

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 where 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].

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