



Territorial analysis: Resilience to climate change at a glance

THE BRITISH VIRGIN ISLANDS

KEY MESSAGES

Climate change risks



Temperatures will continue to rise. Further intensification of the hot season, high to extremely high heat impact potential by 2030, along with more frequent and more intense heat waves. The number of extreme heat events will increase roughly 15-fold by the 2020's and become a nearly year-long occurrence by the 2040s.

Major hurricanes: The frequency of category 4 and 5 hurricanes is expected to increase by 25%–30%. Storms are likely to become 2% to 11% stronger in terms of maximum wind speeds and possibly more frequent.

Continued sea level rise of 11 to 25cm. Rising sea levels combined with stronger winds during the strongest storms substantially increase the potential impact of storm surge and coastal inundation.

Warmer oceans along with steadily rising sea levels, even if global warming is halted in the foreseeable future. Trends in sea surface conditions include a projected rise of 0.77°C to 2.5°C by the end of the 21st century.

Rainfall: Changes in precipitation are more difficult to project; a slight decrease in total rainfall is anticipated, while single rain events will become more intense. Rainfall rates inside hurricanes could increase by up to 30%, increasing flash flood potential.

Droughts will become more prevalent. However, the trend may only become a major issue from the 2050s onwards.

Summary of key socio-economic indicators for The British Virgin Islands

Total Area (square km)	151
Population	37,381
Percent Urbanization	48.5
GDP per capita	US\$34,200
Debt as a percent of GDP	N/A
Unemployment Rate	2.9
Services as a percentage of GDP	93
Services as a percentage of workforce	59
Agriculture as a percentage of GDP	0.2
Agriculture as percentage of workforce	1
Percent Agriculture Land	46,7
Percent Forests	24.3
Human Development Index	N/A

Map of BVI



Figure 1: www.lonelyplanet.com

OVERVIEW

The British Virgin Islands (BVI), officially the Virgin Islands, is a British Overseas Territory located in the northwestern-most portion of the **Leeward Islands** of the **Lesser Antilles Island chain**. The BVI are centred on 18°30' N and 64°30' W and comprise four main islands, namely Tortola, Virgin Gorda, Anegada and Jost Van Dyke, alongside over 50 smaller islands and cays of which 11 are inhabited. The population is 29,151 (according to a 2009 census) of which 23,500 live on Tortola, on which the capital, Road Town, is situated. Tortola is approximately 20 km long and 5 km wide. Terrain varies from nearly flat in Anegada, to hilly in the majority of islands.

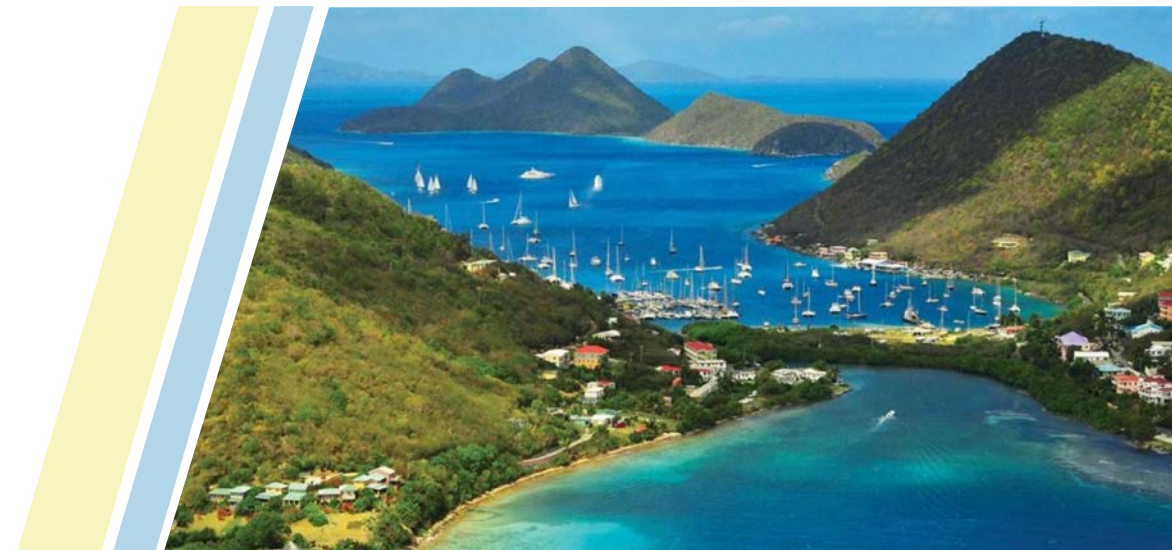
Most islands are volcanic, with the exception of Anegada, rendering soils potentially fertile. However, the rugged topography prevents major agricultural practice. Anegada, a coral island.

As part of the northern Leeward Islands, the BVI are well exposed to trade winds, which keeps temperatures moderate at around 26.5°C.

Based on data from surrounding countries in the Leeward Islands, the heat season (May to October) is characterized by around 36 hot days (when day-time high temperature are above 32°C) and 33 hot nights (with night-time lows above 26°C) on average, as well as, by several heat waves. During the cool season (December to March), heat levels are comfortable and around 31 cool nights (with lows below 22°C) occur on average.

The wet season spans May to November, largely coinciding with the Atlantic Hurricane Season. The mean annual rainfall total is around 1100 mm.

Based on data from surrounding countries in the Leeward Islands, extreme rainfall has the potential to trigger flash floods once every 3 years in the period April to May and nearly once per year between August and November. By contrast, in smaller, more flat islands within the OECS region, spells of seven consecutive dry days occur throughout the year, peaking in frequency during January to May, potentially limiting rainfed crop growth to the wet season. Finally, impactful drought occurs roughly every 4-5 years during the dry season, and roughly every 10-12 years during the wet season, potentially impacting on fresh water availability for local communities.



BRITISH VIRGIN ISLANDS ONE YEAR AFTER HURRICANE IRMA
Source: *Global travel Industry News*

CLIMATE TRENDS AND PROJECTIONS

OECS, with CIMH, undertook an extensive analysis of the current trends and future projections of climate for the region was based on data from various meteorological services across the region, as well as future projections from regional circulation models (RCMs) developed by the Climate Studies Group of the University of the West Indies. In terms of priorities of relevance for the Leeward Islands, these climate trends and projections (across a range of emissions scenarios: a low (Representative Concentration Pathway 2.6 – RCP2.6), mid-range (RCP4.5) and high (RCP8.5)), (see details page 8) point to the following risks.

PROJECTED HEAT TRENDS

Figure 2 shows that the increase in frequency of hot days and nights in the Leeward Islands is further accelerated into the 2020s, when frequency is eight-fold, to end up close to a 100% of all days in the year in most years during the 2040s. However, given the recent observed increase rate appears to be somewhat slower for hot days and hot nights, one might expect a delay in reaching a near 100% frequency.

For **cool days and nights**, one can see that, from a 1961-1990 model baseline of 10% frequency, a decrease of over 75% was already noted by 1981-2010. This compares to observed decrease rate of over 60% for cool days and over 40% for cool nights.

Cool days and nights become virtually absent from the projected future as early as the 2020s.

Finally, looking at the number of days spent in **heat waves** of at least six consecutive days (the so-called warm spell duration index or WSDI), a remarkable increase is noted across all three scenarios, as well as, in the observations.

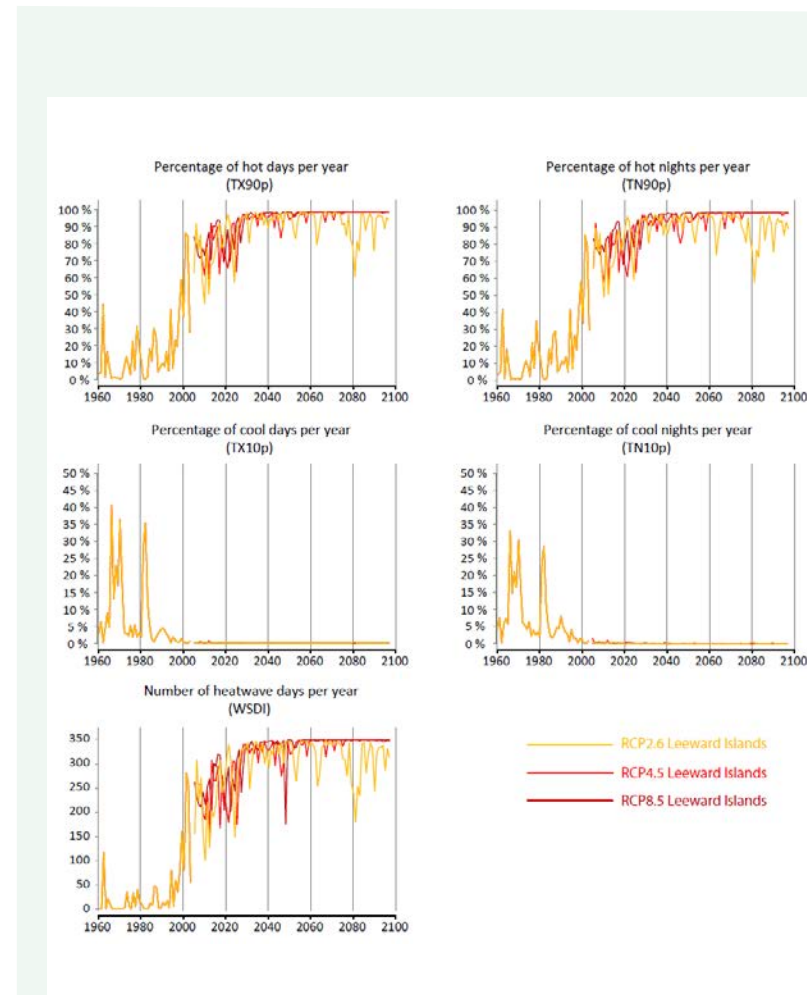


Figure 2

In the Leeward islands: Simulated annual trends in the percentage of hot days (TX90p, top left), hot nights (TN90p, top right), cool days (TX10p, middle left) and cool nights (TN10p, middle right) per year, as well as, trends in the annual number of heatwave days during long heat waves of at least six consecutive days (WSDI, bottom) from three downscaled projections.

Whereas the simulated baseline period only recorded 18 such heatwave days per year on average, the numbers had already increased fivefold by 1981-2010 to further increase roughly 15-fold by the 2020s and becoming a nearly yearlong occurrence by the 2040s.

It should be stressed that the strong simulated trends in the heat-related indices after around 1980 only corresponds well qualitatively with the strong observed trend. However, even with the downscaled projections overestimating the actual trends, hot days and hot nights will likely occur during most days of each year by mid-century, while cool days will likely disappear much sooner. Unfortunately, this committed future change seems to be mostly unavoidable, because the conclusion is valid no matter what RCP scenario is considered.

EXTREME RAINFALL

Projected Changes in Extreme rainfall

There are no clear signals in projected trends of extreme rainfall Figure 3. The year-to-year variability exceeds by far the long-term trend in both the proportion of annual rainfall totals from extremely wet days (R95pTOT) and the number of days with heavy rainfall (R10mm). While the former appears to increase over time in all three scenarios, the R10mm decreases in both RCP4.5 and RCP8.5. However, if both trends do manifest, this means extreme rainfall will become less frequent, but even more intense. This means that the **potential for flash flooding** and related hazards may increase throughout the 21st Century, though changes may be hardly detectable by the 2020s and 2040s.

An indication of such increasing flash flood potential towards 2100 comes from the fact that the RCP8.5 systematically projects fewer years

with at least 5 days with heavy rainfall than RCP4.5 during the second half of the Century. The same is apparent when comparing RCP4.5 to RCP2.6. Indeed, the period 2050 to 2089 contains 19 years with at least 5 days with heavy rainfall in RCP2.6, versus 16 in RCP4.5 and only 10 in RCP8.5.

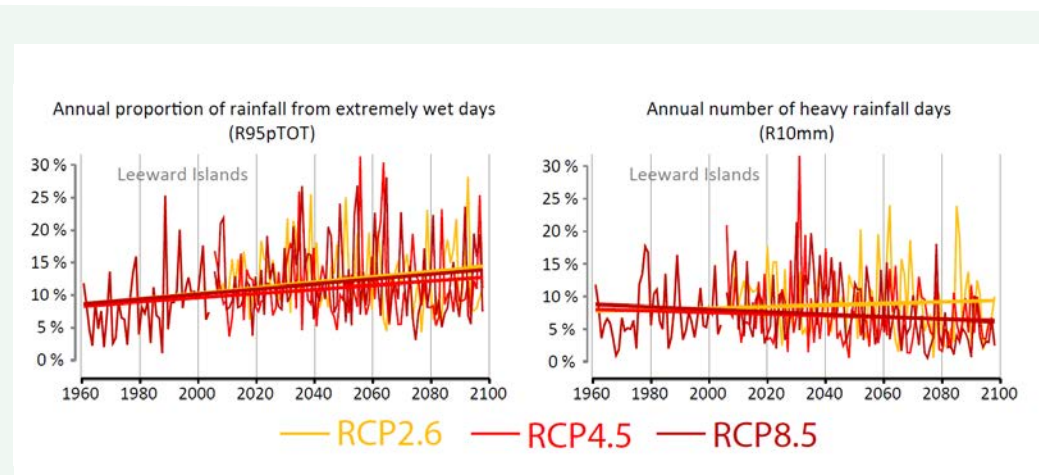


Figure 3

For the Leeward Islands: Simulated annual trends in the percentage of the rainfall total from extremely wet days (i.e. days with rainfall above the 95th percentile only (Rp95TOT, left), the number of days with heavy rainfall (i.e. with at least 10 mm of rainfall – R10mm, right). Also plotted are the simulated trends in the duration (in days) of the longest dry spell (CDD, bottom). The results are shown for the RCP2.6, RCP4.5 and RCP8.5 downscaled projections.

Notes: The absence of significant simulated trends in Rp95TOT and R10mm indicates that flash flood potential may not significantly change in future. Also plotted are the simulated trends in the duration (in days) of the longest dry spell (CDD, bottom). The results are shown for the RCP2.6, RCP4.5 and RCP8.5 downscaled projections. Data source: projections provided by the Climate Studies Group Mona of the University of the West Indies – Mona Campus, Jamaica

DROUGHT

This hazard, while physically dependent on both rainfall and evapotranspiration rates, is of lesser concern in the wetter islands with complex topography than in drier, low topography areas of the OECS region. Where water consumption is intense due to high population density or high consumption by the islands' industries, the sensitivity of the environment and society is significant.

Rainfall-Based Drought Indices

Meteorological drought can be defined as a deficit of rainfall over a period of several weeks to years.

When drier than normal conditions are significant and extend long enough to reduce the amount of available soil moisture, this can lead to crop wilting. Such droughts are called agricultural drought. If drought extends long enough to affect streams, rivers and water reservoirs above and below ground, one can refer to such droughts as hydrological drought. With reduced freshwater availability during prolonged hydrological drought, other socio-economic sectors start being affected, e.g. firefighting, household water provision, construction, tourism, etc. Such drought may be referred to as socio-economic drought. Typically, reduced soil moisture and reduced flow in streams and small rivers takes anywhere between a number of weeks and about 6 months of rainfall deficits – i.e. **short-term drought** – to manifest. After 6 months of significant meteorological drought, stream flow in larger rivers and water levels in large reservoirs becomes affected. Finally, after about 9 to 12 months of rainfall deficits – i.e. **long-term drought** –, water levels in the largest surface reservoirs and in aquifers tend to lower and stream flow in the largest rivers tends to decrease.

Hence, a proxy for the different types of droughts should account for the different timescales involved. Furthermore, it should be scalable to the national context of water management. Its calculation should be possible given the climate record available within the territory. One such proxy, recommended by the WMO is the Standardized Precipitation Index (SPI, McKee et al., 1993). The SPI is calculated as a normalized precipitation anomaly over 1 month to 48 months. Given that most droughts in the OECS are seasonal in nature, the most relevant indices are SPIs calculated over three-month (SPI-3), six-month (SPI-6) and twelve-month (SPI-12) periods. However, it is possible for rainfall deficits to exceed 12 months as was the case during the 2014 to 2016 Caribbean drought.

HEAT - AN UNDERESTIMATED HAZARD

Air temperature does not vary much between seasons and years in BVI. The heat – being moderated by a prevalent easterly breeze – has **historically** not been regarded as a major hazard but a discomfort at times. However, with rising temperatures year-round, a more pronounced heat season with more frequent and intense heatwaves are becoming a **new norm**. Heat discomfort and heat stress has started affecting society and the environment. Important impacts (supported by research findings from around the world, including tropical regions and, where references are given, Caribbean countries) are the following ones:

Human health: increased heat-related mortality and morbidity (suspected, but not measured in the territory – note that heatwaves are the deadliest weather-related

hazard), in particular in persons with lower fitness; increased apathy and aggression; accelerated proliferation of vector borne diseases such as Dengue, etc. (e.g. Lowe et al., 2018).

Education: children's learning ability significantly decreases with increased heat exposure.

Energy: increased cooling demand and reduced efficiency in energy production.

National productivity: loss of hundreds of man hours.

Environment: exacerbation of drought; facilitation of wildfires; stress on animal populations.

Food security: crop failure due to wilting; severe heat stress related mortality and morbidity in livestock (e.g. Lallo et al., 2018).

Finally, because freshwater availability from soils and surface reservoirs can be reduced due to enhanced evapotranspiration rates relative to rainfall, a similar index called the Standardized Precipitation Evapotranspiration Index (SPEI, Vicente-Serrano et al., 2010) can be very useful in monitoring drought. The index is constructed in the same way as the SPI and can therefore be calculated over any relevant time period (e.g. SPEI-3, SPEI-6 and SPEI-12). However, it offers the advantage of calculating a balance between rainfall (i.e. local water input onto the surface) and evapotranspiration (i.e. local water output from the surface).

Projected Changes in Drought

Projected trends in drought are shown in Figure 4 for RCP4.5 and RCP8.5) from 2020 to 2090. Aside from a marked increase in heat exposure, the future projections also indicate that **drought will become more prevalent**. However, the trend may only clearly manifest from the 2050s onwards. An SPI value of around 0 is expected on average if rainfall totals are not changing from the 1961-1990 model climatology. In the RCP4.5 projection the SPI-6 shifts from close to 0 in the 2020s and 2030s to -0.6 and the SPI-12 from 0 to -1.4 – the latter value falling in the very dry category – in the 2070s and 2080s. Over the same periods in RCP8.5, the SPI-6 shifts from near 0 to -0.8 – moderately dry – and the SPI-12 from near 0 to -1.8, or **extremely dry on average** in the 2070s and 2080s. Those significant trends stand out even with the large interannual variability in both the SPI-6 and SPI-12.

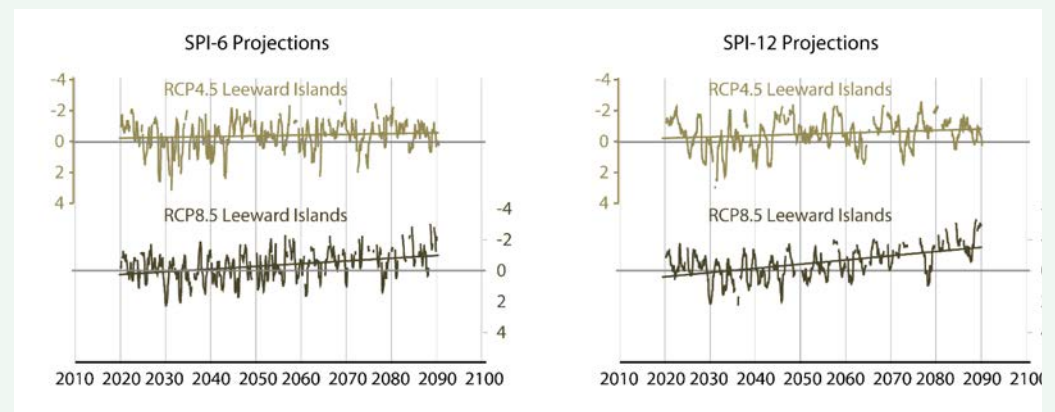


Figure 4

For the Leeward Islands: Simulated trends in the standardized precipitation index over six months (SPI-6, left) and twelve months (SPI-12, right) per year from the RCP4.5 and RCP8.5 downscaled projections.

Data source: projections provided by the Climate Studies Group Mona of the University of the West Indies – Mona Campus, Jamaica

EXTREME WET SPELLS - A PROXY FOR FLASH FLOOD POTENTIAL

The copious rainfall of BVI occurs when spells of intense showers occur in a rapid succession over a small number of days and associated with weather disturbances. The recurring heavy rains during such wet spells can be beneficial for replenishing major water reservoirs. However, extremely intense showers often lead to flash flooding.

Flash floods occur when the rainfall accumulation rate exceeds the rate of soil infiltration and surface drainage. There are rainfall thresholds beyond which the occurrence of wet spells correlates well with the occurrence of flash flood across much of the Caribbean. Caribbean-wide, such extreme wet spells are defined as a three-day period during which the rainfall totals are among the top 1% (i.e. exceed the 99th percentile) of all three-day rainfall totals in the historical record at a weather station (CSGM and CIMH, 2020).

While the flood record is incomplete and the number of recorded floods too low for robust statistical analysis, the use of extreme wet spell occurrence as a proxy for flash flood potential is validated regionally by similar findings in countries with a much larger sample of floods.



FUTURE CLIMATE PROJECTIONS - THE USE OF SCENARIOS AND CLIMATE MODELS

The most widely used tools to assess and simulate future or projected climates are **Global Climate Models** (GCMs, in academic circles referred to as General Circulation Models or Earth System Models). Such models can simulate to a great level of detail and reasonable accuracy how climate would behave around the world provided a scenario of socio-economic evolution or external physical factors would affect the energy balance of the earth's climate system. Three commonly used scenarios are the **RCP2.6** (a scenario based on a low carbon emissions future), **RCP4.5** (medium level of emissions) and **RCP8.5** (high emissions), elaborated by the Intergovernmental Panel on Climate Change (IPCC).

The major advantage of GCMs for the purpose of assessing how climate may change through time in future, is that they provide a **full spatio-temporal coverage** of earth's atmosphere. However, for the purposes of small island states in the OECS region, the spatial resolution is **far too coarse** to allow rigorous sub-regional analysis of future heat, drought and climate extremes. Island sub-regions such as the OECS are better served by **Regional Climate Models** (RCMs), which offer finer spatial resolutions. Among the CMIP-5 generation of projections run by a multitude of different GCMs and used in the IPCC's Fifth Assessment Report and many studies thereafter is the HadGEM2 GCM. To enable sub-regional analysis of trends in extremes, downscaled simulations can be performed using the **PRECIS regional climate** model.

Climate change may put pressures on our societies and environments by shifting them closer to or beyond the thresholds of their coping ranges. Therefore, climate projections are conceived to help provide the **scientific evidence base** for societies to adapt to climate change in future and hence build climate resilience for future generations. Such projections provide necessary insight to support **long term planning** for infrastructure, societal activities and the protection of environmental resources. In this climate profile, a special emphasis will be placed on two-time horizons: a **short-term horizon**, namely the 2020s (relevant within the current political context), and a **mid-term horizon**, namely the 2040s, relevant for infrastructure planning and many other societal and environmental systems.



SOCIOECONOMIC CHARACTERISTICS

Population

The most recent census for The British Virgin Islands was in 2010 where the population was recorded to be 28,054. The data showed that 83% (or 23,419 persons) resided on the island of Tortola; 14% (or 3,930 persons) resided on Virgin Gorda; 1% (or 285 persons) resided on Anegada and another 1% (or 298 persons) on the island of Jost Van Dyke. The remaining islands and cays along with persons living on yachts accounted for less than 1% (or 122 persons) of the total population (Government of British Virgin Islands, 2010). The overall population percentage of males were 49.3% and females were 50.7%. The World Bank has estimated that the population would have increased to 29,802 persons in 2018 (World Bank, 2018).

Main Economic Drivers

The British Virgin Islands gross domestic product (GDP) in 2014 was estimated to be US\$934 million. The two main sectors are tourism and international business & finance. Tourism accounts for one in every four jobs while the international business and finance accounts for one in ten (Capital Economics, 2017). Figure 5 shows the GDP contribution by sector.

Tourism

The BVI had over 1.1 million visitors in 2016, which is a 22% increase from the previous year. Of these, 62% were cruise ship passengers, mainly from the United States, which means they do not typically stay overnight. Whereas overnight visitors, usually on charter boats, accounted for one third (406,000) of the total visitors, which is the highest BVI has ever recorded. The total visitors Page 19 sur 97 in 2015 spent an estimated US\$484 million, which is equivalent to 54% of the BVI's gross domestic product (Capital Economics, 2017).

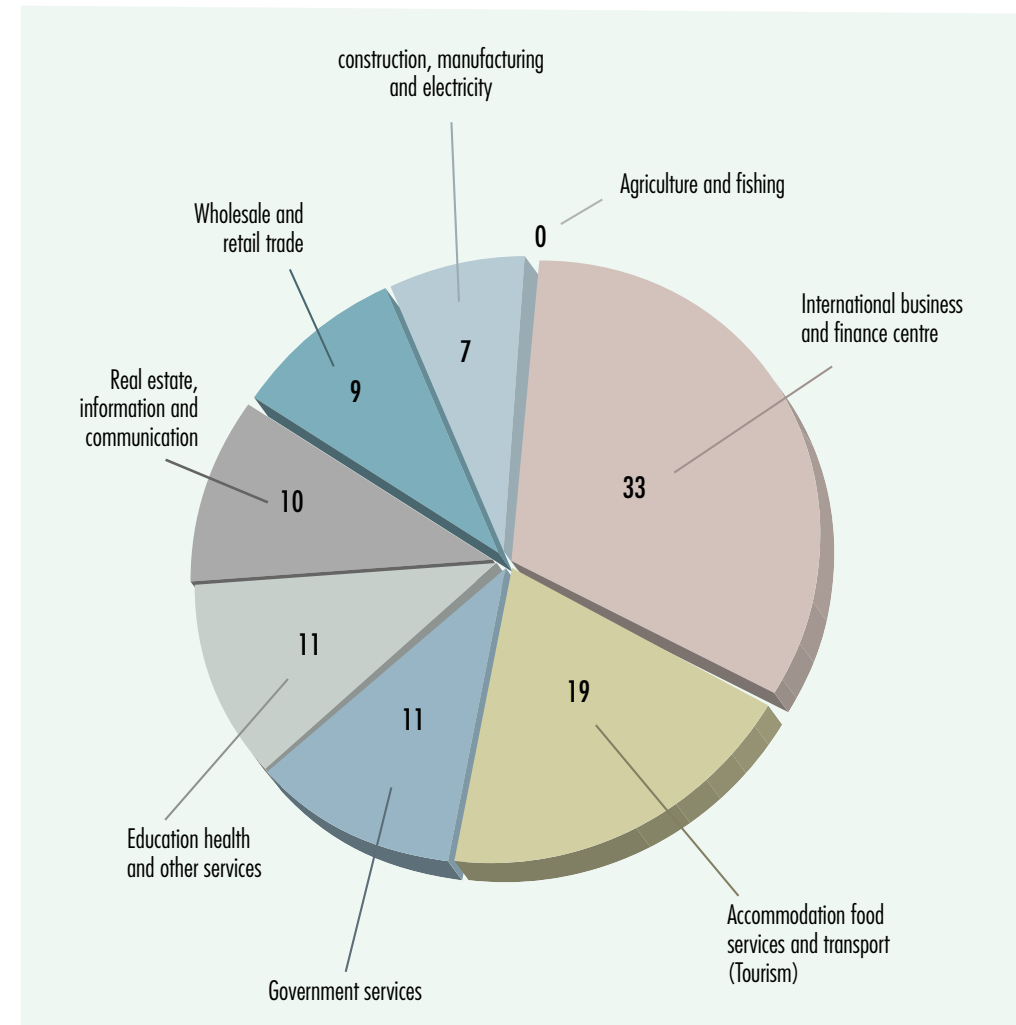


Figure 5: Gross value added (%) by sector for 2014 (Capital Economics, 2017)

Energy

There is only one enterprise that provides electricity to the larger islands of BVI, which is state owned, called British Virgin Islands Electricity Corporation. They serve over 15,000 customers, with their eleven diesel fired generators. Residents on smaller islands are able to produce their own electricity subject to regulation by the BVI government (Capital Economics, 2017).

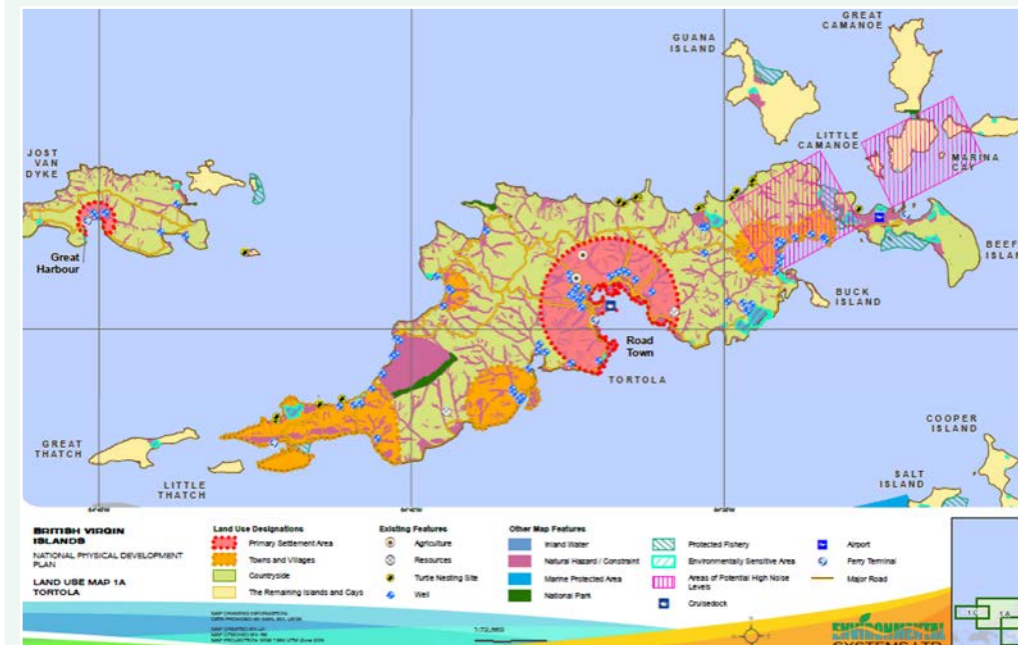
Transport

Each of the main islands has its own internal road network. Tortola has two main roads from east to west and another connecting the island to Beef Island. There are regular ferry services which connect the inhabited islands together, as well as to its neighbouring countries such as the US Virgin Islands. The airport is called Terrance B. Lettsome Airport which is located on Beef Island (which is connected by road bridge to Tortola) provides international air connections, with regular flights to many regional cities (Capital Economics, 2017). There are also smaller airports on the islands of Virgin Gorda and Anegada, that offer direct flights to San Juan and Saint Thomas, seaplane services, and private charter flights.

Land use

Of the 60 islands in BVI, only 15 are inhabited. The land use for the islands inhabited varies from island to island due to the shape of the steep terrain, access to roads and marine areas, therefore large portions of the islands are underdeveloped as a result.

LAND USE IN BRITISH VIRGIN ISLAND



Agriculture

Agriculture GDP contribution is almost non-existent, mainly due to the poor soil quality and steep slopes among the islands, and therefore limits the country's domestic food production. The most important agricultural activity is therefore livestock rearing. The annual domestic agricultural production is approximately 850 tons, which includes beef, sheep, goat, pork, fruits and vegetables: with the main crops being banana, sweet potato and cassava (FAO, 2001).

Health

Public primary health care services are provided from 10 health centres and 4 health posts, and public secondary care is provided at the Peebles Hospital. There is also a well-developed private health care system that includes a private hospital. In 2015, 88 physicians were registered and actively practicing, 45 of these worked in the public sector. There were also 13 dentists working in the territory, with only 2 in the public sector. There were 207 nurses registered to practice, and 162 worked in the public sector (PAHO, 2017).



VULNERABILITY OF SECTORS AND TERRITORIES TO CLIMATE RISKS

WATER RESOURCES

The trend indicating a decrease in the extents of water-related ecosystems is observable in all OECS member states (except Grenada) that report information on SDG 6 achievements. In terms of water stress, the most critical situation is currently observed in St. Kitts and Nevis with a water stress index of 51%, followed by St. Lucia with an index of 14%. The rest of the islands are not under critical water stress, although the current situation can change drastically with the impacts of climate change mainly affecting water resources. There is still a lack of information concerning the impacts of climate change on water resources in OECS Member States, as well as on the identification of possible conflicts of use that may occur in the future if climate change further affects water resource systems resulting in increased scarcity. Nevertheless, some of the Eastern Caribbean islands are already water-stressed for at least part of the year. Some of them currently rely heavily on desalinization or unsustainable abstraction of groundwater resources, especially to serve the tourism industry. Changes in temperature, rainfall and extreme events will inevitably lead to reductions in water availability and quality, as a result both of damage to service infrastructure and reduced water quality through siltation of streams and rivers via landslides and destructive floods.

AGRICULTURE AND FOOD SECURITY

Agriculture is a critical sector in the economies and livelihoods of many of the countries in the Eastern Caribbean, although the region relies heavily on food imports to meet local needs, at a significant cost. The sector comprises primarily rain-fed, small-scale subsistence farms growing multiple crops such as yams, sweet potatoes, and various vegetables such as peppers. There are also some large commercial farms focused on

export crops such as banana and plantain, coconut, citrus, mango, and avocado. Speciality crops such as nutmeg, cinnamon, ginger and cloves are also important export earners for some islands such as Grenada. Other important grown crops are tropical fruit, coconut, cocoa, vegetables, herbs, tree crops and cut flowers.

Livestock production, likewise, is a basic source of food security for local populations in the Caribbean. Cattle, pigs, chickens, and goats are widely produced across the region, as are dairy foods. The sector is integral to rural livelihoods, providing food, materials, income and mechanical power for pulling carts and ploughing fields. Most of the livestock production follows a similar dynamic to that of agriculture, with small-scale subsistence and commercial producers catering primarily to a domestic market. However, recent efforts to diversify the agricultural industry in response to climate change and global markets have supported livestock exports.

Fisheries will be severely impacted by climate variability and change, as the associated impacts of rising seas and extreme weather events alter the productivity of aquatic habitats and the distribution and productivity of marine fish species. These changes are threat multipliers to existing stressors on the sector, including overfishing, loss of habitat, pollution, coral bleaching, and the proliferation of invasive species. See also the coastal resources section.

TOURISM

Tourism is essential to the economy of the Eastern Caribbean, contributing substantially to territorial GDP and serving as a source of employment across the region. Tourism relies on critical, government-owned infrastructure

such as airports and seaports serving travel between islands, as well as on coastal communication systems, utilities and roads. Tourism also depends on a range of privately-owned infrastructure, including hotels and other beach infrastructure as well as boats for ocean activities and vehicles for land transportation. All this infrastructure is vulnerable both to rising sea levels and damage from floods and storm surge, and more directly to the impacts of hurricanes and other extreme events.

COASTAL RESOURCES

Coastal zones in the Eastern Caribbean are all highly vulnerable to changes brought about by climate-change forces such as rising sea levels, warming ocean temperatures, increasing ocean acidity, and the impact of storms. Rapid coastal erosion and increased salinization of coastal areas, as well as impacts on coral bleaching, have immediate impacts. Vulnerability is also increased through inappropriate land use planning and badly designed coastal works such as structures built right on the coast, too close to the beach, hard longitudinal coastal defences on upper beaches (seawalls, revetments), hard cross-shore coastal structures (jetties, groynes), and reclamation of wetlands and mangroves. Built infrastructure, including roads, settlements, hotels and coastal defences, as well as sand mining and other resource extraction and coastal activities have jeopardized the coast and contributed to the destruction of important living resource systems, such as coral reefs, mangroves and seagrass beds (see also the section on food security).

The major future impacts of sea level rise facing the OECS region include coastal erosion, reduction of land space - including urban space - near

coastlines, and saline intrusion into soils and aquifers. Forecasts of coastal erosion impacts on tourism activity within CARICOM member countries point to 30% of coastal tourism infrastructure being affected by a 1 m shoreline retreat (SLR) and 60% by a 100 m shoreline retreat.

TRANSPORT SECTOR AND BUILT ENVIRONMENT

Sea level rise, shifting temperatures and precipitation patterns are climatic changes to baseline conditions that affect transport and housing — and especially the people living within them. These changes can lead to more frequent or more severe droughts, floods, tropical storms and storm surge, and should be considered in road and housing design, siting, materials selection, construction, use, and maintenance. Roads and housing, especially permanent structures, need to be designed to reduce exposure and sensitivity to climate variability and change. Improperly or poorly constructed housing presents one of the greatest risks associated with climate hazards, leaving inhabitants highly vulnerable. Relocation of settlements may become necessary due to gradual impacts such as sea level rise; however, many questions remain on the relocation issue.

In many cases managing for greater uncertainty and risk associated with potential extreme conditions rather than past historical trends should be applied. This type of focus on risk analysis and management is commonly applied by the financial and insurance industries and can also be used in assessing proposed development activities.

HEALTH

Extreme weather, coupled with higher temperatures and changes in rainfall, will impact the region's population both directly and indirectly. Heat stress, for example, induces dehydration and has been linked to chronic kidney disease in agricultural and construction workers, and has the potential to increase respiratory and cardiovascular disease risks. Storms and hurricanes can cause death and lead to flooding with significant other effects on crop production, water quality and water-borne illnesses. Additionally, the increased morbidity and mortality of water borne illnesses, as well as mental health effects of extreme events, along with impacts on cardiovascular and respiratory conditions are all subject to climate stress. Moreover, the region's ageing population is vulnerable to increased heat stress. Disease outbreaks closely associated with the climatic conditions of the Eastern Caribbean include those transmitted by certain mosquito species. Temperature is an important determinant of biting rate and mosquito development. Precipitation provides habitats for the aquatic stages of the mosquito life cycle and strongly influences vector distribution. Changes in climate are already altering the spatial and temporal dynamics of dengue ecology, potentially increasing vector ranges, lengthening the duration of vector activity, and increasing the mosquito's infectious period. Other climate-related public health issues include harmful sargassum algal blooms and Sahara dust which could have serious implications for human health.

IMPACTS OF RAPID ONSET EXTREME EVENTS

Most of the Eastern Caribbean is made up of small island developing states. When an extreme event happens, it is therefore likely to overwhelm an entire country or territory because of its small size and have an outsize impact on national GDP. Emergency services are likely to be overwhelmed, while critical infrastructure serving the entire country may be significantly damaged or destroyed. The devastation is likely to be debilitating without outside support to address the immediate needs of the population.

Gaps in research and information

Although significant progress has been made to capture the available historical records of climate and hazards, there are still large variations in the needs and quality of research, information, and data.

Research gaps

- Analyses allowing a robust description of the climatology, variability, extremes and trends at any location is possible if long, good quality data records of (sub-)daily weather observations are available. This was not the case for the British Virgin Islands, hence leading the analysis to resort to proxies from weather stations in surrounding countries in the Leeward Islands.
- Some knowledge has been gathered since the 1990s on drivers of drought, excessive rainfall and tropical cyclones in the Caribbean as a whole. However, little information is available on the drivers of heat, extreme rainfall, sea level rise at the OECS regional level, let alone the BVI territorial level.
- Knowledge on the impacts of and risk associated with hurricanes, sea level rise and rising ocean temperatures engendering coral reef bleaching in the Caribbean is relatively well established. In addition, recent efforts have led to some advancement in mapping flash flood/flooding and drought as hazards and risk factors to socio-economic sectors in the Caribbean and, by extension, the BVI. However, not much is known or measured with respect to heat impacts on the BVI's society and environment.

Data and information gaps

- A thorough knowledge of the climatology and trends, as well as, the drivers of hazard-triggering extremes within a country depends first and foremost on the availability of long, good quality data records of (sub-)daily weather observations. Without any weather record available from the primary source (i.e. British Virgin Islands Airports Authority Ltd (BVIAAL), research into climate-related hazard impact potential is not possible at this time. Despite the many islands, their small size and very close-by location means large differences in climate are not expected. So, analysis of climate-related hazards may become possible if BVIAAL can produce at least one sufficiently long daily record.
- Much more so than weather observations, socio-economic and environmental impact data with respect to climate-related hazards beyond tropical cyclones and sea level rise are scant in the Caribbean, let alone the BVI. This is particularly the case for heat impacts. Apart from sea level rise, heat is the one hazard that has already intensified and about which there is most confident that it will continue to intensify. Therefore, in future, heat impacts on public health, agriculture, water, education, energy and labour need to be observed, archived and data sets made available for research, so as to determine the different dimensions of risk from excessive heat exposure.

CLIMATE CHANGE POLICY PRIORITIES IN TERMS OF ADAPTATION

The British Virgin Islands (BVI) are British Overseas Territories, i.e., no direct signatory of the UNFCCC nor of the Paris Agreement.

- However, a Virgin Islands Climate Change Adaptation Policy – entitled: Achieving Low-Carbon, Climate-Resilient Development – was prepared by the Conservation and Fisheries Department, Ministry of Natural Resources and Labour and submitted in February 2012.
- This document is an ambitious policy plan stating: *“In order to achieve low-carbon, climate resilient development, The Virgin Islands Climate Change Adaptation Policy includes necessary, cost effective actions to both respond (adapt) to the inevitable local impacts of a changing climate and reduce (mitigate) carbon emissions to minimize the extent of Climate Change and reduce our energy costs. The Policy calls for specific actions across the following sectors: a) Beach and Shoreline Stability, Coastal and Marine Ecosystems, Forestry and Biodiversity, and Fisheries; b) Tourism; c) Insurance and Banking; d) Food security: Agriculture; e) Human Health; f) Critical Infrastructure, Human Settlements, and Water Resources; and g) Energy”.*
- Most importantly, the Premier and Minister of Finance stated in his address about the 2020 BUDGET in November 2019 that an Amendment to the ‘Climate Change Trust Fund Act’ will allow for greater access to various types of regional and international funding avenues.

Relevant Programmes / Projects

SELECTED PROGRAMME / PROJECT	VALUE (USD)	DONOR	YEAR	IMPLEMENTING AGENCY
Regional Project on Climate Change Adaptation (CCA) and Sustainable Land Management (SLM) in the Eastern Caribbean -iLAND Resilience Project.	N.A.	Global Climate Change Alliance (GCCA) EU	five-year	Organization of Eastern Caribbean States (OECS)
Enhancing Capacity for Adaptation to Climate Change (ECACC) in the UK Caribbean Overseas Territories Project (Regional project).	N.A.	UK Department for International Development (DFID)	2007-2011	Caribbean Community Climate Change Centre (CCCCC)

KEY RESOURCES

[BRGM and World Bank \(2016\) ThinkHazard!](#)

[Capital Economics. \(2017\). Creating Value: The BVI's Global Contribution. A Report by Capital Economics for BVI Finance Limited. June 2017.](#)

[CSGM and CIMH \(2020\) State of the Caribbean Climate 2017: Information for Resilience Building. Produced for the Caribbean Development Bank. In press.](#)

[FAO. \(2001\). Land Resources Information Systems in the Caribbean: Proceedings of a Subregional Workshop held in Bridgetown, Barbados 2-4 October 2000. World Soil resources reports 95.](#)

[Government of British Virgin Islands. \(2010\). 2010 Population and Housing Census Report.](#)

[Government of British Virgin Islands. \(2019\). Our territory: Geography. Retrieved 30th December, 2019.](#)

[IPCC \(2012\) Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change \[Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley \(eds.\)\]. Cambridge University Press, Cambridge, UK, and New York, NY, USA.](#)

[IPCC \(2019\), IPCC Special Report on the Ocean and Cryosphere in a Changing Climate \[H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer \(eds.\)\].](#)

[OECS \(2019\) Caribbean Regional Oceanscape Project - Developing Ocean Policy Baseline Analysis Report.](#)

[OECS \(2020\) Climate Change and Projections for the OECS Region.](#)

[PAHO. \(2017\). Health in the Americas. Country report British Virgin Islands. Retrieved on the 30th December, 2019.](#)

[The Virgin Islands Climate Change Adaptation Policy Achieving Low-Carbon, Climate-Resilient Development \(2012\) Prepared by the Conservation and Fisheries Department, Ministry of Natural Resources and Labour, Author: Angela Burnett Penn. August 2010.](#)

[World Bank. \(2018\). Population: British Virgin Islands. Retrieved 30th December, 2019.](#)



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The authors assume full responsibility for the contents of this document.

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