. Physical damage, whether it be the trampling of seagrass or touching of coral, can be extremely detrimental to the environment. A new study conducted on Bonaire highlights the affects this increase in human activity can have on local reefs [1]. They found that an increase in human activity had a significant impact on the state and growth capacity of neighboring reefs. It was found that reefs near areas with increased human traffic (such as Kralendijk, salt flats or oil storage tanks) had reefs with limited or negative growth rates, leading to overall erosion of coral reefs. On the other hand, in areas with limited human interaction (such as in marine reserves were diving is prohibited) they found high levels of carbonate production, highlighting the resilience of these reefs with humans are kept out. Tourism places a great deal of stress on the natural resources on which it depends, leading to natural habitat loss, biodiversity reduction, water and land resources over-exploited, and increased levels of pollution (land and marine) [9].

Sunscreen can also have a very damaging affect. Recent studies highlight sunscreen's impact on different aquatic species, most notably coral [7, 8, 12, 22, 37]. Known effects of frequently used UV filters include bleaching of hard coral, introduction of viral infections, damage and deformation of coral larvae, and damage to coral DNA and reproductive process [34]. In particular, the UV-filter oxybenzone has been identified as a major culprit harming coral [27, 28]. An environmental risk assessment for 3 organic UV-filters within Lac Bay, on Bonaire, found that the UV filters oxybenzone and octocrylene were present in significant levels within both the water column and surface microlayer [24]. Lac Bay is an area of high risk due to its shallow nature and the large number of people who visit.



## Consumption of Natural Resources

The cost of building and sustaining high levels of tourism is often at the expense of local natural resources. The Critical Ecosystem Partnership Fund reported that residential and commercial development should be considered a top biodiversity threat for the Caribbean [33]. Coastal Development, if not controlled, can lead to an overall erosion of the coastline, threatening the picturesque beaches which draw many visitors in. Furthermore, clear cutting of land for development threatens local plant life, both in diversity and population which cause further erosion and a decrease in water quality [17]. These lands are already threatened by an uncontrolled feral grazing population of goats, sheep and donkeys which further remove critical plants.

Other changes to local environments can further stress these already threatened environments. Nearly 42% of mangroves have been lost in Caribbean in past 25 years [33]. The FAO stated that the main cause for this mangrove degradation and loss is due to the rapid and unsustainable development within the tourist industries, such as the building of marinas, hotels or harbors [10]. Additional loss of seagrass due to worsening water conditions and trampling has led to an overall loss of ecosystem services such as providing important habitat and nursery, improving biodiversity, filtering nutrients to improve water quality or trapping sediments limiting the erosion of beaches. Additionally, as the demand for local seafood increases, there is a threat of overfishing on the already stressed reefs. Overfishing of large, popular game fish can be felt throughout the food chain, as an unbalanced ecosystem can cause catastrophic failures.

## Infrastructure

As the number of individuals increases, so do the physical demands on public works infrastructure. This includes items such as water and electricity, along with waste management and sewage. A report released in 2018 found that nearly 85% of wastewater entering the Caribbean Sea is untreated due to an inadequate number of treatment plants, or plants operating in poor conditions [33]. This then causes a decrease in coastal water quality, leading to eutrophication and an increase in algae. These algae then outcompete coral further exacerbating the coral loss issues felt by the islands [17].

For areas which experience strong seasonality, this could mean investing in infrastructure systems which can afford to run during low season and are capable of handling increased loads during high season. The increased demands due to tourism could be used to encourage local governments to reinvest and modernize current systems, perhaps turning to greener options in the future.

Solid waste is also a significant issue, especially for St. Eustatius, Saba and Bonaire where inadequate solid waste disposal has proven to be a significant pollution source, detectable in the soil and ground water [18]. It has been estimated that land-based tourists generate twice as much solid waste per capita than local residents [33].

Tourists are often the main consumer of resources such as water and energy [15]. In fact, tourists within the Caribbean were found to use 1.5 to 2 times the amount of water per day as residents [15]. Furthermore, peak time for tourism generally coincides with dry season, adding an additional stress to water availability [33].

## Climate Change

Tourism contributes to climate change in a variety of ways. International transport has a high carbon footprint [9]. It was estimated that global tourism is responsible for 8% of all global greenhouse gas emissions. For small islands, tourism is often attributed as the main contributor to its domestic carbon emissions [9, 11]. Hotels, with their round-the-clock energy consumption and the tendency to import most of their food, have a high carbon footprint. According to the World Wildlife Fund, 13 nights in a five-star all-inclusive hotel resort can produce food-related carbon emissions of 205 kg per person and 13 nights in a four-star hotel can produce 91 kg of emissions per person [9].

In addition to the demands that tourists bring themselves, additional global stressors due to climate change further threaten these islands. Climate change was identified as one of the six mega trends affecting tourism [4]. Stressors caused by climate change include changes in water quality, worsening storms, Sargassum and other algal blooms and an increase in mosquitos and blood borne diseases. As global stressors continue to increase and worsen, this will have a multiplying effect on the physical effects of tourism if not controlled and monitored.

Among many climate-related challenges, sea level rise (SLR) is a particularly critical issue for coastal tourism in most Caribbean islands [9, 20, 23]. Approximately 29% of Caribbean coastal tourism resort properties would be affected by 1 m SLR and between 49-60% would be affected by the combination of SLR and coastal erosion [25]. This presents the possibility for a loss of beach areas and infrastructure. A similar study conducted by the UN found that a SLR of one meter would cause more than 29% of major resort properties in the Caribbean region to be partially or fully inundated by water, while 49% would be damaged or destroyed by a combination of sea level rise and storm surge [9].

> *“According to the World Wildlife Fund, 13 nights in a five-star all-inclusive hotel resort can produce food-related carbon emissions of 205 kg per person and 13 nights in a four-star hotel can produce 91 kg of emissions per person.”*

# Sustainable Tourism

## Overview

The goal of sustainable tourism is to maximize visitors' enjoyment while minimizing environmental and societal impact. The idea is that by giving visitors an authentic, environmentally focused experience, it is possible to create a system where residents can benefit from tourism without sacrificing their local culture or depleting their natural resources. This is often a difficult balancing act, as traditional methods of tourism are often at great cost to the residents, however, new ideas and tourist demands are creating new avenues for sustainable tourism.

Sustainable tourism options could itself be a selling point for these island destinations. A 2010 Green Economy report found that over a third of all tourists prefer environmentally-friendly tourism options [15,32].

## Implementation

Designing an environment which encourages these measures may require a shift in traditional ways of thinking. Developing clear indicators to measure the success of economic, environmental and societal impact on tourism is a great way to guide these measures. Annual reviews of these indicators could help highlight both the success and failures across the islands to meet these objectives. Perhaps financial incentives could be offered to businesses which score highly within these indicators, further encouraging investment and renovation which will help meet these goals.

## Example of Solutions

Sustainable tourism, when done well, can work to enhance the overall visitor's experience. A perfect example of this is the country of Bhutan. Bhutan works under the concept of "high value, low impact" by carefully regulating the number of visitors entering the country. Here, a daily visitor's tariff is charged, of which a large portion goes to reinvesting in the country's infrastructure [31].

Another striking example, which may be a bit easier to apply to the Caribbean, comes from Fiji. The resort, Six Senses Fiji, is a luxurious five-star resort which runs completely off solar power. Additionally, they collect rainwater and have an on-site filtration system, eliminating the need for single use bottled water. They minimize waste through strict recycling practices and have implemented a composting system for food waste. They also grow as many herbs and vegetables as possible, minimizing import requirements. There is also a focus on increasing biodiversity through their Rise Beyond the Reef program, the 12 giant clams which inhabit the reef and the 17 critically endangered crested iguanas which use the resort's forested area [26].

Voluntouring is also becoming increasingly popular. This is a vacation designed around volunteer options offered. Countless locations have been able to take advantage of the passion of visitors to help build and run conservation efforts, protecting unique natural resources of an area. Typically, these programs are geared towards projects requiring physical labor, such as planting trees, cleaning coral trees or building infrastructure projects such as fences to keep free roaming cattle from over grazing. These projects often provide unique hands on experience with the natural habitat, normally inaccessible to visitors.

# Sustainable Tourism Indicators

When considering the overall success of sustainable tourism, it is important to consider three aspects: environmental (how is the island physically coping with tourism), social (how is local culture and overall satisfaction of residents being influenced by tourism) and economic (how are the islands financially benefitting from tourism. A successful management plan must find a way to balance these three aspects.

## Environmental Indicators

It is often difficult to balance the economic benefits with the environmental toll placed on these islands. This includes both the environmental impact along with utility management, such as energy production, wastewater and solid waste disposal. Managing the environmental impact can be done using indicators such as carbon footprint, land and water quality analysis and state of nature reports. Utility management must take into account the increased demand from tourists for electricity and water usage, water being of particular issue as the Dutch Caribbean islands which have limited or no access to fresh water and rely on desalination to meet its needs. Waste management indicators should take into account how waste is being disposed and what recycling or waste reduction measures are put in place to minimize stress on the islands.

## Societal Indicators

Societal indicators must take into account overall satisfaction of both the tourists and the locals. This can be measured through community involvement in ecotourism activities, tourism revenue generated within the community, number of local workers employed in tourism, training of locals for ecotourism jobs, percentage of return visitors and overall resident satisfaction. Although tourism can be a great way to generate revenue for an island, it cannot be at the expense of local cultural or way of life.

## Economic Indicators

Its already been stated that tourism is a huge economic driver for the Dutch Caribbean islands, however, there are a variety of ways of measuring this success. Indicators highlight trends in seasonality, such as overall number of visitors, hotel occupancy by month, and changes in unemployment rate throughout the year. Other indicators might highlight the overall economic benefits enjoyed by the islands, such as average daily spending rate and length of stay, number of same day visitors, or tourism's contribution to GDP. Lastly, understanding how tourism rates are affecting employment percentages can give a better indication of how tourism is directly impacting local populations. A successful sustainable tourism model must decide the relationship between these indicators and put emphasis on those deemed most critical.

# Recommendations

Developing a sustainable tourism plan to be implemented within the Dutch Caribbean will require integration and teamwork at all levels. Although there is no easy solution, through working together and taking the following items into consideration, the Dutch Caribbean can successfully design a sustainable tourism future to ensure its natural resources are here for generations to come:

- Plan must contain a long-term vision and objectives, with clearly defined roles and responsibilities of those involved, and must establish a monitoring system to ensure implementation is done successfully.

- Ecological footprint of tourism must be kept at a minimum, which means taking into consideration infrastructure needs, impact on local culture and using the economic benefits to better the islands as a whole.

- An honest look at each islands' carrying capacity needs to be used to establish realistic limitations and work to encourage high-end, low-impact tourism over mass tourism.

- Increasing public awareness, of both tourists and residents, through education programs on their environmental impact and recommend best daily practices to minimize these impacts.

- Governments should provide incentives for businesses to develop in a sustainable, environmentally friendly ways.

## DCNA Contact information

**Address:**
Dutch Caribbean Nature Alliance
Kaya Nikiboko Zuid 56
Kralendijk, Bonaire, Dutch Caribbean

**Contact us:**
+599 717 5010
research@DCNAnature.org
www.DCNAnature.org

**Social Media**
facebook.com/DutchCaribbeanNatureAlliance
twitter.com/DCNA

**Credits**
**Photography:** Courtesy of SHAPE Photography or Brenda S. & R. Kirkby unless otherwise Credited.
**Concept and Design:** Deviate Design. www.Deviate.Design

## Sponsors

DCNA's activities are generously supported by The Dutch Postcode Lottery.

BioNews is funded by the Ministry of Agriculture, Nature and Food Quality (LNV)

NATIONALE POSTCODE LOTERIJ

Ministry of Agriculture, Nature and Food Quality

## Members of the Dutch Caribbean Nature Alliance

**Aruba**
Fundacion Parke Nacional Aruba
+297 585 1234
www.arubanationalpark.org

**Bonaire**
STINAPA Bonaire
+599 717 84 44
www.stinapa.org

**Curaçao**
CARMABI
+599 9 462 4242
www.carmabi.org

**Saba**
Saba Conservation Foundation
+599 416 32 95
www.sabapark.org

**St. Eustatius**
STENAPA
+599 318 28 84
www.statiapark.org

**St. Maarten**
Nature Foundation
+721 544 4267
www.naturefoundationsxm.org

A special thanks to our partners, conservationists and scientists for your dedicated work, sharing your expertise and reviewing this issue and the funding support from the Ministry of Agriculture, Nature and Food Quality (LNV). Thank you for being by our side — for your shared passion, encouragement and support to safeguard our precious nature in the Dutch Caribbean.

DCNA produces "BioNews", a free monthly digital newsletter featuring recent nature related news-items about the Dutch Caribbean as well as overviews of recent publications, current research and monitoring programmes and upcoming events.

**Want to know more?** Check the BioNews archive
You can sign-up here or send an email to research@DCNAnature.org

# References

The reports and publications on biodiversity related subjects in the Dutch Caribbean can be found in the Dutch Caribbean Biodiversity Database (DCBD) *(http://www.dcbd.nl)*. The DCBD is a central online storage facility for all biodiversity and conservation related information in the Dutch Caribbean.


1. de Bakker, D.M., van Duyl, F.C. and Perry, C.T. (2019). Extreme spatial heterogeneity in carbonate accretion potential on a Caribbean fringing reef linked to local human disturbance gradients. Global Change Biology. Vol 25, Issue 12, pp. 4092-4104.

2. Bervoets, T. (2010). Working paper on the economic valuation of country St. Maarten's coral reef resources. Nature Foundation St. Maarten, December 2010.

3. Billy, D. 2017. Sustainable Tourism in the Caribbean. https://www.wordsinthebucket.com/sustainable-tourism-in-the-caribbean

4. Buckley, R., Gretzel, U., Scott, D., Weaver, D., Becken, S., 2015. Tourism Megatrends. Tourism Recreation Research. Volume 40, Pages 59-70. https://doi.org/10.1080/02508281.2015.1005942

5. Cado van der Lely, J.A., Beukering, P. van, Muresan, L., Zambrano Cortes, D., Wolfs, E. and S. Schep, 2013. The Total Economic Value of nature on Bonaire. Exploring the future with an ecological-economic simulation model. Report R12-xx, IVM Institute for Environmental Studies

6. CBS 2014. https://www.cbs.nl/nl-nl/nieuws/2014/46/omvang-economie-op-saba-en-sint-eustatius-voor-het-eerst-bepaald.

7. Danovaro, R., Bongiorni, L., Corinaldesi, C., Giovannelli, D., Damiani, E., Astolfi, P., Greci, L., Pusceddu, A. 2008. Sunscreens Cause Coral Bleaching by Promoting Viral Infections. Environ Health Perspect. 2008 Apr;116(4):441-7. doi: 10.1289/ehp.10966.

8. Downs, C.A., Kramarsky-Winter, E., Segal, R., Fauth, J., Knutson, S., Bronstein, O., Ciner, F.R., Jeger, R., Lichtenfeld, Y., Woodley, C.M., Pennington, P., Cadenas, K., Kushmaro A., Loya, Y. 2016. Toxicopathological Effects of the Sunscreen UV Filter, Oxybenzone (Benzophenone-3), on Coral Planulae and Cultured Primary Cells and Its Environmental Contamination in Hawaii and the U.S. Virgin Islands. Archives of Environmental Contamination and Toxicology volume 70, pages265–288(2016)

9. Ewing-Chow, D. 2019. The Environmental Impact of Caribbean Tourism Undermines Its Economic Benefit. FORBES. https://www.forbes.com/sites/daphneewingchow/2019/11/26/the-carbon-footprint-of-caribbean-tourism-undermines-its-economic-benefit/#34ac38e33cb5

10. FAO. Food and Agriculture. 2007. Forestry Paper 153: The world's mangroves 1980-2005." FAO. http://www.fao.org/docrep/010/a1427e/a1427e00.htm

11. Gössling, D., Scott, D., Hall, C.M. 2013. Challenges of tourism in a low-carbon economy. WIREs Climate Change. Vol 4 Issue 6. https://doi.org/10.1002/wcc.243

12. Fent, K., Kunz, P.Y., Zenker, A., Rapp, M., 2010. A tentative environmental risk assessment of the UV-filters 3-(4-methylbenzylidene-camphor), 2-ethyl-hexyl-4-trimethoxycinnamate, benzophenone-3, benzophenone-4 and 3-benzylidene camphor. Mar. Environ. Res. 69, S4–S6. doi:10.1016/j.marenvres.2009.10.010

13. IPS News, 2017. http://www.ipsnews.net/2017/06/caribbean-seeks-climate-proof-tourism-industry/

14. Johnson, A. & Jackson, J. (2015). Fisher and diver perceptions of coral reef degradation and implications for sustainable management. Global Ecology and Conservation, 141.

15. Manning, E. 2016. The Challenge of Sustainable Tourrism in Small Island Developing States (SIDS) https://canadiancor.com/challenge-sustainable-tourism-small-island-developing-states-sids/

16. McClenachan L., O'Connor, G., Neal, B.P., Pandolfi, J.M., Jackson, J.B.C. 2017. Ghost reefs: nautical charts document large spatial scale of coral reef loss over 240 years. Sci Adv 3:e1603155

17. Meesters, E.H., Becking, L.E. and van der Geest, M. (2019). Decline in coral reefs in the Caribbean Netherlands: causes and possible solutions coral recovery. Wageningen University & Research rapport C061/19

18. Meesters, E.H. (2019). Human disturbance impedes growth of coral reefs around Bonaire. Published oct 25th 2019.

19. NOAA. 2017. Extremely active 2017 Atlantic hurricane season finally ends. 30. Nov. 2017. https://www.noaa.gov/media-release/extremely-active-2017-atlantic-hurricane-season-finally-ends

20. Nurse, L. A., Mclean, R. F., Agard, J., Briguglio, L. P., Duvat-Magnan, V., Pelesikoti, N., … Webb, A. (2014) Small islands, 1613–1654. Retrieved from https://hal.archives-ouvertes.fr/hal-01090732/

21. Pauly, D. (1995) Anecdotes and the shifting baseline syndrome of fisheries. Trends in Ecology & Evolution, 10, 430.

22. Paredes, E., Perez, S., Rodil, R., Quintana, J. B. & Beiras, R. 2014. Ecotoxicological evaluation of four UV filters using marine organisms from different trophic levels Isochrysis galbana, Mytilus galloprovincialis, Paracentrotus lividus, and Siriella armata. Chemosphere 104, 44–50.

23. Rhiney, K. (2015). Geographies of Caribbean vulnerability in a changing climate: Issues and trends. Geography Compass, 9(3), 97–114. doi:10.1111/gec3.12199

24. Schaap, I., & Slijkerman, D. M. E. (2018). An environmental risk assessment of three organic UV-filters at Lac Bay, Bonaire, Southern Caribbean. Marine Pollution Bulletin, 135, 490-495.

25. Scott, D., Simpson, M.C., Sim, R. 2012. The vulnerability of Caribbean coastal tourism to scenarios of climate change related sea level rise, Journal of Sustainable Tourism, 20:6, 883-898

26. Six Senses. (2020) Sustainability for eternity at Six Senses Fiji. https://www.sixsenses.com/en/resorts/fiji/sustainability

27. Slijkerman, D., & Bol, S. (2018a). UV filter pollution Bonaire by tourism: Lac Bay monitoring and survey results 2017. Wageningen Marine Research report No. C023/18.

28. Slijkerman, D. and Bol, S. (2018b). Sunscreen Awareness Bonaire - Moving towards a oxybenzone free island. BioNews 15.

# References


29. Statistics Netherlands (CBS). (2018) Tourism in the Caribbean Netherlands in 2017. May 2018. https://www.cbs.nl/en-gb/background/2018/19/tourism-in-the-caribbean-netherlands-in-2017

30. Thomas, K.D., Williams, M.B. and Trotz, M.A. (2014) The Sustainability of Ecotourism Activities: Development of an Accessible, Applicable, and Efficient Tool for Assessment in the Caribbean Region. The West Indian Journal of Engineering Vol.36, No.2, January 2014, pp.51-62 https://sta.uwi.edu/eng/wije/vol3602_jan2014/documents/Manv36n2KThomasJan2014.pdf

31. Tourism Council of Bhutan. 2020. Minimum Daily Package. https://www.tourism.gov.bt/about-us/minimum-daily-package

32. UNEP. 2011. 2010 Green Economy report.

33. Walton, M.M., Hughen, R., Guggenheim, D.E., Escovar-Fadul, X. 2018. A Century of Unsustainable Tourism in the Caribbean: Lessons Learned and Opportunities for Cuba. Ocean Doctor. https://ocean-doctor.org/download/reports/A-Century-of-Unsustainable-Tourism-in-the-Caribbean-Ocean-Doctor.pdf

34. Wood, E. 2018. Impacts of sunscreen on coral reefs. ICRI https://www.icriforum.org/sites/default/files/ICRI_Sunscreen_0.pdf

35. World Travel and Tourism Counsel. 2015. "Economic Impact of Tourism. World Travel & Tourism Council" 2015. 17 Nov. 2015. http://www.wttc.org/research/economic-research/economic-impact-analysis/

36. van Zanten, B., Laclé, F., van Duren, S., Soberon, V., van Beukering, P. 2018. The Value Natural Capital for the Tourism Industry of Aruba. https://www.wolfscompany.com/wp-content/uploads/2018/04/The-Tourism-Value-of-Nature.pdf

37. Zhang, Zifeng, Nanqi Ren, Yi-Fan Li, Tatsuya Kunisue, Dawen Gao, and Kurunthachalam Kannan. "Determination of Benzotriazole and Benzophenone UV Filters in Sediment and Sewage Sludge." Environmental Science & Technology 45, no. 9 (2011): 3909-16.


The reports and publications on biodiversity related subjects in the Dutch Caribbean can be found in the Dutch Caribbean Biodiversity Database (DCBD) *(http://www.dcbd.nl)*. The DCBD is a central online storage facility for all biodiversity and conservation related information in the Dutch Caribbean.

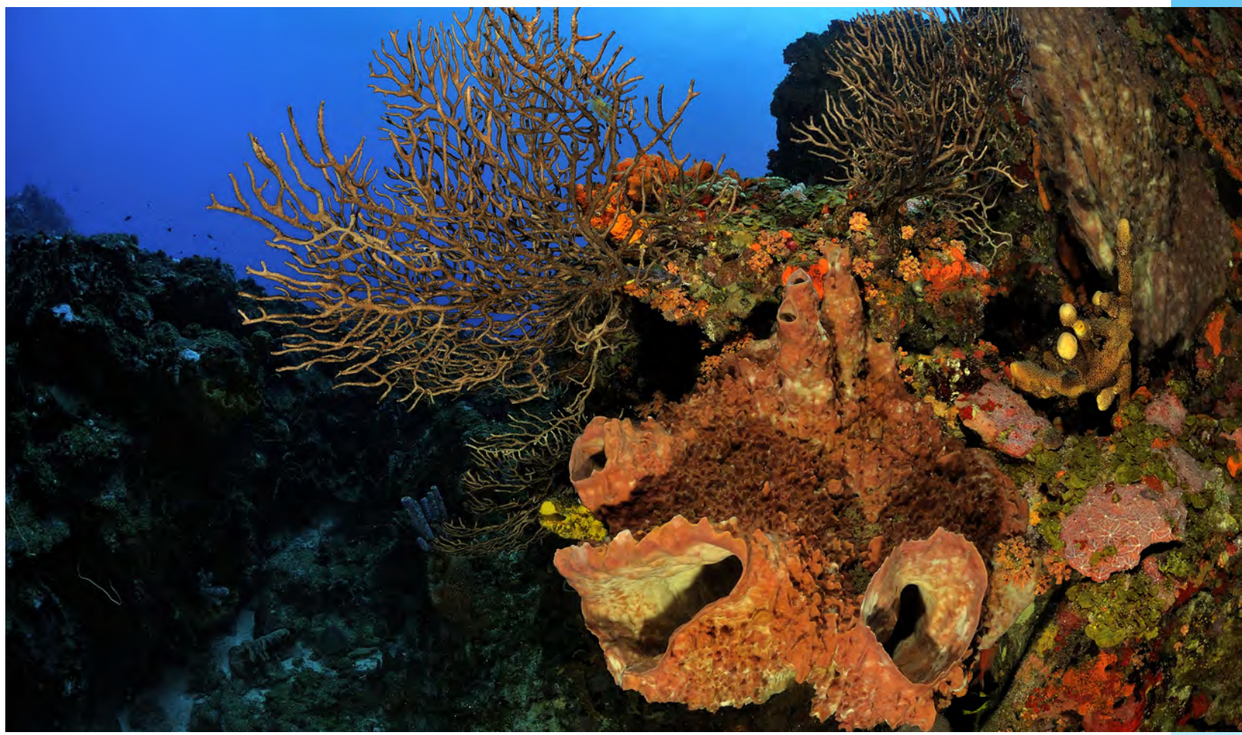


*Photo by: © Hans Leijnse*