CHAPTER 2

Climate Change and the Sustainable Development of Tourism Within the Caribbean

Caribbean Small Island Developing States' (SIDS') growing dependence on tourism has called for a close examination of the many variables that can impact sustainability and viability of the industry. For global tourism policymakers, variations in weather and climate top the list of priority areas for forecasting, planning and are, in some circles, a grave concern. Human-induced changes to long-term climate trends have captured the attention of scholars globally in modern times and climate change has emerged as a critical buzzword at the highest levels of global policymaking. Despite much scepticism over the links between human actions, climate variability and the denial of the global warming phenomenon by some (Björnberg et al. 2017), undeniable evidence exists to support the view that extreme weather conditions, rising temperatures, rising sea levels, and melting of polar ice caps are as a result of carbon emissions and other harmful side effects of the global industrial complex. The level of vulnerability to these climate shifts is by no means equally distributed, and SIDS in general and the Caribbean in particular, have been identified as being amongst the most susceptible to the devastating effects of climate change. As Taylor et al. (2012) indicate, the Caribbean's location and geographic features afford it inherent climate sensitivity. Ranging from low-lying cays (Bahamas and Barbuda), mountain ranges with short coastal areas (St. Lucia and Dominica), and a hybrid of coastal areas and hilly interiors (Jamaica and Antigua), various Caribbean islands are poised to suffer from shifts in sea levels and rising temperatures. In this way, weather patterns

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are directly related to the sustainable development of the region. Caribbean states, though having varied topographical and geographic features, share several characteristics that increase their vulnerability to climate change impacts including limitations in size and natural resources, high susceptibility to natural disasters, and heavily developed and densely populated coastal zones (Baban 2003). This sensitivity is complicated by the almost complete reliance on economic drivers that are dependent on stable climatic conditions, namely, tourism and agriculture. As noted in Chap. 1, tourism and travel account for high levels of direct and indirect employment in Caribbean SIDS. Tourism is in turn dependent on pleasant climatic conditions to be feasible. This chapter assesses this critical relationship between Caribbean tourism and climate change as it is recognized that climate change is not a remote future event for tourism. The varied impacts of a changing climate are becoming evident at destinations around the world and Caribbean SIDS are no exception.

Climate change as defined by World Tourism Organization (UNWTO) (2008) is a change in global or regional climate patterns attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels. Global effects of climate change include warmer land and ocean surface temperatures, shrinking glaciers, rising sea levels (from melting ice and thermal expansion of oceans), adverse changes in precipitation, loss of ecosystems, increased number and intensity of tropical and snow storms, heat waves, and extreme drought and flooding (WMO 2016). Though climatic changes have piqued the interest of scientists for decades, tourism interests have taken special and serious note of the links between the industry and climate since the turn of the twenty-first century. The First International Conference on Climate Change and Tourism was held in Djerba, Tunisia, in 2003, and was hailed as the first step towards mitigating negative impacts of climate changes on tourism. More than 150 participants from 42 countries and 6 international organizations gathered at this event that was convened by the UNWTO. The Djerba Declaration recognized the complex interlinkages between the tourism sector and climate change and established a framework for future research and policymaking on adaptation and mitigation. The Declaration recognized that there is a need for adaptation and mitigation measures and included a series of recommendations for international organizations, government, and private sector agencies for collaborative actions at the international, national, and local destination levels. The recognition within the Djerba Declaration of the complex interlinkages between the tourism sector and climate change

and the need to take adaptation and mitigation measures established a comprehensive framework for future research and policymaking. As explained by the UNWTO report of 2007, the Conference agreed that:

- climate is a key resource for tourism and the sector is highly sensitive to the impacts of climate change and global warming, many elements of which are already being felt. It is estimated to contribute some 5% of global CO_2 emissions.
- tourism—business and leisure—will continue to be a vital component of the global economy, an important contributor to the Millennium Development Goals and an integral, positive element in our society.
- given tourism's importance in the global challenges of climate change and poverty reduction, there is a need to urgently adopt a range of policies which encourage truly sustainable tourism that reflects a "quadruple bottom line" of environmental, social, economic, and climate responsiveness.
- the tourism sector must rapidly respond to climate change, within the evolving UN framework, and progressively reduce its greenhouse gas (GHG) contribution if it is to grow in a sustainable manner. This will require action towards mitigating GHG emissions, derived especially from transport and accommodation activities; adapting tourism businesses and destinations to changing climate conditions; applying existing and new technology to improve energy efficiency and secure financial resources to help poor regions and countries.

Importantly, the Declaration recognized not only that climate change would have peculiar and long-lasting impacts on the industry, but that tourism also contributes to the phenomenon, through the use of energy in several activities mainly air and sea and ground transportation and alterations to and erosion of the natural environment to create new attractions and accommodations for the sector. Undoubtedly, the contribution of the aviation sector is significant, accounting for up to 40% of total emissions from the tourism industry. Moreover, airborne emissions may be between 1.9 and 5.1 times more harmful than surface-based emissions (Gössling and Hall 2006). Trotz (2014) reports that travel and tourism account for 5% of global carbon dioxide emissions, and, further, if the global tourism sector's collective emissions were compared to country emissions, travel and tourism would be the fifth largest carbon dioxide polluter worldwide.

Since the Djerba Declaration, a growing body of knowledge has been generated addressing the complex relationships between the tourism sector and climate change with important research activities on this subject. There is now an extensive recognition of the urgent need for the tourism industry, national governments, and international organizations to develop and implement strategies to face the changing climate conditions and to implement precautionary programmes, as well as to mitigate tourism's environmental impacts contributing to climate change.

The Second International Conference on Climate Change and Tourism (Davos, Switzerland, October 2007) was a follow-up milestone event that brought together a wide variety of stakeholders and delivered a clear commitment for action to respond to the climate change challenge. It emphasized the need for the tourism sector to respond to climate change with urgency if it is to develop in a sustainable manner. Focus was placed on mitigating GHG emissions from the tourism sector, derived especially from transport and accommodation activities; adapting tourism businesses and destinations to changing climate conditions; applying technologies to improve energy efficiency; and securing financial resources to assist regions and countries in need.

As a result of these two global initiatives, the response of the tourism community to the challenge of climate change has visibly increased over the last five years. The increasing volume of literature on the impact of climate on tourism demand is due to the recognition that a more precise modelling of tourism demand must include weather and climate, since they are significant influences on the tourism industry. Intrinsically, tourism hinges on pleasant and stable weather to keep guests satisfied. Uyarra et al. (2005) established that warm temperatures, clear waters, and low health risks were the main environmental attributes important to tourists visiting the islands. In addition, the rise in sea level and its consequences on beach coverage (Nicholls et al. 2011), coral reef health (Hoegh-Guldberg et al. 2007), and the proliferation of jellyfish (Purcell 2005) are all being impacted by climatic shifts and can affect a tourist's attraction to tropical SIDS. Appropriate weather is also critical. Destinations that focus on ice-based sports and attractions need to maintain low temperatures to facilitate ice production. Countries like those in the Caribbean whose mainstay includes beach vacations and outdoor attractions need moderately warm temperatures and predictable rainfall. Studies associating climate with tourism indicate that changes in climate are likely to affect the

length of the season for tourists as well as the expected environment. Temperature could potentially have positive implications for the length of the season and/or the environment, while other studies have found results to indicate that it has negative implications for tourism. Lise and Tol (1999), using cross-section data, undertook a cross-section analysis on tourists originating in Organisation for Economic Cooperation and Development (OECD) countries, and found that the optimal temperature for their destination countries ranged from 21 °C to 24 °C. For tourism, therefore, climate change is not a remote event, but a phenomenon that already affects the sector (Table 2.1).

Importantly, climate change will generate both negative and positive impacts in the tourism sector and these impacts will vary greatly by market

Table 2.1 Main impacts of climate change and their implications for tourism

Impact	*Implications for tourism*
Warmer temperatures	Altered seasonality, heat stress for tourists, cooling costs, changes in plant-wildlife-insect populations and distribution range, infectious disease ranges
Decreasing snow cover and shrinking glaciers	Lack of snow in winter sport destinations, increased snow-making costs, shorter winter sports seasons, aesthetics of landscape reduced
Increasing frequency and intensity of extreme storms	Risk for tourism facilities, increased insurance costs/loss of insurability, business interruption costs
Reduced precipitation and increased evaporation in some regions	Water shortages, competition over water between tourism and other sectors, desertification, increased wildfires threatening infrastructure and affecting demand
Increased frequency of heavy precipitation in some regions	Flooding damage to historic architectural and cultural assets, damage to tourism infrastructure, altered seasonality (beaches, biodiversity, river flow)
Sea level rise	Coastal erosion, loss of beach area, higher costs to protect and maintain waterfronts and sea defences
Sea surface temperature rise	Increased coral bleaching and marine resource and aesthetic degradation in dive and snorkel destinations
Changes in terrestrial and marine biodiversity	Loss of natural attractions and species from destinations, higher risk of diseases in tropical-subtropical countries
More frequent and larger forest fires	Loss of natural attractions, increase of flooding risk, damage to tourism infrastructure
Soil changes (such as moisture levels, erosion, and acidity)	Loss of archaeological assets and other natural resources, with impacts on destination attractions

Source: World Tourism Organisation (2008)

segment and geographic region. The implications of climate change for any tourism business or destination will also partially depend on the impacts on its competitors. Rising temperatures and melting snow attractions may have a positive spin-off for tropical destinations, for instance. A negative impact in one part of the tourism system may constitute an opportunity elsewhere. Tourists also have the greatest capacity to adapt to the impacts of climate change, with relative freedom to avoid destinations impacted by climate change or shifting the timing of travel to avoid unfavourable climate conditions. In traditional summer beach destinations (like Caribbean SIDS) the summer season might lengthen, and the winter season might be more appealing to tourists, providing opportunities to reduce seasonality and expand the tourism product. Northern coastal areas might benefit from warmer summers, attracting more tourists and lengthening summer season. Consequently, there will be "winners and losers" at the business, destination, and nation level. However, this should not lull Caribbean SIDS into complacency as effects can be just as devastating to the sun-centric tourism product. For instance, visits to nature reserves, cycling, golf tourism, beach tourism, nautical tourism, or urban/cultural tourism can require certain weather conditions. Shift in travel patterns and particularly higher temperatures in temperate home countries of many tourists may have important implications, including proportionally more tourism spending in temperate nations and proportionally less spending in warmer nations now frequented by tourists from temperate regions. According to the UNWTO (2008) the direct effect of climate change might be significant enough to alter major intraregional tourism flows where climate is of paramount importance, including Northern Europe to the Mediterranean and the Caribbean, North America to the Caribbean, and to a lesser extent Northeast Asia to Southeast Asia.

Warmer temperatures and greater sunshine have been found to influence travel patterns and tourism expenditures in some temperate nations. The climatic factors identified as having the greatest impact on tourism are temperature, sunshine, radiation, precipitation, wind, humidity, and fog (Stern 2006; Hamilton and Lau 2004). These factors are significant both to the tourist's assessment of his or her health and well-being and to the tourism industry. Environmental factors have always been key components when tourists choose a holiday destination and there is also evidence that the weather conditions experienced at the destination have an important influence on overall holiday satisfaction (UNWTO 2008). Climate defines

the length and quality of tourism seasons and plays a major role in destination choice and tourist spending. Scott et al. (2008) in their report commissioned by the UNWTO classified the range of climate change impacts on tourism into the five categories of direct and indirect impacts of climate, possible changes to tourist mobility, destination vulnerability, and social impacts. Forster et al. (2012) concluded that 40% of visitors to Anguilla considered the hurricane season in their decision-making process. Further, the researchers found that respondents were less likely to choose a holiday option when hurricane likelihood and intensity risk increased. The influence of hurricane risk and intensity was strongest with older Americans and vacationers seeking a beach holiday. Indeed, tourists have a great adaptive capacity (depending on three key resources: money, knowledge, and time) with relative freedom to avoid destinations impacted by climate change or shifting the timing of travel to avoid unfavourable climate conditions (UNWTO 2008: 81).

Despite controversies in research regarding the veracity of statistical models in predicting tourist flows under scenarios of climate change (Bigano et al. 2006), strategic planning is needed by the tourism industry as climate is an important resource sought after by tourists. As has been previously indicated, projected changes in the distribution of climate resources are anticipated to have important consequences for tourism demand. As such, the response of tourists to the complexity of destination impacts will reshape demand patterns and play a pivotal role in the eventual impacts of climate change on the tourism industry. Understanding and anticipating the potential shifts in tourist demand will remain critical areas of tourism planning.

Beach tourism remains the dominating market segment, constituting a key part of the economy of most SIDS and Caribbean countries. Coastal and island destinations such as St. Lucia, Bahamas, Jamaica, and Barbados are extremely vulnerable to direct and indirect impacts of climate change (such as storms and extreme climatic events, coastal erosion, physical damage to infrastructure, sea level rise, flooding, water shortages, and water contamination). This high vulnerability often couples with a low adaptive capacity, in SIDS and coastal destinations of developing countries. In many beach destinations the high tourist season coincides with low water regimes in dry seasons, aggravating water management and environmental issues.

Nature-based tourism as seen in Dominica relies on a high diversity of tourism resources (landscapes, flagship species, ecosystems, outdoor

activities relying on specific resources like water level in rivers for canoeing, etc.). These resources are highly variable in space, and will be affected by climate change in various ways. Although ecosystems can be highly vulnerable to climate change impacts, they have greater adaptation when compared to beach tourism, given the wide range of activities that can be developed and conducted in natural areas. Therefore, there are good possibilities to design effective adaptation strategies for ecotourism and nature-based destinations.

Most energy use in tourism, as in many other economic sectors, is based on fossil fuels, with only a fraction of energy being generated through renewable energy sources. There is little doubt that the earth's climate is reacting to the use of fossil fuels and other harmful toxins. Temperature recordings for 2015 broke several records. The year ended the warmest five-year period ever recorded and was the first time in recorded history that the world's annual temperature exceeded the halfway point to the 2 °C (3.6 °F) threshold agreed under the Paris Agreement.[1] The average global temperature has increased by approximately 0.6 °C during the twentieth century. More than that, the rate of increase in air temperature in the Caribbean subregion has exceeded the international mean (Mimura et al. 2007).

Individually, Caribbean and other developing countries do not emit significant amounts of carbon dioxide relative to more advanced economies of the Global North. As Dominican PM Roosevelt Skerrit has explained, the Caribbean is a victim of the emissions of larger and more energy-dependent nations. He noted, "We are shouldering the consequences of the actions of others, actions that endanger our very existence, and all for the enrichment of a few elsewhere" (Skerrit 2017). Though not a large contributor to the global problem, Caribbean SIDS have experienced devastating effects of extreme weather brought on by climate

[1] Paris Climate Agreement is an agreement within the United Nations Framework Convention on Climate Change (UNFCCC). The Paris Agreement's central aim is to strengthen the global response to the threat of climate change by keeping the global temperature rise in this century well below 2 °C above preindustrial levels and to pursue efforts to limit the temperature increase even further to 1.5 °C. The agreement addresses mitigation strategies to reduce greenhouse gas emissions and adaptation strategies necessary to strengthen the ability of countries to respond to climate change threats. The agreement increases transparency through country submissions of intended nationally determined contributions, which detail emission reduction strategies and other climate-related action plans and timeframes for adaptation and resilience building (UNFCCC 2018).

changes. Moore (2010) concluded that extreme weather events could affect the Caribbean hotel infrastructure as well as tourist attractions, while on the demand side a change in climatic features could lead to a shift in visitor patterns. In particular, the study determined that in a worst-case scenario, tourist arrivals could fall by about 1% per year, costing the region about US$118 million to US$146 million in lost revenues per annum. The region has experienced boom in arrivals; however, there have been repeated occurrences of devastating hurricanes to which the region is becoming more and more vulnerable as Table 2.2 indicates.

Table 2.2 Major storms in the Caribbean and countries affected: 2010–2017

2010	Tropical Storm Earl	Anguilla
	Tropical Storm Tomas	St. Lucia, St. Vincent and the Grenadines, Barbados
2011	Tropical Storm Ophelia	Dominica
	Tropical Storm Harvey	Belize
	Tropical Storm Irene	Turks and Caicos Islands, Bahamas, Haiti
2012	Hurricane Ernesto	Belize, St. Lucia, St. Vincent and the Grenadines
	Tropical Storm Isaac	Dominica, Haiti, St. Lucia, Bahamas
	Hurricane Sandy	Bahamas, Haiti, Jamaica
2013	Tropical Storm Chantal	Dominica, St. Lucia, Barbados, Haiti, Jamaica
	Tropical Storm Gabrielle	Bermuda
2014	Tropical Storm Bertha	Dominica, Turks and Caicos Islands, the Bahamas
	Tropical Storm Cristobal	Turks and Caicos Islands, the Bahamas
	Tropical Storm Fay	Bermuda
	Tropical Storm Gonzalo	Anguilla, Antigua and Barbuda, St. Kitts and Nevis
2015	Hurricane Danny	Dominica
	Tropical Storm Erika	Dominica
	Hurricane Joaquin	Bahamas, Haiti, Jamaica, Bermuda, Turks and Caicos
2016	Tropical Storm Earl	Belize
	Tropical Storm Matthew	Barbados, St. Lucia, St. Vincent and the Grenadines, Haiti, Dominica, Turks and Caicos Islands, Grenada, Haiti, Jamaica, the Bahamas
	Tropical Storm Otto	Nicaragua
2017	Hurricane Irma	St. Kitts and Nevis, Anguilla, Antigua and Barbuda, Turks and Caicos, the Bahamas, St. Martin/St. Maarten, Bahamas, Cuba, British Virgin Islands, St. Barthélemy
	Hurricane Maria	Dominica, St. Lucia, Turks and Caicos, Barbados, St. Vincent and the Grenadines, Guadeloupe

Source: CCRIF Annual reports; CDEMA Annual reports; Sullivan (2017)

***Voices of the Present*: Joy Jibrilu, Director General, Bahamas Ministry of Tourism**

The countries of the Caribbean and, in fact, the North Atlantic Basin are being threatened by climate change which produces extreme weather events resulting in the loss of habitats and ocean acidification, food scarcity, declining biodiversity, the loss of human talent and destruction of cultural and historical assets in the natural and built environments—all of which produce significant impacts on the tourism industry. The Caribbean is among the most acutely affected regions of the world from climate change, although it is a small contributor to the pollution caused by global greenhouse gas emissions that create extreme weather events.

The 2017 hurricane season produced 17 major storms and 6 major hurricanes and has been the costliest hurricane season on record with a collective $280 billion in damages to affected states. This has captured the attention, not only of Caribbean governments, but the world, further underscoring the importance of the Paris Climate Accord, an agreement signed by 96 member countries of the United Nations Framework Convention on Climate Change (UNFCCC) which set the agenda for the financing of greenhouse gas emissions mitigation, and adaption in the year 2020.

In 2017 tourism-dependent nations of Barbuda, Puerto Rico, St. Maarten, and Dominica were among those decimated by the category 5 Hurricanes Irma and Maria. Skerrit (2017) reported on the devastation thus:

> Our homes are flattened. Our buildings roofless. Our water pipes smashed. And road infrastructure destroyed. Our hospital is without power. And schools have disappeared beneath the rubble. Our crops are uprooted. Where there was green, there is now only dust and dirt. The desolation is beyond imagination.

Projections also indicate that not-so-slowly rising sea levels in the region are a serious threat to low-lying islands such as the Bahamas. Here, sea level rise could lead to displacement of coastal communities, coastal erosion and loss of land, salination of aquifers, and damage or loss of coastal infrastructure, including airports, major roads, and billions of dollars of tourism superstructure (Thomas and Benjamin 2018). Alarmingly, even

1 metre rise in sea level would inundate 80% of the Bahamas, making it one of the most vulnerable Caribbean islands with respect to sea level rise and storm surge (CCCRA 2012).

The Caribbean must also must bear some responsibility for climate change and embrace mitigation approaches where possible. Reducing regional dependence on carbon-based fuels is the first step. There is a symbiotic relationship between tourism and climate change. Tourism can provide important opportunities to reduce the overall vulnerability of communities to climate change through sustainable development in SIDS, and the capacity of the tourism sector to adapt to climate change is thought to be relatively high due to its dynamic nature. According to Joy Jibrilu, Director General of the Bahamas Ministry of Tourism, countries of the region must prioritize the formulation of long-term and coordinated strategies and policies aimed at strengthening resilience in public infrastructure and the built environment (hospitals, harbours, airports, shelters, electricity grid, water treatment and distribution centres, etc.) in order to increase resilience to natural disasters and climate change.

***Voices of the Present*: Hugh Riley, Secretary General & CEO, Caribbean Tourism Organization**

Caribbean governments have demonstrated a generally clear understanding of the effects of climate change by their attention to the warnings of organizations such as the CCCCC, and their engagement with and vocal support of international protocols aimed at encouraging responsible environmental policies and practices. The Inter-American Development Bank (IDB) has also developed a model focused on Smart and Sustainable Islands, which is being promoted. Its emphasis is on low carbon and climate resilient measures to "smarten" the islands and minimize the impending effects of climate change by aggressively promoting sustainable measures in all sectors, including tourism. Plans are now being developed and implemented to assist the region to adopt a smart climate focus to build resilience and reduce vulnerabilities within the sector and more widely. In 2013, the Caribbean Disaster Emergency Management Agency (CDEMA) sought funding to develop a "Disaster Risk Management and Climate Change Adaptation Strategy and Plan of Action for the Caribbean Tourism Sector".

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Any citizen of this region who had misunderstood the effects of climate change on warmer temperatures, rising sea levels, coral bleaching and wildly intensifying weather events, probably got a chance at a clearer understanding when two Category Five hurricanes swept through the region in September 2017 causing widespread death and destruction in a dozen Caribbean countries.

The spate of devastating hurricanes in the region in September 2017 has further highlighted the need for SIDS like the Caribbean states to invest in resilience and to "build back better", using strengthened building standards and codes, and promoting better enforcement of planning regulations after a natural disaster. It is now timely to review and take action related to the 2013 CDEMA Disaster Risk Management Plan (mentioned above) and relevant updates for the sector.

The many complementary initiatives are linked to the United Nations Sustainable Development Goals and integrated into various approaches contained in a Caribbean Tourism Organization Strategic Plan for 2018–2022. The CTO works closely with regional and international partners such as CDEMA, the Caribbean Hotel & Tourism Association and the IDB, to move forward on the sustainable development agenda and its strategic priorities.

The CTO is an advocate of the multi-faceted approach to resilience, totally embracing environmental, socio-cultural and economic resilience. Because tourism is a primary economic driver for most of the Caribbean, reducing that sector's vulnerability is key to protecting the wellbeing of the 40 million people who live in the Caribbean. The CTO strongly believes the Caribbean will continue to be at serious risk as long as the region lacks the capacity to establish 'rainy day' funding mechanisms on which to draw when disaster strikes.

Caribbean governments have realized that climate change adaptation can only be implemented effectively in an integrated policy framework. Coordination between agencies to allow mainstreaming of climate change and sustainable development led to the formation of the Caribbean Disaster Emergency Management Agency (CDEMA) in 1991 (CDEMA 2011). CDEMA is a regional intergovernmental agency for disaster management in the Caribbean Community (CARICOM). The Agency was established initially as the Caribbean Disaster Emergency Response Agency (CDERA)

with primary responsibility for the coordination of emergency response and relief efforts to Participating States that require such assistance. It transitioned to CDEMA in 2009 to fully embrace the principles and practice of Comprehensive Disaster Management (CDM). The agency focuses on all aspects of disaster risk management and takes a comprehensive approach. It addresses both natural and man-made disasters in all sectors and at all stages of disaster management including mitigation, awareness building, prevention, disaster response, and post-impact recovery (Kirton 2013). CDEMA works in conjunction with national disaster offices which have the ultimate responsibility to respond to disasters on a country level. As the frequency and intensity of natural disasters and climate-related negative events increase, regional cooperation and capacity building in disaster risk management become increasingly important.

In addition to the CDEMA, Caribbean governments have met the challenge set out by the Djerba conference, which noted that part of the adaptive strategy and disaster resilience for SIDS should include disaster-specific insurance schemes. In 2007, the Caribbean Catastrophe Risk Insurance Facility (CCRIF) (CCRIF 2010) was formed as the first multi-country risk pool in the world, and was the first insurance instrument to successfully develop parametric policies backed by both traditional and capital markets. It was designed as a regional catastrophe fund for Caribbean governments to limit the financial impact of devastating hurricanes and earthquakes by quickly providing financial liquidity when a policy is triggered. CCRIF helps to mitigate the short-term cash flow problems small developing economies suffer after major natural disasters. CCRIF's parametric insurance mechanism allows it to provide rapid payouts to help members finance their initial disaster response and maintain basic government functions after a catastrophic event. Since the inception of CCRIF in 2007, the facility has made 36 payouts to 13 member governments on their tropical cyclone, earthquake, and excess rainfall policies, totalling US$130.5 million, as illustrated in Table 2.3.

Jamaica is also spearheading the development of the Global Centre for Tourism Resilience and Crisis Management, which is envisioned to spearhead proactive measures to ensure that tourism-dependent nations develop strategies to mitigate against climate change and remain open for tourist business after natural disasters. Specific countries have also made efforts to mainstream adaptability into their tourism policy frameworks. In Tobago where climate change is impacting water management due to increased and longer droughts, small-scale structural adaptations have

Table 2.3 CCRIF payouts: 2007–2017

Event	*Country affected*	*Payouts (US$)*
Earthquake, November 29, 2007	Dominica	528,021
Earthquake, November 29, 2007	St. Lucia	418,976
Tropical Cyclone Ike, September 2008	Turks and Caicos Islands	6,303,913
Earthquake, January 12, 2010	Haiti	7,753,579
Tropical Cyclone Earl, August 2010	Anguilla	4,282,733
Tropical Cyclone Tomas, October 2010	Barbados	8,560,247
Tropical Cyclone Tomas, October 2010	St. Lucia	3,241,613
Tropical Cyclone Tomas, October 2010	St. Vincent and the Grenadines	1,090,388
Tropical Cyclone Gonzalo, October 2014	Anguilla—Excess Rainfall Policy	493,465
Trough System, November 7–8, 2014	Anguilla	559,249
Trough System, November 7–8, 2014	St. Kitts and Nevis	1,055,408
Trough System, November 21, 2014	Barbados	1,284,882
Tropical Storm Erika, August 27, 2015	Dominica—Excess Rainfall Policy	2,402,153
Earthquake, June 9, 2016	Nicaragua	500,000
Tropical Cyclone Earl, August 2016	Belize—Excess Rainfall Policy	261,073
Tropical Cyclone Matthew, September 2016	Barbados	975,000
Tropical Cyclone Matthew, September 2016	Barbados—Excess Rainfall Policy	753,277
Tropical Cyclone Matthew, September 2016	St. Lucia—Excess Rainfall Policy	3,781,788
Tropical Cyclone Matthew, September 2016	St. Vincent and the Grenadines—Excess Rainfall Policy	285,349
Tropical Cyclone Matthew, October 2016	Haiti	20,388,067
Tropical Cyclone Matthew, October 2016	Haiti—Excess Rainfall Policy	3,020,767
Tropical Cyclone Otto, November 2016	Nicaragua	1,110,193
Tropical Cyclone Irma, September 2017	St. Kitts and Nevis	2,294,603
Tropical Cyclone Irma, September 2017	Anguilla	6,529,100
Tropical Cyclone Irma, September 2017	Anguilla—Excess Rainfall Policy	158,823
Tropical Cyclone Irma, September 2017	Antigua and Barbuda	6,794,875
Tropical Cyclone Irma, September 2017	Turks and Caicos Islands	13,631,865
Tropical Cyclone Irma, September 2017	Turks and Caicos Islands—Excess Rainfall Policy	1,232,767
Tropical Cyclone Irma, September 2017	The Bahamas—Excess Rainfall Policy	234,000
Tropical Cyclone Maria, September 2017	Dominica	19,294,800
Tropical Cyclone Maria, September 2017	Dominica—Excess Rainfall Policy	1,054,022
Tropical Cyclone Maria, September 2017	St. Lucia—Excess Rainfall Policy	671,013
Tropical Cyclone Maria, September 2017	Turks and Caicos Islands	419,372
Tropical Cyclone Maria, September 2017	Barbados—Excess Rainfall Policy	1,917,506
Tropical Cyclone Maria, September 2017	St. Vincent and the Grenadines—Excess Rainfall Policy	247,257
Rainfall event, October 18–20, 2017	Trinidad and Tobago	7,007,886
Total for the Period 2007–2017		**130,467,630**

Source: CCRIF (2017)

been implemented by individual accommodation providers and tour operators, which include retrofitting buildings with rainwater collectors, increasing storage tank capacity, converting toilets to saltwater supply, and adding diesel-powered desalination capacity. Importantly, water conservation education for employees and guests is practised in hotels and attractions as well as revised landscaping practices and limited use of pools.

Between 2009 and 2012, the Caribbean Carbon Neutral Tourism programme was piloted in the Bahamas and Belize. The programme assessed the carbon footprint of the tourism sector and evaluated approaches that could effectively reduce that footprint. It also served to identify and develop financial mechanisms able to effectively establish a carbon-neutral tourism product in the Caribbean. Finally, it prepared a programme to access climate financing to be used to integrate climate resilience in the tourism sector (Trotz 2014).

In order for the region to maintain its coveted place among the world's travellers in the face of climatic shifts that threaten to weaken the fabric of the industry, a multifaceted approach must be undertaken which includes the following, as illustrated in Table 2.4. "Soft" coastal protection needs to be undertaken to prevent erosion. These measures include reforestation of mangroves and reef protection. Importantly, integration of climate change factors into regulatory frameworks for tourism development need to be top priority, such as Environmental Impact Assessment for tourism infrastructure and establishments. Efforts need to be placed on reducing tourism pressures on coral reefs by protecting specific areas from swimming, scuba diving, and related water sports. To combat the more harmful effects of extended droughts, accommodations must be mandated to employ water conservation techniques, such as rainwater storage, the use of water-saving devices, or waste water recycling.

Any sustainable plan for climate change resilience must develop practical response plans including water supply planning (in drought-susceptible destinations) and risk assessment and preparedness strategies, and implement early warning systems (particularly for flooding). Training programmes which will build capacity are also key to improving adaptive capacity of authorities and managers of protected areas, especially in biodiversity hotspots of SIDS. Capital also has to be allocated to establish scientific monitoring survey programmes to assess ecosystem changes and take necessary protection measures. Tangible and accessible Codes of Ethics also need to be implemented in a multi-sectorial approach, which would provide a checklist or criteria that a hotel chain can provide to its

Table 2.4 Possible adaptation measures for tourism in small island countries and barriers to implementation

Adaptation measures	*Relevance to tourism*	*Barriers to implementation*	*Measures to remove barriers*
"Soft" coastal protection	Many valuable tourism assets at growing risk from coastal erosion	Lack of credible options that have been demonstrated and accepted	Demonstration of protection for tourism assets and communities
Enhanced design, siting standards, and planning guidelines	Many valuable tourism assets at growing risk from climate extremes	Lack of information needed to strengthen design and siting standards	Provide and ensure utilization of targeted information
Improved insurance cover	Growing likelihood that tourists and operators will make insurance claims	Lack of access to affordable insurance and lack of finance	Ensure insurance sector is aware of actual risk levels and adjusts premiums
Shade provision and crop diversification	Additional shade increases tourist comfort	Lack of awareness of growing heat stress for people and crops	Identify, evaluate, and implement measures to reduce heat stress
Reduce tourism pressures on coral	Reefs are a major tourist attraction	Reducing pressures without degrading tourist experience	Improve off-island tourism waste management
Desalination, rainwater storage	Tourist resorts are major consumers of fresh water	Lack of information on future security of freshwater supplies	Provide and ensure utilization of targeted information
Tourism activity/ product diversification	Need to reduce dependency of tourism on "sun, sea, and sand"	Lack of credible alternatives that have been demonstrated and accepted	Identify and evaluate alternative activities and demonstrate their feasibility
Education/ awareness raising	Need to motivate tourism staff and also tourists	Lack of education and resources that support behavioural change	Undertake education/awareness programmes

Source: Becken, S. and Hay, J. (2007), as cited in UNWTO (2008)

suppliers/providers, to help them perform their services to the sector in an environmentally respectful manner.

The adaptive capacity of tourists also needs to be considered in climate change planning and programme development. For instance, travellers who focus on ecotourism are notably eco-conscious and should be targeted for mitigation and "green" options during the trip which focus on conservation and preservation of natural resources. Measures such as these not only reduce or remove external stresses such as pollution, but also ensure

that tourists feel a part of the process of climate change mitigation rather than having strict measures imposed from external stakeholders. Similarly, active participation of local communities living within or near protected areas in policymaking and management processes is critical to securing buy-in for mitigation strategies and to increase the chances of success of such programmes. Tour operators could play a central role in mitigation, through their capacity in influencing the whole tourism supply chain, and shape demand patterns. They, thus, could play a role in customers' awareness raising and soft mobility product development. Compared to the transport sector, tour operators and travel agents are probably less sensitive to the possible impacts of mitigation policies: they sell complete products where travel forms part of a complex holiday experience, well-being, and pleasure. Innovation is a key factor for effective and timely adaptation.

Naturally, the use of alternative fuels (e.g., biodiesel) and renewable energy sources (e.g., wind, photovoltaic, solar, thermal, geothermal, biomass, and waste) is an important macro strategy that Caribbean SIDS must consider if they are serious about reducing carbon emissions. Integrated emission management (including supply chain management) and wider environmental management awareness raising among the population on recycling are key. This essentially means that tourism policy planners must move outside of tourist-centric spaces to ensure that the wider population practises wholesome techniques which will reduce Caribbean SIDS' negative impact on the environment. To this end, for instance, the Tourism Product Development Company in Jamaica, responsible for all areas of diversification of the tourism offering, is an avid partner in recycling education efforts towards maintaining an ecologically sustainable tourism product. Since 2017, the company has embarked on an island-wide campaign and school competition in partnership with Recycling Partners of Jamaica to encourage children to collect plastic bottles. The initiative also educates children about how plastics may be reused. The most recent competition in 2018 was expanded to include the entire community of Treasure Beach in St. Elizabeth and saw great support from the local population.

In the final analysis, Caribbean tourism interests must be applauded for responding to the very real threat that climate change poses to the viability of the sector. However, more must be done to promote and undertake investments in energy efficiency tourism programmes and the use of renewable energy resources, with the aim of reducing the carbon footprint of the entire tourism sector. We must strive to conserve biodiversity,

natural ecosystems, and landscapes in ways which strengthen resilience to climate change and ensure a long-term sustainable use of the environmental resource base of tourism. Very often, plans are stymied by the transversal nature of the tourism sector which makes coordination difficult (e.g., interministerial, public-private-community relationships). In a region where SIDS are competing for tourist attraction, it is easy to operate in a framework of fragmentation. However, unity is the only method for survival. The impact of climate change on tourism is everyone's business, because tourism is everyone's business.

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